Shikshan Prasarak Mandal, Kamptee's

Seth Kesarimal Porwal College of Arts & Science & Commerce, Kamptee – 441 001

Affiliated to RTM Nagpur University, Nagpur, Maharashtra NAAC Accredited with 'B^{++}' Grade

Website: www.porwalcollege.in E-mail : iqac.skpc@gmail.com; principal @skpckamptee.org

Internal Quality Assurance Cell (IQAC)

Dr. V. N. Chavan
Principal

Dr. R.A.Tiwari
Co-ordinator

Date :

Session 2023 – 2024

Criterion 1–Curricular Aspects

1.1 Curricular Planning and Implementation

1.1.2 The Institution adheres to the academic calendar including for the conduct of Continuous Internal Evaluation

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1. RTMNU Academic Calendar
2. Syllabus Showing 20% Internal Marks
3. Time Table (Winter-2023 & Summer-2024)
4. Practical Exam.

IQAC Coordinator
Co- ordinator
IQAC
Seth Kesarimal Porwal College
of Arts & Science & Commerce
Kamptee

SETH KESARIMAL PORWAL COLLEGE S.K.P. KAMPTEE

Principal

Principal
S.K. Porwal College
Kamptee

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

(Established by Government of Central Provinces Education Department by Notification No. 313, dated 1st of August, 1923 & presently a State University governed by Maharashtra Public Universities Act, 2016(Maharashtra Act No. VII of 2017))

(Academic Section)

Academic Section, Rashtrasant Tukadoji Maharaj Nagpur University, Jamnalal Bajaj Administrative Building, Mahatma Jotiba Phule Educational Premises,Cangas Square to Ambazari T-Point Road,Nagpur-440033

No. Acad. /Acad Calc. /2023/ 229 Date: 25/05/2023

NOTIFICATION

It is notified for general information of all the University conducted/ constituent/ affiliated colleges that the Academic Calendar **for the session 2023-24 will be as under:**

ACADEMIC CALENDAR FOR THE COURSES CONDUCTED AS PER SEMESTER & ANNUAL PATTERN FOR SESSION 2023-24.

1. Terms & Vacation

First Term (Odd semesters & Annual Pattern)	:	16.06.2023 to 31.10.2023
Winter Vacation	:	01.11.2023 to 30.11.2023
Second Term (Even semesters & Annual Pattern)	:	01.12.2023 to 30.04.2024
Summer Vacation	:	02.05.2024 to 15.06.2024

2. Admissions

a) Last date of Admission (First term odd sem. & First Year Annual Pattern)	:	7th August, 2023
b) Last date for Admission with prior permission of the Vice-Chancellor	:	7th September, 2023

3. Last date of submission of Enrolment forms to the university : Within fifteen days from the notified last date of Admission

4. Examination

A. Winter Examinations.

1. Commencement of Exam.

a) Failure Students in even semesters
b) Regular students in odd semesters : 16.10.2023
c) Failure students in Annual Pattern

2. Last date for receipt of exams. forms

a) Regular students : 31.08.2023 **(for admission other than Ist year)**

b) Old Ex-Students : 31.08.2023

c) Ex-Students of immediately previous examination : Within 15 days from the date of declaration of the result of summer Exams.

B. Summer Exams.

1. Commencement of Exams.

a) Failure students of odd semester
b) Regular students of Even semester : 15.03.2024
c) Failure & Regular students of Annual Pattern

2. Last date for receipt of examinations forms

a) Regular Students : 15.02.2024
b) Old Ex-Students : 15.02.2024
c) Ex-Students of immediately previous exam : Within 15 days from the date of declaration of the result of winter Exams.

5. Declaration of Results : As per governing provisions of the Act.

6. Convocation Winter 2022 & Summer 2023 : **December 2023**

Special Instructions :

1. The Principals/Heads of the institutions are authorised to ask teachers to attend duties during vacation for exam related work, if needed.
2. The Principals/Heads of the institutions should communicate the list of students admitted in their colleges/ institutions to the university within 15 days from the last date of admission as notified by the university.
3. Students admitted after the last date as specified above shall not be considered for enrolment in the University and therefore, shall not be permitted to appear at the university examinations.
4. All government & other holidays are calculated on the basis of last year's statistics. It is likely to be same except small variations after the declaration by the Government/authorities. The schedule of such holidays will be separately notified by the university at the beginning of Calendar Year.
5. Theory and Practical examinations may be held on Sunday with prior permission and intimation.
6. It is necessary by the Principals/Head of the Department to certify the number of actual teaching days conducted during the academic session.
7. All efforts should be made to achieve more than 180 teaching days in Annual Pattern and 90 days per Semester in Semester Pattern.
8. This schedule is applicable only for the entry level admissions to various courses excluding the courses where admissions are governed by centralized admission process. The last date for admissions in higher level semesters shall be 10 days after results of qualifying examinations.
9. Therefore, the last date of admissions for all courses where centralized admission process is adopted shall be notified separately.
10. The Last Date of examination forms for CAP round admission will be 15 days from the last date of admissions.
11. In case, Admissions governed by **Conditional Eligibility** the last date for submission of examinations form shall be within fifteen days after declaration of its qualifying examinations provided such students should have been admitted provisionally for the next higher academic session as per Direction No. 27 of 2006 and 6 Of 2010.

By Order of the Hon'ble Vice- Chancellor

(Dr. Raju Hiwase)
Registrar

Copy forwarded for information and necessary action to :-

1. P.A. to Hon'ble Vice-Chancellor, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
2. P.A. to Hon'ble Pro-Vice-Chancellor, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
3. P.A. to Registrar, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
4. The Principals of all Colleges / Head of the Post- Graduate Teaching Departments of the Rashtrasant Tukadoji Maharaj, Nagpur University, Nagpur.
5. All Officers of the Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
6. The Registrar of All Universities in the Maharashtra State.
7. Dr. Prashant Maheswary, Dean, Faculty of Science & Technology and Director, Multi-Facility Computer Centre, RTM, Nagpur University, Nagpur.
8. The Editor, All local News Papers. They are requested to kindly publish the above Notification in their esteemed News Paper as a News Item.

(Dr.Rajendra Utkhede)
Deputy Registrar (Acad.)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

"(Established by Government of Central Provinces Education Department by Notification No. 513 dated the 1st of August, 1923 & presently a State University governed by Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017).)"

DIRECTION NO. 45 OF 2023

CONDUCT OF END SEMESTER EXAMINATIONS BY THE CONDUCTED/AFFILIATED COLLEGES/INSTITUTIONS OF THE UNIVERSITY, DIRECTION 2023.

Whereas, Maharashtra Public Universities Act, 2016 (VI of 2017) (hereinafter the Act) has come into force from 1st March 2017 and the same applies to the Rashtrasant TukadojiMaharaj University (the University);

AND

Whereas, the University has been conducting various undergraduate programs in all the four faculties of the University through its conducted and affiliated colleges/institutions;

AND

Whereas, the academic programs offered/approved by the University are regulated by framing Ordinances/Directions in respect of the eligibility for admission to the programme, the structure and duration of the programme, the chargeable fees from the learners, conduct of end semester/annual examinations leading to the award of respective degrees to be conferred by the University through the convocations to be organised by the University;

AND

Whereas, Ordinance no. 19/2008 of the University makes provision for appointment of paper setters /examiners /moderators / Chief Supervisor/ Internal Supervisor and other persons by the University and their duties and responsibilities in respect of conduct of University Examinations and other matters which are ancillary and incidental to the conduct of University examination;

AND

Whereas, the issue of assigning the responsibility of conducting some of the end semester/ annual examinations in respect of the various programmes offered /approved by the University to the conducted / affiliated college/ institutions was under the active consideration of the University for some time;

AND

Whereas, the Board of Deans in its meeting held on 19th July 2021, vide item no. 40 approved the scheme of examinations in respect of the odd semesters of all the non-professional under graduate programmes offered by the University to be conducted at the college level, prepared by a Committee under the chairmanship of Hon'ble Vice Chancellor;

AND

Whereas, the Academic Council vide its decision on item no. 1(C) n its meeting held on 9th August 2021 approved the scheme of the conduct of end semester examinations for the odd semesters of non-professional under graduate programmes by the affiliated/conducted colleges of the University and further decided to refer the matter to the Management Council of the University for taking appropriate policy decision as well as other decisions regarding financial matters in entrusting the responsibility of conduct of examinations for the Odd semesters by the colleges of the University;

AND

Whereas, the Management Council of the University in its meeting dated 13th August 2021 vide item no. 94 (C)(2) resolved to constitute a committee under the Chairmanship of Dr. Sanjay Kavishwar for determining the modalities and parameters to assign the responsibility of conducting end semester examinations of odd semesters, i.e. 1st, 3rd, 5th and so on, by the colleges of the University and the said Committee after considering all the issues pertaining to conduct of University examination at college level for odd semesters of Under graduate programmes had submitted its detailed report, which was placed before the Management Council in its meeting held on 22nd September 2021 vide item no. 143 and the Management Council considered and approved the recommendations of the said committee;

AND

Whereas, in the meeting of Academic Council held on 5th June 2023, it was resolve that the time table of the examination of odd semester examination to be conducted by the colleges under this direction shall be prepared and published by the University and not by the examination committee of the respective college, so also the question papers will be provided by the University in order to have uniformity in the colleges;

AND

Whereas, the existing ordinances/Directions governing various under graduate programmes offered/approved by the University in its Four faculties provide for conduct of end semester examinations for the Odd semesters by the University, it has become necessary to issue a separate Ordinance overriding the provision of respective ordinances/Directions providing for conduct of end semester examinations for Odd semesters of the concerned programmes exclusively by the University but since Ordinance making is a time consuming process and as per the above said decision of the Management Council the end semester examinations for the 1st Semesters of all the Under graduate programmes except the professional programmes for which the students have been admitted in the Academic year 2021-22 is to be conducted by the colleges

at the end of the 1st semester which is approaching in immediate near future, there is an exigency to issue a suitable Direction as contemplated by the provisions of section 12(8) of the Act for implementing the above said decision of the Management Council of the University;

AND

Whereas, Direction No. 1 of 2022 entitled "Conduct of End Semester Examinations by the Conducted/Affiliated Colleges/Institutions of the University, 2022" has been issued by the University on 11/01/2022 but the said Direction does not incorporate the revised decision of the Management Council of the University on the point of sharing of the examination Fee, charged from the students, between concerned college/institution and the University, vide Item No. 4 in its meeting dated 3rd December 2021, necessitating modification in the relevant provisions of Direction no. 1 of 2022 which requires repeal of the said Direction and issuance of a replacement Direction;

AND

Whereas, the Government Resolution No. HSC 1092/58878/(205)/V.S.-5, dated 19th November, 1993 grants approval to the B.P.E. degree course as equivalent to the B.A., B.Com. and B.Sc. courses of the then Nagpur University.

AND

Whereas, the B.P.E. course in the University is now renamed as B.P.E.S. course, and hence there is a necessity of including B.P.E.S. in the 'Programme' mentioned in the Direction.

AND

Whereas, the Direction No. 9 of 2023, entitled, 'Conduct of End Semester Examinations by the Conducted/Affiliated Colleges/Institutions of the University, Direction-2023' was issued and the same has lapsed by virtue of the provision of the proviso to Section 12(8) of the Act, it has become necessary to issue a fresh Direction incorporating the provisions of the said lapsed Direction with necessary modifications in view of the decision of the Academic Council taken in its meeting dated 5.6.23.

Now, therefore, I, Dr. Subhash R. Chaudhari, Vice-Chancellor, in exercise of my powers under section 12(8) of the Act do hereby issue the following new Direction;

1. This Direction may be called **"CONDUCT OF END SEMESTER EXAMINATIONS BY THE CONDUCTED / AFFILIATED COLLEGES / INSTITUTIONS OF THE UNIVERSITY, DIRECTION-2023.."**

2. This Direction shall come into force from the date of its issuance and the end semester examinations for odd semester of the non-professional undergraduate programmes shall be conducted by the colleges/institutions as per the provisions of this Direction. However, in the academic year 2021-22 end semester examinations for the Ist semester only, in the academic year 2022-23 examinations for the Ist and IIIrd semesters only and in the academic year 2023-24 and onward the examinations for the 1st, 3rd and 5th semesters shall be conducted by the colleges/Institutions.

3. In this Direction unless the context requires otherwise the words and phrases shall have the meaning assigned herein:-

   i. **"Cluster of Institutions"** means a group of colleges which have come together for the purpose of conducting the end semester examinations, in terms of the provisions of this Direction.

   ii. **"College"** means any conducted/affiliated college/institution of the University offering any undergraduate programme for the odd semesters of which the end semester examinations is to be conducted by the said college/institution.

   iii. **"Course"** means theory or practical subject the contents of which, process of evaluation and its parameter are specified in the syllabus of the program.

   iv. **"Examination Committee"** means a committee constituted as per the provisions of this Direction for the purpose of conduct of end semester examinations including the supplementary examinations

and revaluation and other incidental matters in respect of Odd semesters of the under graduate programmes.

v. **'Programme'** includes B.A., B.A. (R.S.), B.Sc., B.Sc. (Home Science), B.Sc. (I.T.), B.Sc. (Forensic Science), B.Sc.(Finance), B.Com., B.B.A., B.C.C.A., B.C.A., B.C.T., B.F.D., B.I.D., B.T.S., B.J.D., B.A.E.S.T., B.S.W., B.Lib., B. Voc., B.Sc. (Data Science), B.Sc. (A.I.)and B.P.E.S. but excludes all the under graduate programmes in all the four faculties of the University for which admissions to the 1st semester (and lateral entry) are done through the centralized admission process (CAP) conducted by the State Government of Maharashtra.

vi. **'Subject Expert'** means a teacher including, a teacher appointed on contractual basis or Clock Hour Basis, having sufficient professional or teaching experience in the relevant subject.

4. Notwithstanding anything to the contrary contained in any Ordinance/Statute/Direction the end semester examinations of the odd semesters of all the under graduate programmes in which admissions to the 1st semester or any other entry level semester is not done through the centralized admission process conducted by any agency of the state government shall be conducted by the colleges offering such a undergraduate programmes. The modalities for conduct of end semester examinations by the respective colleges shall be as per the provisions of this Direction herein below.

However, the provisions of Ordinance No. 19/2008, providing for appointment of paper setters/examiners/moderators/Chief Supervisor/Internal Supervisor and other persons by the University and their duties and responsibilities in respect of conduct of University Examinations and other matters which are ancillary and incidental to the conduct of University examination, to the extent they are not inconsistent with the provisions of this Direction shall also be applicable in respect of end semester

examinations conducted by the affiliated/ conducted colleges/institutions under this Direction.

5. **Coverage and Scope**

a) The colleges/institutions offering non professional undergraduate programmes for which admissions in the first semester (and lateral entry) are not done through the centralized admission process conducted by the State Government of Maharashtra shall be responsible for the conduct of the end semester examinations including supplementary examinations for the odd semesters of the concerned programme these programmes specially include B.A., B.A. (R.S.), B.Sc., B.Sc. (Home Science), B.Sc. (I.T.), B.Sc. (Forensic Science), B.Sc.(Finance), B.Sc. (Data Science), B.Sc. (A.I.) B.Com., B.B.A., B.C.C.A., B.C.A., B.C.T., B.F.D., B.I.D., B.T.S., B.J.D., B.A.E.S.T., B.S.W., B.Lib., B. Voc. And B.P.E.S. programmes. The responsibility to conduct examinations includes both theory as well as practical examinations.

b) In conducting the end semester examinations by the colleges/institutions it shall be mandatory, notwithstanding anything contrary herein, to comply scrupulously with the provisions of the Maharashtra Public Universities Act, 2016 and the Ordinances and Directions issued by the University, from time to time, in respect of conduct of the end semester examinations by the colleges/institutions.

c) It shall be mandatory for the teachers working in the colleges conducting the end semester examinations to perform all the duties in respect of conduct of the examinations as if the examinations are conducted by the University.

6. The colleges/Institutions which have to conduct the end semester examinations including the supplementary examinations for the Odd

semesters of the non professional undergraduate programmes shall follow the procedure and take the necessary steps as mentioned herein below;

A. Examination Forms, Fees and Hall Tickets

a) The procedure for filling up the examination forms by students shall continue as it is in practice. It shall be the responsibility of the colleges/institutions to receive forms from the students and submit the same to the university within the prescribed time

b) The last date for submission of examination form and fine in case of late submission of form will be as per the circulars notified by the University from time to time.

c) The examination fees to be paid by the student and fine in case of late submission of form shall be prescribed by the University from time to time.

d) On receipt of examination forms, the college shall submit the forms to the University within prescribed date along with 25% of total examination fees, Remaining 75% of total examination fees to be retained by the college for operating expenses to conduct examinations.

e) The University shall process the examination forms in due course of time and provide hall tickets to the college at least 1 week before commencement of examination.

f) The colleges/Institutes shall distribute the hall tickets to the students who have filled the examination forms

g) If there are any grievances related to discrepancies in hall tickets, the Examination Section of the University shall address the same on priority basis and resolve them before actual commencement of examination.

B. **Examination Committee**

a) Each college /Institution conducting examination on behalf of the University shall have a duly constituted 'Examination Committee' which shall consist of following members:-

i. Principal of the College as a Chairperson of the Committee

ii. Minimum Two – Three teachers nominated by the Principal

iii. Minimum One Non-Teaching staff member nominated by the

Principal

iv. Examination In-charge nominated by the Principal who will act as a Member-Secretary

b) The teachers nominated in Examination Committee are eligible to be appointed evaluators and Moderators of answer books.

c) The 'Examination Committee' shall carry out all the functions related to examination such as evaluators, conduct of examination, maintaining record of attendance of examinees, ensuring timely evaluation of answer books, preparing results and submitting the marks to the University, and preserving all records of examination for minimum 3 years after completion of examination.

C. **Time-Table**

a) The University shall provide time table for conduct of winter examinations at least 20 days before the commencement of the examination. This shall be published on the examination portal of the University.

b) The college is required to conduct the actual examination (Theory and Practical) as per the above time table.

c) The Examination Committee shall also take effort to communicate university time table with the students by other suitable means.

d) The delivery of question papers to all the examination centers will be online through email from the university to the authorized email of the chairman of the examination committee at the concerned examination center.

D. Answer Books

a) The colleges/Institutions shall print the requisite number of answer-books of 16 pages each on A-4 size paper. The cover page of answer-book shall contain –

a. Name and Logo of the College

b. Space for Name of Examination, Name of Subject, date of examination, Roll No., Enrolment No., Center No., signature of invigilator, etc.

c. Separate table for marking

d. No answer books supplied by the university shall be used for either theory examination conducted by the college or the practical examinations by the college under this Direction.

E. Evaluation of Answer Books

a) The Examination Committee shall prepare a comprehensive list of examiners for theory papers and practicals.

b) In case, a particular college does not have adequate number of teachers, the examiners/moderators can be appointed from other colleges.

c) In case of practical, the Examination Committee shall appoint external examiners from other colleges. Remuneration/Conveyance Allowance to such examiners shall be paid according to the University norms and shall form a part of the operating expenses of conducting an examination by the college and to be born by the college/institution.

d) The answer-books will be evaluated by designated examiners in the college premises only and they will not be allowed to take answer-books out of the college premises.

e) There should be a designated evaluation center within the college premises and entry in such a center should be restricted only for the persons authorized by the Examination Committee.

f) The evaluation work needs to be completed within 10 days from the date of examination for each subject.

g) The Examination Committee shall ensure that the marks obtained by students appearing in examination are submitted to the University within 15 days from the last date of examination.

F. Revaluation of answer books

a) A student, not satisfied with the marks, can apply for revaluation of answer-book/s for maximum of two papers within 7 days of declaration of result in a form prescribed by the college.

b) A student shall obtain the prescribed form of application for revaluation from college and submit the same to the college along with a fee of Rs. 150 per paper. The revaluation fee shall be retained by the college.

c) The college shall send the information about application for revaluation to the University in a format provided by the University.

d) The University shall then provide a separate link for resubmission of marks by college for students who have applied for revaluation.

e) The Examination Committee shall appoint two examiners other than original examiner for revaluation. In case of non-availability of adequate number of teachers, the examiners can be appointed from other colleges. The task of revaluation of answer-book/s needs to be completed within 10 days of the last date for receipt of application for revaluation.

f) The college, shall then resubmit the average marks awarded by two evaluators. This shall be done within 10 days of the last date for receipt of application for revaluation.

g) The University, after processing these marks shall declare the result and provide the revised mark list to college within 10 days of submission of revised marks by the college.

H. Supplementary Examination for Odd Semester Examination

a) The application form for supplementary examination will be provided by the college.

b) A failure student will be required to fill up the form for supplementary examination to the college within 10 days of declaration of result along with the examination fee as per University norms.

c) The college shall submit the examination forms to the University within prescribed date.

d) The University shall prepare and communicate the time-table for supplementary examination.

e) The schedule for supplementary examination shall commence within 20 days of the last date of receipt of applications for supplementary examination.

f) The Examination Committee shall conduct the supplementary examination of applicants as per declared Time-Table declared by the

University and submit the marks to the University within 10 days of the last date of re-examination.

g) The University shall then process the submission and declare results of supplementary examination within 15 days of receipt of marks from college.

h) All such mark lists will be issued with a mention of 'Supplementary Examination'.

i) The procedure for revaluation during supplementary examination shall be the same as mentioned above.

j) The students who are declared successful in the supplementary examination shall be eligible to take admission in the next higher class as per the norms of the A.T.K.T. of relevant examination as given in the direction. For the purposes of admission in next class students passed in regular exams and in supplementary exam shall be treated at par.

I. Preservation of Examination Records

a) The college shall submit the marks for all subjects to the University. The University shall provide an 'Upload' facility for the same on its portal.

b) The college shall preserve all examination records such as all attendance lists, list of evaluators and moderators, copies of marks submitted to University, records related to revaluation and supplementary examination, etc. at least for a period of three years from the date of examination.

c) The college shall preserve all answer-books for a period of minimum TWO years from the date of examination.

J. Provision for 'Cluster of Institutions'

a) In order to maintain high academic standards and to achieve scale of economy, two or more institutions may come together and form a cluster for conducting University Examinations.

b) The participating institutions are required to mutually sign a document of forming a cluster mentioning the composition of 'Examination Committee' and functioning of cluster. A duly signed copy of this document is required to be submitted to the University.

c) In case a cluster is formed, the 'Examination Committee' will have to be formed for the cluster. In such a committee, there shall be equal representation of teachers from all the participating institutions and the Chairman will be the Principal of any of the participating institutions to be decided on mutual agreement of these institutions.

d) The representative of each participating institution will act as 'Examination In-charge' for his/her college.

e) The answer-books will be required to be printed individually by the participating institutions.

f) In case of a cluster, Evaluation of Answer-Books can be done centrally for all participating institutions

h) However, marks are required to be submitted to the University individually by participating institutions.

i) The financial matters related to printing, evaluation of answer-books, etc. need to be agreed upon mutually by participating institutions.

K. **Role of University**

a) Processing of Examination forms and generating Roll Nos.

b) Providing Hall tickets to college

c) Providing Time table for examination and supplementary examination.

d) Providing Question Papers.

e) Providing user friendly interface on the portal for submission of marks

f) Providing prescribed formats, wherever necessary

g) Timely processing and declaration of results

h) Providing Mark lists to colleges in timely manner

i) Monitoring the examination at college in order to maintain quality, transparency and fairness

L. **Monitoring of Examinations and Declaration of Results by the University**

a) The University shall establish a robust mechanism to ensure that the colleges are conducting examination in fair and transparent manner and are maintaining high standards of quality.

b) Declaration of result and issuance of mark list shall be the sole responsibility of University.

c) After declaration of result, the University shall provide mark lists of students to the college within maximum 15 days.

d) A random check would be more effective for this purpose.

i. After declaration of results, the University shall call for specific answer-books on a day's notice; OR

ii. After declaration of results, the University shall send a Supervisor with specific queries to the college to check some specific answer-books.

M. Grievance Redressal

a) A student or teacher having any grievance with respect to conduct of examination at college/institution shall be addressed to 'The Director, Board of Examinations and Evaluation'(BOEE).

b) The Director, BOEE shall address the grievance in accordance with the provisions of The MPU Act, 2016 and other ordinances.

N. **Malpractices**

a) Any malpractices or fraudulent activities observed or reported shall be forwarded to the University's Disciplinary Action Committee along with available evidences for further investigation and necessary action.

O. Declaration of result of the final semester of the programme.

Notwithstanding anything to the contrary herein and also the provisions of other Directions/Ordinances, governing the academic programmes, the norms regarding declaration of result of final semester of each programme shall be published by the University separately, in the due course of time.

Date: 31-10-23
Place: Nagpur

(Dr. Subhash R. Chaudhari)
Vice-Chancellor

Bachelor of Commerce (OB & CBCS) Examination

Scheme of Examination for Bachelor of Commerce (B.Com.) Outcome Based & Choice Based Credit System (OB & CBCS) from Academic Session 2022-23

As approved by the Faculty of Commerce and Management and the Academic Council vide item No. 24 in its meeting held on 8th July 2022

1. **Details of eligibility for B.Com. semester 1 examination**

A) For the **B.Com. 1st Semester,** Examinee shall have Passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education/CBSE/ICSE, with English at Higher or Lower level and any Modern Indian Language at higher or lower level with any combination of optional subjects;

OR

B) XII Standard Examination of Maharashtra State Board of Secondary and Higher Secondary Education in Vocational Stream with one language only; OR any other examination recognized as equivalent thereto; in such subjects and with such standards of attainments as may be prescribed Minimum Competition vocation course (MCVC).

OR

C) Any other Equivalent Examination of any State in (10+2) pattern with any combination of subjects.

2. **Teaching and Examination Scheme**

Course Nomenclature:

CC – Core course
AEC – Ability Enhancement Course
SEC – Skill Enhancement Course
DSE – Discipline Specific Electives (Specialisations)
ODL – Open and Distance Learning

Bachelor of Commerce (B.Com.)

B.Com. – Semester I

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH) *	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 1	Fundamentals of Accounting	1T1	5	80	20	100	40	100	4
2	CC 2	Business Economics - I	1T2	5	80	20	100	40	100	4
3	CC 3	Compulsory English	1T3	5	80	20	100	40	100	4
4	CC 4	Second language Supplementary English/ Marathi Hindi Other	1T4.1 1T4.2	5	80	20	100	40	100	4

		Languages # **OR** Vocational Courses	1T4,3							
5	AEC 1	Commercial Firms **OR** Digital Marketing (Any One) **OR** Vocational Courses	1T5-A 1T5-B	5	80	20	100	40	100	4
6	SEC 1	Business Skills **OR** MS-Office (Any One)	1T6-A 1T6 B	5	80	20	100	40	100	4
		Total		**30**	**480**	**120**	**600**	**240**	**600**	**24**

* Semester end examination

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.
4. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semesters I, II, III & IV, students shall opt for one subject from Ability Enhancement Courses (AEC) and one subject from Skill Enhancement Courses (SEC). The Core Courses will remain compulsory
6. The syllabus and question paper pattern of Second Language subject of B. Com. Semester; I, II, III & IV i.e. a) Supplementary English b) Marathi c) Hindi will be as per the Commerce Language Board.
7. # The syllabus and question paper pattern of other second languages like Sanskrit, Urdu, Guajrati, Telegu, Bengali, Persian, Arabic, Pali & Prakrit and Latin will be as per the Boards of the faculty of Arts for B.A. Semester- I, II, III & IV respectively

Vocational Courses – Semester I

Course Code	Subjects	Total Hours	Examination Scheme				Credits
			Theory (Uni)	Internal (College)	Practical (Uni)		
			Max Marks theory Paper (TH)	Max Marks(IM)	Max Marks actical (PR)	Min Passing Mark	Total Mark (TH. + PR + IM)
1T7	Entrepreneurship Development	60	80	20	-	40	100	4

1T8	1T8.1- Computer Application-II **or** 1T8.2- Principles and Practiceof Insurance-II **or** 1T8.3- Advertising, Sales Promotion & Sales Management-II	60	80	20	-	40	100	4

B.Com. – Semester - II

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH)*	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 5	Statistics and Business Mathematics	2T1	5	80	20	100	40	100	4
2	CC 6	Business Economics II	2T2	5	80	20	100	40	100	4
3	CC 7	Compulsory English	2T3	5	80	20	100	40	100	4
4	CC 8	Second language Supplementary English/ Marathi Hindi Other Languages # **OR** Vocational Courses	2T4.1 2T4.2 2T4.3	5	80	20	100	40	100	4
5	AEC 2	Commercial Services **OR** Fundamentals of Banking (Any One) **OR**	2T5-A 2T5-B	5	80	20	100	40	100	4

		Vocational Courses								
6	SEC 2	Financial Markets Operations OR Skill Development (Any one)	2T6-A 2T6-B	5	80	20	100	40	100	4
		Total		**30**	**480**	**120**	**600**	**240**	**600**	**24**

* Semester end examination

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.
4. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semesters I, II, III & IV, students shall opt for one subject from Ability Enhancement Courses (AEC) and one subject from Skill Enhancement Courses (SEC). The Core Courses will remain compulsory
6. The syllabus and question paper pattern of Second Language subject of B. Com. Semester; I, II, III & IV i.e. a) Supplementary English b) Marathi c) Hindi will be as per the Commerce Language Board.
7. # The syllabus and question paper pattern of other second languages like Sanskrit, Urdu, Guajrati, Telegu, Bengali, Persian, Arabic, Pali & Prakrit and Latin will be as per the Boards of the faculty of Arts for B.A. Semester- I, II, III & IV respectively

Vocational Courses: Semester II

Course Code	Subjects	Total Hours	Examination Scheme					Total Marks (TH. + PR + IM)	Credits
			Theory (Uni)	Internal (College)	Practical (Uni)				
			Marks Theory Paper	Max Marks (IM)	Marks Practical (PR)	Min Passing Marks			
2T7	Entrepreneurship Development	60	80	20	-	40		100	4

2T8	2T8.1- Computer Application-II **or** 2T8.2- Principles and Practice of Insurance-II **or** 2T8.3- Advertising, Sales Promotion & Sales Management-II	60	80	20	-	40	100	4

B.Com. – Semester - III

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH)*	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 9	Financial Accounting - I	3T1	5	80	20	100	40	100	4
2	CC 10	Monetary Economics - I	3T2	5	80	20	100	40	100	4
3	CC 11	Compulsory English	3T3-A	5	80	20	100	40	100	4
4	CC 12	Second language Supplementary English/ Marathi Hindi Other Languages # **OR** Vocational Course	3T4.1 3T4.2 3T4.3	5	80	20	100	40	100	4
5	AEC 3	Company Law **OR** Income Tax (Any One) **OR** Vocational Course	3T5-A 3T4-B	5	80	20	100	40	100	4
6	SEC 3	Holistic Development **OR** Computerized Accounting	3T6-A 3T6-B	5	80	20	100	40	100	4

		(Any One)								
		Total		30	480	100	600	240	600	24

* Semester end examination

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.
4. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semesters I, II, III & IV, students shall opt for one subject from Ability Enhancement Courses (AEC) and one subject from Skill Enhancement Courses (SEC). The Core Courses will remain compulsory.
6. The syllabus and question paper pattern of Second Language subject of B. Com. Semester; I, II, III & IV i.e. a) Supplementary English b) Marathi c) Hindi will be as per the Commerce Language Board.
7. # The syllabus and question paper pattern of other second languages like Sanskrit, Urdu, Guajrati, Telegu, Bengali, Persian, Arabic, Pali & Prakrit and Latin will be as per the Boards of the faculty of Arts for B.A. Semester- I, II, III & IV respectively

Vocational Courses: Semester III

Course Code	Subjects	Total Hours	Examination Scheme				Total Marks[TH. +PR + IM]	Credits
			Theory (Uni)	Internal (College)	Practical (Uni)			
			Max Marks Theory Paper (TH)	Max Marks (IM)	Max Marks Practical (PR)	Min Passing Marks		
3T7	Entrepreneurship Development	60	80	20	-	40	100	4
3T8	3T8.1- Computer Application-II or 3T8.2- Principles and Practice of Insurance-II or 3T8.3- Advertising, Sales Promotion & Sales Management-II	60	80	20	-	40	100	4

B.Com. – Semester – IV

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH)*	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 13	Financial Accounting - II	4T1	5	80	20	100	40	100	4
2	CC 14	Monetary Economics - II	4T2	5	80	20	100	40	100	4
3	CC 15	Compulsory English	4T3	5	80	20	100	40	100	4
4	CC 16	Second language Supplementary English/ Marathi Hindi Other Languages # **OR** Vocational Courses	4T4.1 4T4.2 4T4.3	5	80	20	100	40	100	4
5	AEC 4	Organizational Behaviour **OR** Banking Procedure & Practice (Any One) **OR** Vocational Course	4T5-A 4T5-B	5	80	20	100	40	100	4
6	SEC 4	Secretarial Practice **OR** Insurance Procedure & Practice (Any One)	4T6-A 4T6-B	5	80	20	100	40	100	4
		Total		**30**	**480**	**120**	**600**	**240**	**600**	**24**

* Semester end examination

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.

4. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semesters I, II, III & IV, students shall opt for one subject from Ability Enhancement Courses (AEC) and one subject from Skill Enhancement Courses (SEC). The Core Courses will remain compulsory
6. The syllabus and question paper pattern of Second Language subject of B. Com. Semester; I, II, III & IV i.e. a) Supplementary English b) Marathi c) Hindi will be as per the Commerce Language Board.
7. # The syllabus and question paper pattern of other second languages like Sanskrit, Urdu, Guajrati, Telegu, Bengali, Persian, Arabic, Pali & Prakrit and Latin will be as per the Boards of the faculty of Arts for B.A. Semester- I, II, III & IV respectively

Vocational Courses: Semester IV

Course Code	Subjects	Total Hours	Examination Scheme					Total Marks(TH.+PR + IM)	Credits
			Theory (Uni)		Internal (College)	Practical (Uni)			
			Max Marks Theory Paper(TH)		Max. Marks	Max. Marks Practical	Min Passing Marks		
4T7	Entrepreneurship Development-IV	60	80		20	-	40	100	4
4T8	4T8.1- Computer Application-IV Or 4T8.2- Principles and Practice of Insurance-IV Or 4T8.3- Advertising, Sales Promotion and Sales Management-IV	60	80		20	-	40	100	4

B.Com. – Semester - V

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 17	Financial Accounting - III	5T1	5	80	20	100	40	100	4
2	CC 18	Tax Procedure and Practice	5T2	5	80	20	100	40	100	4
3	CC 19	Human Resource Management	5T3	5	80	20	100	40	100	4

4	CC 20	Agricultural Economics	5T4	5	100	20	100	40	100	4
5	DSE 1	Cost Accounting **OR** Commercial Psychology **OR** Mercantile Law I **OR** Business Entrepreneurship Development (Any One) **OR** Vocational Course	5T5-A 5T5-B 5T5-C 5T5-D	5	80	20	100	40	100	4
6	SEC 5	Company Audit **OR** Internship # **OR** Vocational Course	5T6-A 5I6-B	5 --	80 --	20 100 #	100 100 #	40 40 #	100 100 #	4 4 #
		Total		**30**	**480**	**120**	**600**	**240**	**600**	**24**

* Semester end examination

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.
4. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semester V & VI, students have to opt for one subject from Discipline Specific Electives (DSE). The Core Courses will remain compulsory.

Vocational Courses: Semester V

Course Code	Subjects	Total Hours	Examination Scheme				Total Marks (TH + PR + IM)	Credits
			Theory (Uni)	Internal (College)	Practical (Uni)			
			Max Marks Theory Paper (TH)	Max Marks (IM)	Max Marks Practical (PR)	Min Passing Marks		
5T7	Entrepreneurshi pDevelopment-V	60	80	20	-	40	100	4
5T8	5T8.1 Computer Application-V Or							

	5T8.2 Principles and Practice of Insurance-V **Or** 5T8.3 Advertising, Sales Promotion and Sales Management-V	50	80	20	-	40	100	4

B.Com. – Semester - VI

Sr. No.	Course Type	Course/Subject Name	Course Code	Teaching Scheme	Examination Scheme				Total Marks	Credits
				Total Periods per Week	Max. Marks (TH)	Max. Marks (IM)	Total Marks	Min. Passing Marks		
1	CC 21	Financial Accounting - IV	6T1	5	80	20	100	40	100	4
2	CC 22	International Economics	6T2	5	80	20	100	40	100	4
3	CC 23	Advanced Statistics	6T3	5	80	20	100	40	100	4
4	CC 24	Financial Management	6T4	5	80	20	100	40	100	4
5	DSE 2	Managerial Accounting **OR** Hospitality and Health Care Management **OR** Mercantile Law II **OR** Commercial Geography of Vidarbha Region (Any One) **OR** Vocational Course	6T5-A 6T5-B 6T5-C 6T5-D	5	80	20	100	40	100	4
6	SEC 6	Marketing Process **OR**	6T6-A 6T6-B	5	80	20	100	40	100	4

		Advertising Skills **OR** Vocational Course								
			Total	**30**	**480**	**120**	**600**	**240**	**600**	**24**

Note:

1. The duration of each theory class should be a minimum of 48 minutes.
2. TH = Theory, IM = Internal Marks.
3. One credit is equivalent to one hour of Teaching per week, that is to say, for each subject, 48 Minutes * 5 (weekly periods) = 240 Minutes = 4 Hours i.e. 4 Credits.
4. Each semester will consist of 15 to 18 weeks of Academic Work equivalent to 90 actual teaching days.
5. For Semester V & VI, students have to opt for one subject from Discipline Specific Electives (DSE). The Core Courses will remain compulsory.

Vocational Courses: Semester - VI

Course Code	Subjects	Total Hours	Examination Scheme				Total Marks (TH. + PR + IM)	Credits
			Theory (Uni)	Internal (College)	Practical (Uni)			
			Max Marks Theory Paper (TH)	Max Marks (IM)	Max Marks Practical (PR)	Min Passing Marks		
6T7	Entrepreneurship Development-VI	60	80	20	-	40	100	4
6T8	6T8.1 Computer Application VI **Or** 6T8.2 Principles and Practice of Insurance VI **Or** 6T8.3 Advertising, Sales Promotion and Sales Management-VI	60	80	20	-	40	100	4

Course Composition Matrix:

	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Courses
CC	4	4	4	4	4	4	24
AECC	1	1	1	1	1	1	6
SEC	1	1	1	1	*1*	*1*	4 + *2* = 6
DSE	-	-	-	-	*1*	*1*	*2*
Total Sem Credits	24	24	24	24	24	24	36
Total Credits	144						

Figures in Italics (in SEC & DSE) indicate optional course type selections

List of Core Courses, Ability Enhancement Compulsory Courses, Skill Enhancement Courses and Discipline Specific Elective

A) List of Core Courses (CC)*

SN	Semester	Paper / Subjects
1	Sem I	Fundamentals of Accounting
2		Business Economics – I
3		Compulsory English
4		Second language Supplementary English/ Marathi/ Hindi/Other Languages
5	Sem II	Statistics and Business Mathematics
6		Business Economics – II
7		Compulsory English
8		Second language Supplementary English/ Marathi/ Hindi/Other Languages
9	Sem III	Financial Accounting – I
10		Monetary Economics - I
11		Compulsory English
12		Second language Supplementary English/ Marathi/ Hindi/Other Languages
13	Sem IV	Financial Accounting – II
14		Monetary Economics – II
15		Compulsory English
16		Second language Supplementary English/ Marathi/ Hindi/Other Languages
17	Sem V	Financial Accounting – III
18		Tax Procedure and Practice
19		Human Resource Management
20		Agricultural Economics
21	Sem VI	Financial Accounting – IV
22		International Economics
23		Advanced Statistics
24		Financial Management

B) List of Ability Enhancement Courses (AEC)*

Semester	Paper / Subjects
Sem I	Commercial Firms
(Any One)	Digital Marketing
Sem II	Commercial Services
(Any One)	Fundamentals of Banking
Sem III	Company Law

(Any One)	Income Tax
Sem IV	Organizational Behaviour
(Any One)	Banking Procedure & Practice

C) List of Skill Enhancement Courses (SEC)*

Semester	Paper / Subjects
Sem I	Business Skills
(Any One)	MS Office
Sem II	Financial Market Operations
(Any One)	Skill Development
Sem III	Holistic Development
(Any One)	Computerized Accounting
Sem IV	Secretarial Practice
(Any One)	Insurance Procedure & Practice
Sem V	Company Audit
(Any One)	Internship
Sem VI	Marketing Process
(Any One)	Advertising Skills

D) List of DSE (Discipline Specific Electives)*

Semester	Paper / Subjects
Sem V (Any One)	Mercantile Law I
	Business Entrepreneurship Development
	Cost Accounting
	Business Entrepreneurship Development
Sem VI (Any One)	Mercantile Law II
	Commercial Geography of Vidarbha Region
	Managerial Accounting
	Hospitality and Healthcare Management

If the student wishes to opt for any course, other than offered by the University, He / she can register for any other equivalent credit ODL (Open and Distance Learning) courses and submit the passing certificate.

***Detailed curriculum contents of courses in 1st and 2nd Semester are mentioned in Appendix A.**

3. Workload

Workload Chart (70 periods per week) (Odd Semesters)

B.Com. Semester I			
Sr. No.	Course Type	Course/ Subject	No. of Periods
1	CC	Fundamentals of Accounting	5
2	CC	Business Economics – I	5
3	AEC	Commercial Firms OR Digital Marketing	5
4	SEC	Business Skills OR MS Office	5
Total Periods			20

B.Com. Semester III			
Sr. No.	Course Type	Subjects	No. of Periods
1	CC	Financial Accounting - I	5
2	CC	Monetary Economics - I	5
3	AEC	Company Law OR Income Tax	5
4	SEC	Holistic Development OR Computerized Accounting	5
			20

B.Com. Semester V			
Sr. No.	Course Type	Subjects	No. of Periods
1	CC	Financial Accounting - III	5
2	CC	Tax Procedure and Practice	5
3	CC	Human Resource Management	5
4	CC	Agricultural Economics	5
5	AEC DSE	Cost Accounting OR Commercial Psychology OR Mercantile Law I OR Business Entrepreneurship Development	5
6	SEC	Company Audit OR Internship	5
			30

Workload Chart (70 periods per week) (Even Semesters)

B.Com. Semester II			
Sr. No.	Course Type	Course/ Subject	No. of Periods
1	CC	Statistics and Business Mathematics	5
2	CC	Business Economics - II	5
3	AEC	Commercial Services OR Fundamentals of Banking	5
4	SEC	Financial Market Operations OR Skill Development	5
Total Periods			20

B.Com. Semester IV			
Sr. No.	Course Type	Subjects	No. of Periods
1	CC	Financial Accounting - II	5
2	CC	Monetary Economics - II	5
3	AEC	Organizational Behaviour OR Banking Procedure & Practice	5
4	SEC	Secretarial Practice OR Insurance Procedure & Practice	5
			20

B.Com. Semester VI			
Sr. No.	Course Type	Subjects	No. of Periods
1	CC	Financial Accounting - IV	5
2	CC	International Economics	5
3	CC	Advanced Statistics	5
4	CC	Financial Management	5
5	AEC DSE	Managerial Accounting OR Hospitality and Health Care Management OR Mercantile Law II OR Commercial Geography in Vidarbha Region	5
6	SEC	Marketing Process OR Advertising Skills	5
			30

Weekly Workload Chart (Languages) (For Semesters I,II, III & IV)

Sr. No.	Courses/ Subjects	Periods
1	Compulsory English	5 Periods of Theory + 1 Period of Tutorial for a Batch of 20 Students
2	Second language Supplementary English/ Marathi/ Hindi/Other Languages	5 Periods of Theory

4. Assessment

- The final total assessment of the candidates is made in terms of an internal assessment (Sessional) and an external assessment for each course/subject taken together.
- For each paper (other than Internship), 20 marks will be internal assessment and 80 marks for semester-end examination (external assessment) to be conducted at the college level (Odd semesters examinations) and RTM Nagpur University level (Even semester examinations)
- All subjects shall have a wokload of 5 periods per week, including 4 periods of theory and 1 period for classroom activity-based teaching per week. For Compulsory English 1 additional Tutorial period for a batch of 20 students is allotted.
- Expected classroom activities shall consist of the following: (a) Group Discussion (b) Seminars (c) Power Point Presentations (d) Elocution (e) Debate (f) Role Play (g) Case Studies (h) Educational Games. The teacher is expected to undertake a minimum of four of the aforesaid activity.

Internal Assessment

1a	Attendance of the student during a particular semester	05 Marks
1b	An assignment based on curriculum to be assessed by the teacher concerned	05 Marks
1c	Subject wise class test or activities conducted by the teacher concerned	10 Marks
1	**Internal assessment Total marks**	**20**
2	**Semester wise End Examination marks**	**80**
	Total Marks Per Course	**100**

- The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations / as instructed by the university. These marks will be considered for the declaration of the results.
- The record of internal marks, evaluation & results should be maintained for a period of one year by the respective institute/college for verification by the competent authority.

Internship and its evaluation

During the fifth semester, those students who opt for SEC 5 as "Internship" will have to undergo an internship of 6-10 weeks (Minimum 120 hours) with industry, business, service or social organization. Article ship attended during the fifth semester of B.Com. for Professional Courses like CA/CS/ICWA/CMA/CFA, etc. will be considered as "Internship" provided appropriate documentary proofs are submitted by the student. Students should submit an authentic Internship Completion Certificate issued by the competent authority of the business/institution under whom the internship is undertaken. The respective college will assess and evaluate the same as per parameters (like PowerPoint Presentation, Brief Report, etc.) laid down by the college from time to time.

5. Standard of Passing

The scope of the subject, percentage of passing in Theory and Project and Internal Assessment will be governed as per following rules:

(i) In order to pass the Bachelor of Commerce (B.Com.) 1st, 2nd, 3rd, 4th, 5th and 6th Semester Examinations, and an examinee shall obtain not less than 40 % marks in each paper, that is to say combined in the written Examination conducted by the University and in internal assessment put together.

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fresh fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

6. **Credit and Grade Point System:**

A) **Conversion of Marks to Grades and Calculations of SGPA (Grade Point Average) and CGPA (Cumulative Grade Point Average):** In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades by some mechanism wherein the overall performance of the Learners can be reflected after considering the Credit Points for any given course. However, the overall evaluation shall be designated in terms of Grade. There are some abbreviations used here that need an understanding of each and every parameter involved in grade computation and the evaluation mechanism. The abbreviations and formulae used are as follows: -

Abbreviations and Formulae Used

G: Grade

GP: Grade Points

C: Credits

CP: Credit Points

CG: Credits X Grades (Product of credits & Grades)

SGPA = ΣCG: Sum of Product of Credits & Grades points / ΣC: Sum of Credits points

SGPA: Semester Grade Point Average shall be calculated for individual semesters. (It is also designated as GPA)

CGPA: Cumulative Grade Point Average shall be calculated for the entire Programme by considering all the semesters taken together

CGPA to Percentage (%) conversion formula: Percentage (%) = (CGPA) * 10

After calculating the SGPA for an individual semester and the CGPA for entire program, the value can be matched with the grade in the Grade Point table as per the ten (10) Points Grading System and expressed as a single designated GRADE such as O, A, B, C, D, P and F

Sr. No.	Letter Grade	Grade Points	Mark Range	Performance
1	O	10	Above 90 upto 100	Outstanding
2	A+	9	Above 80 upto 90	Excellent
3	A	8	Above 70 upto 80	Very Good
4	B+	7	Above 60 upto 70	Good
5	B	6	Above 50 upto 60	Above Average
6	C	5	Above 45 upto 50	Average
7	P	4	40 to 45	Pass
8	F	0	Below 40	Fail
9	AB	0	Absent	Fail

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

B) Division at the B.Com. semester VI examination shall be declared on the basis of the aggregate marks at the B.Com. semester I, semester II, semester III, semester IV, semester V and semester VI examinations taken together and the CGPA will be calculated and notified.

C) **The successful examinees at the B.Com. semester VI examination shall be awarded division based on CGPA**

7. **Promotion to Higher Semester (A.T.K.T.):**
The unsuccessful candidate of any semester examination shall be ALLOWED TO KEEP THE TERM (ATKT) in accordance with the following table: (Theory and Internal assessment of that theory subject shall be jointly considered as single passing head).

Admission to academic year	Candidate should have passed All courses of the following examination	Candidate should have filled the examination form and appeared for the following examinations	Candidate should have passed in Minimum **50% courses of** the following examination
1st Semester	**H.S.S.C./Equivalent**	-----	-----
2nd Semester	-----	**1st Semester**	-----
3rd Semester	-----	**2nd Semester**	**50% courses of 1st and 2nd Semesters taken together**
4th Semester	-----	**3rd Semester**	**As Above**
5th Semester	**1st and 2nd Semesters**	**4th Semester**	**50% courses of 3rd and 4th Semesters taken together**
6th Semester*	**As Above**	**5th Semester**	**As Above**

Note: (*) A candidate admitted to Final Semester can appear for Final Semester examination however the result of the Final Semester examination will be withheld unless the candidate clears all the lower examinations of the **B.Com. Course.**

8. **Provision for Multiple Exit and Multiple Entry**

The B.Com. program offered under this direction provides an opportunity to students for multiple exit from the program as per following conditions:

a. A student can exit the program after successful completion of 1st and 2nd Semester courses and obtaining 48 credits. Such a student is eligible to be awarded 'Certificate in Commerce' by the University provided that a student has successfully completed at least one 'Skill Based Course'.
b. A student can exit the program after successful completion of 1st, 2nd, 3rd and 4th Semester courses and obtaining 96 credits. Such a student is eligible to be awarded 'Diploma in Commerce' by the University provided that a student has successfully completed at least one 'Skill Based Course'.
c. A student who has completed the 3 years program and earned 144 credits will be considered eligible for award of 'Bachelor of Commerce' degree by the University.
d. A student who wishes to exit the program before completion of 3 years is required to apply to the university through the Principal.
e. A student who opted for exit from the program before completion of 3 years (a & b) above shall be eligible for admission to next year of the program in any subsequent academic session. However, if at the time of admission, if this scheme of examination is not in force, the student will have to complete the program according to the provisions made under the direction prevailing at the time of such admission.

9. Provision for Transfer of Credits

The B.Com. program offered under this direction provides enhanced academic flexibility to students in terms of selecting the courses they want to learn. A student can opt for any course from any statutory/recognized University or any recognized online learning platform such as SWAYAM/NPTEL/EdX/Coursera in lieu of a course (except Core Course and Discipline Specific Electives) mentioned in this scheme of examination. The mechanism for transfer of credits earned through these courses to be adhered is mentioned here:

1. Any Core Course or Discipline Specific Elective mentioned in this scheme of examination cannot be opted out by a student.
2. A student can opt out any course other than Core Course/Discipline Specific Elective and earn equal number of credits by completing any ODL or Online course/s from any statutory/recognized University or any recognized online learning platform such as SWAYAM/NPTEL/EdX/Coursera.
3. If a student is willing to opt out any such course, he/she will have to mention this while submitting the examination form to the University for respective semester.
4. A certificate of completion of such an ODL/Online course shall be submitted by the student to the University through college before end term evaluation.
5. Such a certificate shall mandatorily have the number of credits, duration of the course and grades/marks obtained by the student and shall preferably have a QR code for verification.
6. The college shall submit the grades and marks obtained by the student to the University along with Internal Assessment marks for the concerned examination.
7. If a student has opted for an ODL/Online course in a particular semester and failed to submit the certificate within prescribed time, the student will be marked for 'Absent' for a particular course in that examination. Such a student will be required to fill in the examination form in the consecutive attempt and submit the passing certificate in order to get his/her corrected result.

10. Eligibility for award of Degree:

In order to become eligible for award of 'Bachelor of Commerce (B.Com.)' degree, a student has to fulfil the following conditions:

a. A student has to earn minimum 144 credits in not less than 3 years.
b. A student has to successfully complete (pass) all Core Courses and Discipline Specific Electives mentioned in this direction.

NOTE: This scheme of teaching and examination for Bachelor of Commerce program shall be effective from the academic session 2022-23 and a comprehensive direction for other regulations in this connection shall be soon issued by the University.

Bachelor of Commerce (OB & CBCS) Examination

Academic Year 2022-23 onwards

Appendix 'A'

Detailed Syllabus for 1st and 2nd Semesters

Bachelor of Commerce
B.Com. (CBCS) – Sem I
B.Com. - First Year Semester-I
Course Type: Core Course
Course Name: Fundamentals of Accounting
Course Code: 1T1

Course Outcomes:

CO1	Given the information about the business transactions/ each student will be able to identify the nature of transaction/ events and will be able to record the financial transaction in the books of accounts i.e. Journal, Ledger, personal, Real, Nominal Account and Subsidiary Books etc. by applying double entry book system of accounting.
CO2	Given the Trial Balance of a Sole Trading concern along with the accompanied adjustments the students will be able to prepare the financial statement of a Sole Trader at the end of a financial year.
CO3	Given the detail business transactions between the Head office and Branches, students will be able to prepare Branch Account, cash and Credit sales, debtors & stock and debtor method of accounting.
CO4	Given the Trial Balance along with the adjustment of a Co-operative society a student would be able to prepare Trading Account, Profit & Loss Account, Profit & Appropriation Accounts and Balance Sheet of Co-operative Society As per State Co-operative Societies Act, 1960.
CO5	Given the information of business Receipts and Payments, student will be able to a simple cash book.

Unit - I Basic of Financial Accounting

An overview of basic of books keeping and accountancy. Objective, Importance, Advantages, Limitations and Functions of Accounting. Double Entry System, Branches of Accounting. Capital and Revenue Receipt & Expenditure. Preparation of Journal, Ledger's, Simple Cash book, Trial Balance.
(Theory & Numerical)

Unit - II Accounting Concepts:

Meaning, objectives and principles of Accounting, Accounting Concepts & Conventions, Indian Accounting Standards- AS 1 to AS 10. Basic concept of Profit & Loss A/c and Balance Sheet. Preparation Final accounts of Sole Traders (Excluding Manufacturing A/c)

(Theory & Numerical)

Unit - III Branch Accounting (Excluding Foreign Branch)

Meaning of Branch Objective of Branch Accounting, Type of Branches, Mentioned of Accounting Records, Transactions relating to Branch, Accounting procedure of Branch. (Theory & Numerical)

Unit - IV Final Accounts of Co - Operative Societies:

(As per Maharashtra Co-Operative Societies Act 1960)

Introduction, Types of Co-operative societies. Preparation of Trading A/c, Profit and Loss A/c, P & L Appropriation A/c and Balance Sheet. (Theory & Numerical)

Note: Activities for subject/Chapter related (Workshop, Seminar, Guest Lecture, Group Discussion, Visit to Business organisation)

The Financial year ends on 31st March.

Reference Books :

1. Dr. S. M. Shukla : Financial Accounting, Sahitya Bhawan Publication
2. Gupta R. L. - Advanced Financial Accounting - S. Chand & Sons
3. Kumar, Anil S. - Advanced Financial Accounting - Himalaya Publication House
4. Shukla and Grewal : Advanced Accounts (S. Chand & Ltd. New Delhi)
5. Jain and Narang : Advanced Accounts (Kalyani Publishers, Ludhiana)
6. Dr.S. K. Singh: Financial Accounting, S.B.P.D Publication, Agra
7. Dr. Vijay Bagde, Dr. Pramod Fating, Dr. Prashant Gulhane: Financial Accounting-I; Sir Sahitya Kendra, Nagpur.
8. Dr. P. Wath, Dr. R. Jadhao, Dr. R. Selukar :- Financial Accounting- Sai Jyoti Prakashan

Question Paper Pattern

B.Com. - First Year Semester-I

1T1: Financial Accounting-I

N.B. - 1) All questions are compulsory.

2) All questions carry equal marks.

Q. No. 1 - Unit I

a) Theory 08 Marks

	b) Problem	08 Marks
	OR	
	c) Problem	16Marks
Q. No. 2 - Unit II		
	a) Theory	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	16Marks
Q. No. 3 - Unit III		
	a) Theory	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	16Marks
Q. No. 4 - Unit IV		
	1. Theory	08 Marks
	2. Problem	08 Marks
	OR	
	3. Problem	16Marks
Q. No. 5	a) Unit –I Problem	04 Marks
	b) Unit –II Problem	04 Marks
	c) Unit –III Problem	04 Marks
	d) Unit –IV Problem	04 Marks

Bachelor of Commerce
B.Com (CBCS) – Sem I
Course Type: Core Course
Course Name: Business economics -I
Course Code: 1T2

Course outcomes

CO1	Students will be able to classify fundamental problems of an economy
CO2	Students will be able to use demand analysis & Indifference curves analysis in given situation
CO3	Students will be able to apply various demand forecasting techniques
CO 4	Students will be able to identify key elements in supply and isoquant curves
CO 5	Students will be able to measure and comment on elasticity of demand for given data

Unit 1:

Introduction to economics: Contents of economics, stages of economic evolution, essential processes of economy, fundamental problems of an economy, basic terms and concepts – goods, utility, value, price, wealth, income and equilibrium

Unit 2:

Demand Analysis: defining demand & Law of demand & Exceptions, utility analysis, indifference curves analysis, Types of demand – direct & Indirect demand, derived & Autonomous demand, durable and non-durable goods demand, firm & industry demand, total market and segment demand, , Determinants of Demand; Elasticity of Demand: Changes in demand, demand function, concept of elasticity, measurement of elasticity

Unit 3:

Demand Forecasting: forecasts and forecasting techniques, Qualitative techniques – expert opinion survey , consumers complete enumeration survey, sales force opinion survey, consumers end use survey , Quantitative techniques – trend projection technique, barometric method , Econometric techniques – regression method

Unit 4:

Supply- Meaning, Criticism, factors influencing factors of supply. Law of supply, movements and shifts in supply curve. Elasticity of supply, determinants of supply.

Production Analysis: Production function, returns to factor and returns to scale, Output elasticity Isoquant Curves definition, General Properties

References

1. Business Economics , V.G. Mankar, Himalaya Publication House
2. Modern Economics, H.L.Ahuja, S.Chand & Co Ltd.
3. Micro Economics P.N.Chopra, Kalyani Publishers.
4. Micro Economics, D.D.Chaturvedi, Galgotia Publishing Company.
5. Modern Economic Theory, K.K.Dewett, S.Chand & Co Ltd.

B. Com. (CBCS) Sem I
Course Type: Ability Enhancement Course
Course Name: Commercial Firms
Course Code: 1T5 – A

Course Outcomes:

CO1	Students will be able to relate the concepts of commercial firms
CO2	Students will be able to interpret the concept of sole trader into practice
CO3	Students will able to analyse partnership firm and will gain knowledge about starting a partnership firm.
CO4	Students will be gain knowledge about comp and it's various concept and will be able to gain knowledge about starting a company.
CO5	Students will relate to the concept of start ups and will be aware about starting a start ups and will be able to prepare project report

1) Commercial firms: Concept and importance. It's contribution in economic growth
2) Sole trader: meaning, definition, salient features, procedure to start a sole trade business. Activities included in sole trading. Partnership: concept, meaning, characteristics importance , procedure to be adopted for starting partnership. Activities involved in partnership business
3) Company: concept, meaning, characteristics, procedure to start a company, activities involved in company business
4) Start ups: concept and meaning, role in economic development, various Government schemes for start ups. Preparation of project report for start ups

QUESTION PAPER PATTERN

BCOM – I : SEMESTER I

1T2- Commercial Firms

TIME:- 3 Hours] [Full Marks:- 80

N.B. – 1) All questions are compulsory.

2) All questions carry equal marks

Q.1.

(a) UNIT – I 08 Marks

(b) UNIT – I 08 Marks

OR

(c) UNIT – I 16Marks

Q.2.

(a) UNIT – II 08 Marks

(b) UNIT – II 08 Marks

OR

(c) UNIT – I 16Marks

Q.3.

(a) UNIT – III 08 Marks

(b) UNIT – III 08 Marks

OR

(c) UNIT – I 16Marks

Q.4.

(a) UNIT – IV 08 Marks

(b) UNIT – IV 08 Marks

OR

(c) UNIT – I 16Marks

Q.5.

a) UNIT – I 04 Marks

b) UNIT – II 04 Marks

c) UNIT – III 04Marks

d) UNIT – IV 04 Marks

B. Com (CBCS) Sem – I

Course Type: Ability Enhancement Course

Course Name: Digital Marketing

Course Code: 1T5 - B

Course Outcomes

CO1	The students will be able to understand the concept and develop the knowledge of Digital Marketing, E-Commerce and M-Commerce.
CO2	The students will be able to understand the concept & will be equipped with the practical knowledge of creating Electronic mail (Email), Websites, Brochure / Flyers.
CO3	The students will be able to develop the knowledge about usage and Procedures for handling various important Digital Marketing Platforms for Earning Income.
CO4	The students will be able to develop the knowledge about Recent Trends for Earning Income through Digital Marketing.
CO5	The students will be equipped with the practical knowledge of various important Digital Marketing Platforms.

Unit 1. Digital Marketing: Introduction, meaning, significance and benefits. Myths in Digital Marketing. Digital marketing process, Introduction to E-Commerce, M-Commerce, Traditional marketing Vs Digital Marketing.

Unit 2. Electronic mail (Email) and Websites: Meaning & Features of Email, Procedure for sign-up and sing-in in Email. Usage of BCC & CC in Email, procedure to send the attachment through email. Meaning & Features of Websites, Procedure for Creating Website, Domain name, uses of hyperlink. Procedure for Creating Brochure / Flyers.

Unit 3. Usage of Digital Marketing Platforms for Earning Income: Procedures for handling- Search Engine Optimisation (SEO), Search Engine Marketing (SEM), Social Media Optimisation (SMO), Social Media Marketing (SMM), Email Marketing, Mobile marketing, Pay Per Click (PPC) Advertising, Google AdSense, Content Marketing, Affiliate Marketing, Influencer Marketing.

Unit 4. Recent Trends for Earning Income through Digital Marketing: Procedures for - Creating Blog, Creating YouTube Channel, Setting up Facebook Advertising Account, Starting Freelancing Service, using Podcast for Selling Products. Procedure for Selling products on Instagram, Procedure for Creating seller account on various Digital Marketing Platforms- Amazon, Flipkart, etc.

References Books:

- *Fundamentals of Digital Marketing, Puneet Bhatia, Pearson Education; second edition (June 2019)*
- *Digital Marketing, Seema Gupta, McGraw Hill Education; Second edition (August 2020)*
- *Digital Marketing: Complete Digital Marketing Tutorial, Kailash Chandra Upadhyay, Notion Press; 1st edition (August 2021)*
- *Digital Marketing, Moutusy Maity, Oxford University Press (June 2022)*
- *Recent Trends in Digital Commerce, Dr. Medha Kanetkar, Dr. Manish Vyas, Mrs. Mrunmayee Khati, Sainath Prakashan (June 2021)*
- *The Essential Social Media Marketing Handbook, Gail Z. Martin, Rupa Publications India (20 June 2018)*
- *Social Media Marketing 2021, by Michael Branding, Notion Press; 1st edition (June 2021)*

QUESTION PAPER PATTERN
BCOM – I : SEMESTER I
1T2 Commercial Firms
TIME:- 3 Hours] [Full Marks:- 80
N.B. – 1) All questions are compulsory.
2) All questions carry equal marks.

Q.1.
(a) UNIT – I 08 Marks
(b) UNIT – I 08 Marks
OR
(c) UNIT – I 16Marks

Q.2.
(a) UNIT – II 08 Marks
(b) UNIT – II 08 Marks
OR
(c) UNIT – I 16Marks

Q.3.
(a) UNIT – III 08 Marks
(b) UNIT – III 08 Marks
OR
(c) UNIT – I 16Marks

Q.4.
(a) UNIT – IV 08 Marks
(b) UNIT – IV 08 Marks
OR
(c) UNIT – I 16Marks

Q.5.
a) UNIT – I 04 Marks
b) UNIT – II 04 Marks
c) UNIT – III 04Marks
d) UNIT – IV 04 Marks

B. Com. (CBCS) Sem I

Course Type: Skill Enhancement Course

Course Name: Business Skills

Course Code: 1T6 – A

Course Outcomes:

CO1	The student will be able to **classify** different forms of business and business activities
CO2	The student will be able to **differentiate** between management and administration and also will be able to **formulate** a plan for a given activity
CO3	The student will be able to **distinguish** types of organisations and will also able to **decide** actions for a given situation
CO4	The student will be able to **select** leadership skills in a group and **demonstrate** direction skills to achieve objectives
CO5	The student will be able to **demonstrate** the roles, skills and functions of management required for a business activity

Unit-I: Nature and Scope of Business: Meaning and Definition of Business, Characteristics, Objectives of Business, Classification of Business Activities, Industry, Commerce & Trade, Social Responsibility of Business Towards Different Groups. Forms of Business Units: Sole Trader, Partnership, Joint Stock Company and Co-Operative Society – Meaning, Characteristics, Advantages & Disadvantages.

Unit-II: Management and Administration: Meaning and Definition of Management, Characteristics, Scope, Importance, Management and Administration, Management – A Science or Art. Planning: Meaning, Nature and Characteristics, Process, Importance, Types, Components.

Unit-III: Decision Making: Concept, Characteristics – Importance, Process, Types of Decisions. Organizing: Concept, Principles, Types – Line, Functional, Line and Staff, modern types of organizations-Projects, Matrix, Formal and Informal Organization, Advantages and Disadvantages.

Unit-IV: Direction: Meaning, Nature, Importance and Techniques. Co-Ordination: Meaning, Principles, Internal and External Co-Ordination, Methods of Achieving Effective Co-Ordination. Leadership: Leadership – Concept, Characteristics, Types and Qualities. Concept of Morale. Control: Meaning, Characteristics, Need, Procedure, Types, Essentials of Good Control System, Control Devices.

Reference Books

1. Ramaswamy, I. (2011). Principles of Business Management, (8th ed.), Himalaya Publishing House, New Delhi.
2. Principles of Management and Administration. Author, D. Chandra Bose. Publisher, PHI Learning, 2009

3. Robbins, S. (2017). Management, (13th ed.), Pearson Education, New Delhi
4. "The Practice of Management", Peter Drucker, Om Books India
5. Ghuman, K & Aswathapa, K, (2017). Management concepts and cases (10th ed.), Tata McGraw Hills, New Delhi
6. Koontz, H, & Weihrich, H (2016). Essentials of Management: An International Perspective (8th ed.), Tata McGraw Hills, New Delhi

QUESTION PAPER PATTERN

BCOM – I : SEMESTER I

1T6-A – Business Skills

TIME:- 3 Hours] [Full Marks: 80

N.B. – 1) All questions are compulsory.

2) All questions carry equal marks.

Q.1.
(a) UNIT – I 08 Marks
(b) UNIT – I 08 Marks
OR
(c) UNIT – I 16Marks

Q.2.
(a) UNIT – II 08 Marks
(b) UNIT – II 08 Marks
OR
(c) UNIT – I 16Marks

Q.3.
(a) UNIT – III 08 Marks
(b) UNIT – III 08 Marks
OR
(c) UNIT – I 16Marks

Q.4.
(a) UNIT – IV 08 Marks
(b) UNIT – IV 08 Marks
OR
(c) UNIT – I 16Marks

Q.5.
a) UNIT – I 04 Marks
b) UNIT – II 04 Marks
c) UNIT – III 04Marks
d) UNIT – IV 04 Marks

CA

B.Com (CBCS) SEM –I

Course Type: Skill Enhancement Course

Course Name: MS-OFFICE

Course Code: 1T6-B

	Course Outcome
CO1	Student will be able to create and manage word documents with required formatting. Students will be able to compose word documents and operate relevant features and tools of MS Words.
CO2	Student will be able to perform operations like creating, storing, and formatting data using different Excel formatting tools and features.
CO3	Students will able to perform calculations using functions, and present the data visually using charts and graphs.
CO4	Student will be able to create and design professional presentation using different features & tools of PowerPoint.
CO5	Students will be able to prepare and appraise professional business data, document and presentation.

Unit I
Microsoft Word

Introduction ; Getting familiar with the interface of Word; Backstage View(File); Creating, Saving, Opening, Closing of document; Editing text Documents; Inserting & Deleting text, Toolbars; Inserting Tables, Pictures, Shapes, Icons, Smart Art, Drop Cap, Date and time, Object, Word Art, Special Symbols, Hyperlinks, Header and footer, Page Numbering, Charts; Use columns and breaks; Using step-by-step mail merge wizard; Review documents using - Spelling and Grammar check, word count; Different views of word document, Change the view of document ; Using format painter ;Creating styles; Using Page Setup Settings , Printing of the document; Sharing the document ;Exporting of word document

Unit II

Microsoft Excel – I

Introduction ; Getting familiar with the interface of Excel; Backstage View(File); Excel Toolbars; References-Absolute and Relative; Working with worksheet/workbook; Data Entry in Excel; Formatting of data –Formatting Cell, Rows, Columns , Sheet ; Different formatting - Number Formatting ,Text formatting ,Date Formatting ,Alignment Settings, Font Formatting, Border ,Shading , Format as Table; Changing Row /Height ,Using Hide /unhide options;

Moving or copying sheet; Renaming Sheet; Flash Fill ;Using find and select options-Go to, Go To Special ; Sharing the excel workbook; Exporting of worksheet

Unit III

Microsoft Excel – II

Outline -Group, Ungroup, Subtotal; Conditional Formatting; Performing Calculations with Functions and formulas, Function Library-Date and Time Functions, Mathematical Functions, Logical Functions, Text Functions, Statistical Functions, hlookup, vlookup; Converting data from text to columns, removing duplicates; Creating Effective Tables & Charts; Data analysis using Sort ,Filter and data validation feature in excel; Pivot table & Pivot charts; Page Setting & Printing

Unit IV

Microsoft PowerPoint

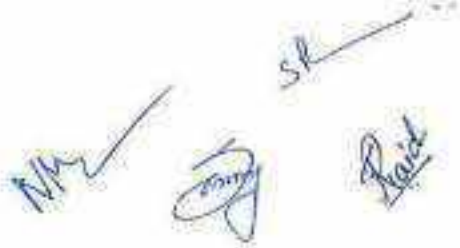
Introduction ; Getting familiar with the interface of PowerPoint; Backstage View (File); Slide Layout; Formatting in PowerPoint; Different Toolbars; Inserting Clip Art, Picture, Slide, Organization Chart, Smart art ,Table, Hyperlink; Presentation Views ; Master Slide; Working With Movies and Sounds; Using different design themes; Changing Slide Size and background ; Applying Animation and Slide Transition; Slideshow ; recording slide show; Page Setting & printing; Sharing the presentation ;Exporting the presentation to Video

Text Books

1. MS Office 2016 Quintessential Course –Vishnu P Singh, Asian Computer Books
2. Microsoft Office 2016 Step by Step, Joan Lambert, Curtis Frye, Microsoft Press
3. Information Technology, Vikrant Malviya, Himalaya Publishing House

Reference Books

1. Introduction to Information Technology, Renu Vashishth & Dr. Neeru Mudra, Himalaya Publishing House
2. Computer course –Prof. Satish Jain, Shashi Singh, M. Geetha, BPB Publication
3. Office 16 in easy steps, Michael Price Mike Mc Grath, BPB Publications
4. Office 2016 for beginners- Steven Weikler, Alpha Lifestyle Productions
5. Microsoft office 2016 Word, Excel, One Note Book - Vol 1-Lalit Mali, Notion Press



Bachelor of Commerce
B.Com. (CBCS) – Sem II
Course Type: Core Course
Course Name: Statistics and Business Mathematics
Course Code: 2T1

CO1	Given the information about a particular variables, Student will be demonstrate an understanding of statistics by creating frequency distribution as per the Statistical Series.
CO2	From the given data set student will be able to compute Mean, Median, Mode and other measure of central tendency as required.
CO3	From the given data, Students will be able to know dispersion and to calculate Standard Deviation, Quartiles, Quartile Deviation & Co-efficient of Variation.
CO4	From the given data set the student will be able to compute the Skewness & it's coefficient by using Karl Pearson's and Bowley's method.
CO5	From the given information student will able to calculate Percentage, Simple Interest, Compound Interest and also able to calculate Profit or Loss arising out a business transactions.

B.Com. - First Year Semester-II

2T1: Statistics and Business Mathematics

Unit - I Statistics & Measures of Central Tendency

Meaning, Scope, Importance, Functions and Limitations of Statistics. Collection of data, Tabulation and Classification, Frequency distribution. Mean, Median, Mode, Geometric Mean and Harmonic Mean (Theory & Numericals)

Unit -II Dispersion-

Meaning and significance of dispersion, Methods of measuring dispersion, Standard Deviation, Quartiles, Quartile Deviation, Co-efficient of variation (Theory & Numericals)

Unit - III Skewness-

Absolute Measures of Skewness, Relative Measures of Skewness, Karl Pearson's Coefficient of Skewness, Bowley's Coefficient of Skewness. (Numericals)

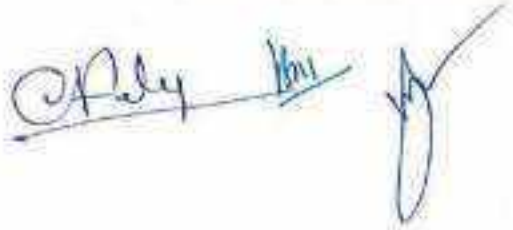
Unit - IV Business Mathematics:-

Percentages, Simple Interest, Compound Interest, Profit/ Loss. (Numericals)

Note: Activity for subject/Chapter related (Workshop, Seminar, Guest Lecture, Group Discussion)

Reference Books:

1. Fundamentals of statistics : D. V. Elhance & Veena Elhance.
2. Statistics : V. K. Kapoor : S. Chand & Sons.
3. Statistics : B. New Gupta: Sahitya Bhavan Agra.
4. Fundamental of Statistics : S. C. Gupta - Himalaya Publishing House.
5. Business Mathematics & Statistics : NEWK Nag & S.C. Chanda - Kalyani Publishers
6. Statistics and Business Mathematics: Dr. Pramod Fating, Dr. Milind Gulhane, Dr. Vijay Bagde, Sir Sahitya Kendra, Nagpur
7. Problem in Statistics : Y. R. Mahajan: Pimplapure Publisher Nagpur
8. Statistics and Business Mathematics: Dr. Gulhane, Dr. Chopde



with effect from S-2023

Question Paper Pattern
B.Com. – First Year Semester-II
2T1: Statistics and Business Mathematics

N.B. – 1) All questions are compulsory.
2) All questions carry equal marks.

Q. No. 1 – Unit I

	a) Theory	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	16Marks

Q. No. 2 – Unit II

	a) Theory	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	16 Marks

Q. No. 3 – Unit III

	a) Problem	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	16 Marks

Q. No. 4 – Unit IV

	a) Problem	08 Marks
	b) Problem	08 Marks
	OR	
	c) Problem	08 Marks
	d) Problem	08 Marks

Q. No. 5	a) Unit- I Problem	04 Marks
	b) Unit –II Problem	04 Marks
	c) Unit-III Problem	04Marks
	d) Unit-IV Problem	04 Marks

Dr R. Karmore
Chairman

19/03/23

18/03/23

18/03/23

BE

Bachelor of Commerce
B.Com (CBCS) – Sem II
Course Type: Core Course
Course Name: Business economics-II
Course Code: 2T2

Course outcomes

CO1	Students will be able to establish relationship between cost and Output in short / long run
CO2	Students will be able to differentiate between various Market structures
CO3	Students will be able to determine prices under different market structures
CO4	Students will be able to explain basic concepts of macroeconomics
CO5	Students will be measure national income using given data

Unit 1:
Cost Analysis: Cost Concepts – Actual & Opportunity cost, fixed costs and Variable costs, explicit and implicit costs, total, average and marginal costs, historical costs and replacement costs, short run costs and long run costs, accounting costs and economic costs. Determinants of costs; Short run cost-output relationship; long run cost-output relationship; Economies and diseconomies of scale – factors causing economies & dis-economies; estimating cost output relationship – accounting method, engineering method, econometric method

Unit 2:
Market Structures – Concept, meaning, Definition, Classification of market structures, Perfect Competition, Monopolistic Competition. Product Differentiation. Oligopoly: Homogeneous and Heterogeneous Oligopoly, Price Rigidity in Oligopoly. Kinked Demand Curve. Monopoly Features, Equilibrium. Difference between Perfect Competition and Monopoly

Unit 3:
Pricing Concepts– demand, cost of production, objective of firm, government policy, nature of competition, Cournot's Model, Collusion Model, Leader- Follower Model; Price determination under perfect competition, Price determination under Monopolistic competition; price determination under monopoly

Unit 4:
Introductory Macroeconomics: Concept of inflation, employment, money supply, monetary policy, fiscal policy, Balance of payments, National income, consumption function. Savings and Investment – equality between savings and investments; Determinants of National Income, Measurement of national income.

References:
1.Business Economics, H.L.Ahuja, S.Chand Publishing
2. Micro Economics, P.N.Chopra, Kalyani Publishers.
3.Micro Economics, D.D.Chaturvedi, Galgotia Publishing Company.
4.Principles of Economics, D.M.Mithani, Himalaya Publishing House.

Com

B.Com. (Choice-Based Credit System)

Semester II

Course Type: Ability Enhancement Course

Course Name: Commercial Services

Course Code: 2T5 – A

Course Outcomes:

CO1	The Students will be able **to understand** the concept of commercial services and their practical importance
CO2	The students will be able **to evaluate** the current and emerging trends in Aviation and Hospitality services.
CO3	The students will be able **to interpret** the trends, role and importance of Information Technology Enabled Services (ITES).
CO4	The student will be able **to analyse** the effect of the new innovative services on the banking and insurance sector.
CO5	The students will be able **to apply** the concepts, functions and techniques of the Marketing Mix of Services.

Syllabus:

UNIT I

Commercial Services: Meaning, Characteristics, Scope and Classification of Services, Emerging Trends and Importance of the service sector in India.

Marketing Mix of Services: Product, Place, Price, Promotion, People, Process of Services delivery and Physical evidence.

Career Opportunities: Factors for growth of Service Sector in India and Career Opportunities in Commercial Services.

UNIT II

Aviation Services: Role and Importance, Current Trends, Challenges and Future Opportunities in India, Government initiatives towards the aviation industry.

Hospitality Services: Diversity of Hospitality Industry, Role and Importance, Emerging Trends, Challenges and Future Opportunities in the Indian Hospitality Industry

UNIT III

Information Technology Enabled Services (ITES): Overview and Current Trends of ITES, Role and Importance of ITES.

Concept and Scope of Business Process Outsourcing (BPO), Knowledge Process Outsourcing (KPO), Legal Process Outsourcing (LPO) and Enterprise Resource Planning (ERP).

Challenges and Future Opportunities for ITES in India.

UNIT IV

Banking Services: Overview and Importance of Banking Services with respect to recent developments in India. Concept of Credit Cards and its usage and No Cost EMI system. Effects of Privatization on Banking Services in India.

General Insurance Services: Concept and Role of General Insurance Services. Growth and development due to the emergence of Online platforms in Insurance services. Impact of the opening of the Insurance sector for private players.

Reference Books:

1. Service Sector in Indian Economy: Talluru Sreenivas, Discovery Publishing House
2. The Service Sector in India's Development: Gaurav Nayyar, Cambridge University Press
3. Service Marketing: S.M. Jha, Himalaya Publishing House
4. Service Sector Management: C. Bhattacharjee, Jaico Books
5. Service Sector Management: Sanjay Patankar, Himalaya Publishing House

QUESTION PAPER PATTERN
BCOM – I : SEMESTER I
1T2- Commercial Firms
TIME:- 3 Hours] [Full Marks:- 80
N.B. – 1) All questions are compulsory.
2) All questions carry equal marks.

Q.1.
(a) UNIT – I 08 Marks
(b) UNIT – I 08 Marks
OR
(c) UNIT – I 16Marks

Q.2.
(a) UNIT – II 08 Marks
(b) UNIT – II 08 Marks
OR
(c) UNIT – I 16Marks

Q.3.
(a) UNIT – III 08 Marks
(b) UNIT – III 08 Marks
OR
(c) UNIT – I 16Marks

Q.4.
(a) UNIT – IV 08 Marks
(b) UNIT – IV 08 Marks
OR
(c) UNIT – I 16Marks

Q.5.
a) UNIT – I 04 Marks
b) UNIT – II 04 Marks
c) UNIT – III 04Marks
d) UNIT – iV 04 Marks

Bachelor of Commerce
B. Com. (CBCS) – Semester II
Course Type: Ability Enhancement Course
Course Name: Fundamentals of Banking
Course Code: 2T5 – B

Course Outcomes:

CO1	The students will be able to Classify Banking Functions
CO2	The students will be aware of Types of Bank Accounts and its Eligibility.
CO3	The students will be aware of Bank Account Procedure for Opening, operating, Transfer and Closing
CO4	The students will be Know of Types of Bank services for the Customers .
CO5	The students will be enlightened regarding the new concepts introduced in the banking system.

Unit I: Evolution of Bank

1) **Evolution of Bank** , Nature, Meaning, Definition of Bank,
2) **Types of Bank** – Public Bank, Private Bank, Commercial Bank, Co-operative Bank, Postal Bank, Agricultural Bank,
3) **Functions of Banks** – Primary, Secondary
4) **Role of Banking in Economic Development of India.**

Unit II: Bank Accounts Types and Handling Procedure

1) **Saving Bank Account** – Meaning and Importance of SB Account , Eligibility for open SB Account
2) **Current Account**- Meaning and Importance of Current Account , Eligibility for open Current Account
3) **Fixed Deposit Account**- Meaning and Importance of FD Account , Eligibility for open FD Account
4) **Recurring Deposit Account** - Meaning and Importance of RD Account , Eligibility for open RD Account

Unit III: Procedure for opening and Operating transfer and closing of Accounts

1) **Procedure for opening of account**- Know your customers Norms (KYC Norms), Application forms, Introduction, Proof of residence, Specimen signature and Nomination.
2) **Procedure for operating accounts**- Pay-in-slips, Withdrawal Slips, Issue of Pass book, Issue of cheque book, Issue of fixed deposit receipt, premature encashment of fixed deposits . Procedure of F.D., Repayment of Term Deposit (F.D) on Due date with interest.
3) **Transfer of accounts** – Transfer of accounts to other branches, Other Person
4) **Closing of Accounts** - Dormant accounts, Zero Balance, Bounced cheque or overdrafts, Suspected Identity Theft, Criminal Conviction, Change at the bank, Death of account Holder.

Unit IV: Customer Services

1) **Fund Transfer**- Bank Draft, Meaning, Procedure of Issue and Encashment of Demand Draft.
2) **Online Banking**- Meaning, Procedure of IFSC systems, RTGS/NEFT
3) **Safe Custody and Safe Deposit Lockers** – Importance and Need, Procedure of Opening ,Operating, Closing . Documentation
4) **Handling Foreign Exchange Transaction** – Meaning and Importance of Foreign Trade, Banks role in foreign Trade, Foreign Exchange and Exchange Rates.

Recommended books

- **Practice and Law of Banking, G. S. Gill**
- **Banking: Law and Practice, P. N. Varshney**
- **Banking: Law and Practice in India, Tannan**
- **Banking: Law and Practice in India, Maheshwari**
- **Banking: Law and Practice, Prof. Mugle**
- **Banking and Financial System, Vasant Desai.**
- **Fundamentals of Banking, DR. R. S. S. Swami**
- **Report on trends and progress of banking in India- RBI Bulletin.**
- [illegible]

Bachelor of Commerce
B. Com.(CBCS) - Semester -II
Course Type: Skill Enhancement Course
Course Name: Financial Markets operation
Course Code: 2T6 - A

Course Outcomes

CO1	The student will be able to explain the importance of financial Institutions
CO2	The student will be able to interpret the structure of Financial Regulations in India
CO3	The student will be able to explain the importance of Financial Markets
CO4	The student will be able to distinguish between primary and secondary capital markets
CO5	The student will be able to identify the Components of money markets

UNIT 1: **Financial institutions and regulatory bodies:**

Institutions: (Meaning and functions) Merchant Banks, Investment companies, Management Investment companies, Development banks, Mutual Funds. **Regulators: (functions, scope, roles and responsibilities)** RBI, SEBI, IRDA, PFRDA (Functions, Scope, Roles and responsibilities)

UNIT 2: **Capital Markets- Primary Markets**

Meaning, Role and importance, Composition, instruments, New Issue Market: Features, objectives and functions, Constituents or players, Modes of procuring long term funds; Public issue, Rights issue, Bonus issue, Private placement.

UNIT 3 : Capital Markets - **Secondary Markets.:**

Meaning, Role and Importance. Functions of the stock exchange, Listing of securities and its benefits, Stock market indices, Types of dealings, types of securities traded on the Indian stock exchanges, Comparison of the three exchanges (BSE, NSE, OTCEI)

UNIT 4: **Money Markets:**

Meaning, features of organized and unorganised money markets Instruments: Treasury Bills, Certificate of Deposits, Commercial Paper, Call money Commercial bills, Inter-corporate deposits, Inter-bank participation certificates. **Credit Rating Agencies**: Meaning and role of such agencies. A brief idea about: CRISIL, ICRA.

Suggested Books

1. Financial Market Operations by Alok Goyal, Mridula Goyal; VK Global Publications
2. Financial Market Operation by Dr. I.M. Sahai; SBPD Publishing House.
3. Financial Institutions and Markets: Structure, Growth and Innovations by L M Bhole and Jitendra Mahakud; McGraw Hill Education

B.Com (CBCS)– Semester II

Course Type: Skill Enhancement Course

Course Name: Skill Development

Course Code:2T6-B

Course Outcomes

CO1	The Students will be able **to relate** the concept of skill development and its importance
CO2	The students will be able **to interpret** the problem solving technique and multiple approaches to creativity.
CO3	The students will be able **to relate** importance of communication skills for interpersonal communication
CO4	The student will be able **to analyse** team behavior and impact of empowerment and delegation
CO5	The students will be able to explore various skill development avenues.

Unit 1:

Introduction to skills & personal skills, developing self awareness on the issues of emotional intelligence, self learning styles, values, attitude towards change, learning of skills and applications of skills.

UNIT – 2:

Problem solving and building relationship: Problem solving, creativity, innovation, steps of analytical problem solving, limitations of analytical problem solving, impediments of creativity, multiple approaches to creativity, conceptual blocks, conceptual block bursting. Skills development and application for above areas.

UNIT – 3:

Building relationship Skills for developing positive interpersonal communication, importance of supportive communication, coaching and counseling, defensiveness and disconfirmation, principles of supportive communications. Personal interview management. Skill analysis and application on above areas.

UNIT – 4:

Team building: Developing teams and team work, advantages of team, leading team, team membership. Empowering and delegating: Meaning of empowerment, dimensions of empowerment, how to develop empowerment, inhibitors of empowerment, delegating works. Skills development and skill application on above areas.

Suggested Books:

V.S.P. Rao Managerial Skills Excel Books,2010, New Delhi

2. David A Whetten, Cameron Developing Management skills, PHI 2008

3. Ramnik Kapoor Managerial Skills Path Makers, Bangalore

4. Kevin Gallagher, Skills development for Business and Management Students,Oxford,2010

5. Monipally,Muttthukutty Business Communication Strategies Tata McGraw Hill.

6. McGrath E.H. (9th Ed., 2011). Basic Managerial Skills. Prentice Hall India Learning Private Limited

7. Whetten D. (8th Ed., 2011). Developing Management Skills. Prentice Hall India Learning Private Limited

8. Gulati S. (2001). Corporate Softskills. Rupa Publication Pvt Ltd

9.Gallagher (2010). Skills Development for Business & Management Students. Oxford University Press

POST GRADUATE PROGRAM IN SOCIOLOGY

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

POST GRADUATE (CBCS) (NEP) SEMESTER SYLLABUS

2023-2024

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester I

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/ point (40%)	Total
						Internal Evaluation	End SEM Exam.		
6.0	Major	Mandatory	PGSO1M01	Classical Sociological Thinkers	4	20	80	B/6	100
			PGSO1M02	Perspective on Indian Society -I	4	20	80	B/6	100
			PGSO1M03	Constitution and Social Change in India	4	20	80	B/6	100
			PGSO1M04	Sociology of Religion - I	2		50	B/6	50
		Elective	PGSO1E05	G1P1: Family, Kinship and Marriage	4	20	80		100
			PGOS1E06	G2P1: Gender and Society.					
			PGSO1E07	G3P1: Sociology of Social Movement					
			PGSO1E08	G4P1: Sociology of Education					
	RM		PGSO1M09	Quantitative Research Methodology **OR** Qualitative Research Methodology	4	20	80	B/6	100
	Cumulative Credit/ Marks				22				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RM: Research Methodology, RP: Research Project, CS: 40%

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester II

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.0	Major	Mandatory	PGSO2M01	Contemporary Sociological Theory	4	20	80	B/6	100
			PGSO2M02	Perspectives on Indian Society-II	4	20	80	B/6	100
			PGSO2M03	Sociology of Change and Development	4	20	80	B/6	100
			PGSO2M04	Sociology of Religion - II	2		50	B/6	50
		Elective	PGSO2E05	G1P2: Rural and Urban Transformation	4	40	60	B/6	100
			PGSO2E06	G2P2: Women In Indian Society					
			PGSO2E07	G3P2: Social Movement in India					
			PGSO2E08	G4P2: Education and Society in India					
	OJT/FP		PGSO2M09	Field project FP	4	100		B/6	100
	Cumulative Credit/ Marks				22				550
	Cumulative Credit for PG diploma (Sem. 1+2)				44				
	Exit option: PG Diploma (40 Credits) after three years UG Degree								

Note: For **Elective** Department offers 4 **Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters. **RM: Research Methodology** **OJT: On Job Training: Internship/Apprenticeship** **CS: 40 %**

17/9/23

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester III

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Exam		
6.5	Major	Mandatory	PGSO3M01	Modern Sociological Theories	4	20	80	B/6	100
			PGSO3M02	Feminist Sociological Thinkers	4	20	80	B/6	100
			PGSO3M03	Globalisation and Society	4	20	80	B/6	100
			PGSO3M04	Social Problems in Contemporary India	2		50	B/6	50
		Elective	PGSO3E05	G1P3: Sociology of Social Stratification	4	40	60	B/6	100
			PGSO3E06	G2P3: Sociology of Social Exclusion					
			PGSO3E07	G3P3: Media and Society					
			PGSO3E08	G3P3: Environment and Society					
	RP		PGSO3M09	Research Project	4	100		B/6	100
	Cumulative Credit/ Marks				66				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project

CS: 40%

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester IV

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.5	Major	Mandatory	PGSO4M01	Postmodern Social Theories	4	20	80	B/6	100
			PGSO4M02	Recent trends in Social Theories	4	20	80	B/6	100
			PGSO4M03	Economy and Society	4	20	80	B/6	100
		Elective	PGSO4E04	G1P4: Sociology of Marginalized Communities	4	20	80	B/6	100
			PGSO4E05	G2P4: Science, Technology and Society					
			PGSO4E06	G3P4: Culture and Symbolic Transformation					
			PGSO4E07	G4P4: State, Politics and Development					
	RP		PGSO4M08	Research Project	6	150		B/6	150
	Cumulative Credits/ Marks				22				550
	Cumulative Credit for 2-year PG degree				88				

2 Year - 4 Semester PG Degree (80 credits) after three-year UG degree

OR

1 Year- 2 Sem PG Degree (40 credits) after four year of UG degree

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project, C5: 40%

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

P.G. CBCS (NEP) Semester Pattern Syllabi of SOCIOLOGY

STRUCTURE OF THE CBCS (NEP) SEMESTER PATTERN P.G. PROGRAM

The P.G. CBCS semester pattern shall come into force from the academic year2023 - 2024 for the students seeking enrollment in semester I. While the students of semester III and semester IV shall go through the CBCS semester pattern examinations.

1. The CBCS (NEP) semester pattern P.G. PROGRAM shall give sufficient opportunity to the students of all departments for choice of subjects as shown in major electives.
2. The whole course shall be of full-time course of two years duration.
3. The semester I, II and III shall have four major mandatory papers (compulsory papers) and one core elective paper (optional papers) in four groups offering wider choice to the students to opt for any one group of them. The semester IV shall have three major mandatory papers (compulsory papers). There shall be again one core elective paper, which is in continuation of the group, which opt in first semester.
4. In semester I, students shall have a choice to choose any one of the course from RM (Research methodology) which he want to use in research projects of semester III & IV. RM is mandatory course.
5. In semester II, student himself shall engage in fieldwork and submit a fieldwork report to the institution/department. Based on hours engage in fieldwork and report submitted to institution/department, his/her credits will be evaluated. University will provide the direction time to time on the process of evaluation of fieldwork and other issues related to this course.
6. In semester III and IV, student shall avail a course RP (Research Project) which is mandatory and divided into two parts. The courses Research Project - I and Research Project - II, which shall opt by students, are the part of Semester III and Semester IV simultaneously. Student in the guidance of supervisor shall decide the topic of this course. The conditions of supervisor-ship and other issues will be decided by university time to

time.

7. 2100 marks, i.e. 88 credits in order to be awarded M.A. degree in Sociology by RTM Nagpur University.
8. The CBCS P.G. course shall be based on continuous internal evaluation of the students out of 20 marks in each paper (except 2 credits paper), along with the external evaluation based on a descriptive written examination of 80 marks by the university.

   Regarding 2 credits papers, University or Board of studies will declare the policy as per further notifications.

CODE OF EXAMINATION

Written Examination:

1. There shall be a written external examination of descriptive type in each paper at the end of every semester.
2. Each 4-credit paper shall be of 80 marks of external examination of 3 hours duration and 2-credit papers shall be of 50 marks of external examination of 2 hours duration.
3. The question paper shall contain 5 questions (four long questions and one short question) with an internal choice except for the short question. The short question shall be put like A, B, C and D at the question No. 5 i.e. the last question of the paper. The students shall have to answer all questions including all A, B, C and D of Q.No.5.
4. Each question shall carry an equal value of 16 marks in 4-credit course and 10 marks in 2-credit course.

Nature of Internal Evaluation:

1. There shall be an internal evaluation of each student of 20 marks in each theory paper at the end of every semester in 4-credit course. It should be note that there is no internal evaluation in 2-credit courses.
2. Out of 20 internal marks in each theory paper, 10 marks shall be for Home Assignment and another 10 marks for daily attendance, viva-voce test and seminar presentation of the students based on the course content. The viva-

voce tests and seminar presentations shall be conducted by a committee consisting of the Head of the Department/Principal of the college/Director of the Institute or Centre running the P.G. Course and the teacher of the concerned subject.

3. The teacher of the concerned subject shall decide the task to be assigned to the students for home assignment, viva-voce test and seminar presentation. The students' evaluation shall be done on consensus among all the members of the committee conducting the viva-voce test and seminar presentation.

Passing Marks

1. The students shall be required to score a minimum of 40 marks in each paper out of 100 including internal marks in order to pass in the examination.
2. Scheme of Marking for Research Paper - I and II

A. Examination and Evaluation scheme for field Project)FP)

Sr.	Contents	hours	Marks Distribution
1	Orientation of Field Project	10 (2*5)	-
2	Field Work	96hours (16*6)	40
3	Field Diary	Related to FW	10
4	Report Writing	12 hours (2*6)	20
5	Presentation	2 hours	10
6	Internal Viva-voce	---	20

Internal Viva-voce conducted on the objectives of Field project with Power point Presentation. Its Field Diary and Field Report should be consider a basic document for viva-voce.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Scheme of Teaching and Examination

for

Two year Post Graduate Programme

M. Sc. (Microbiology)

(As per NEP 2020 Structure and Credit Distribution)

Course Effective from 2023-2024

Scheme of Teaching and Examination for M. Sc. (Microbiology)

As per NEP 2020 Structure and Credit Distribution of PG Degree Program

for Two Year Choice Based Credit System (Semester Pattern)

Effective from 2023-2024

Semester I

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total (Hrs)	Total Credit	Examination Scheme						
									Theory				Practical		
				(Th)	TU	P			Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microbial Metabolism	MMI1T01	4	-	-	4	4	3	80	20	40	-	-	-
2	DSC	Enzymology and Techniques	MMI1T02	4	-	-	4	4	3	80	20	40	-	-	-
3	DSE	Elective 1 (Choose any One) 1. Advance Techniques in Microbiology 2. Membrane Structure and Signal Transduction	MMI1T03	4	-	-	4	4	3	80	20	40	-	-	-
4	RM	Research Methodology	MMI1T04	4	-	-	4	4	2	80	20	40	-	-	-
5	LAB 1	Practical I	MMI1P01	-	-	6	6	3	2-6*				50	50	50
6	LAB 2	Practical II (Including Research Methodology)	MMI1P02	-	-	6	6	3	2-6*				50	50	50
Total				16	-	12	**28**	**22**	**-**	**320**	**80**	**160**	**100**	**100**	**100**

Marks of Theory Component= 400 Marks of Practical Component= 200 TOTAL = 600
Min.Passing: 160+100= 260

Semester II

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total (Hrs)	Total Credit	Examination Scheme						
									Theory				Practical		
				(Th)	TU	P			Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Environmental Microbial Technology	MMI2T05	4	-	-	4	4	3	80	20	40	-	-	
2	DSC	Immunology and Immunodiagnostics	MMI2T06	4	-	-	4	4	3	80	20	40	-	-	
3	DSE	Elective 2 (Choose any one) 1. Microbial Metabolites 2.Pharmaceutical Microbiology	MMI2T07	4	-	-	4	4	3	80	20	40	-	-	
4	OJT	On Job Training / Field Project	MOJ2P01	-	-	8	8	4	3-8*	-	-	-	50	50	50
5	LAB 3	Practical III	MMI2P03	-	-	6	6	3	2-6*	-	-	-	50	50	50
6	LAB 4	Practical IV	MMI2P04	-	-	6	6	3	2-6*	-	-	-	50	50	50
Total				12	-	20	**32**	**22**		**240**	**60**	**120**	**150**	**150**	**150**

Marks of Theory Component = 300 Marks of Practical Component= 300 TOTAL = 600
Min. Passing: 120+150= 270

Semester III

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total (Hrs)	Total Credit	Examination Scheme						
									Theory				Practical		
				(Th)	TU	P			Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microbial Diversity,Evolution and Ecology	MMI3T08	4	-	-	4	4	3	80	20	40	-	-	-
2	DSC	Molecular Biology and Genetics	MMI3T09	4	-	-	4	4	3	80	20	40	-	-	-
3	DSC	Recombinant DNA Technology and Nanobiotechnology	MMI3T10	4	-	-	4	4	3	80	20	40	-	-	-
4	DSE	Elective 3 (Choose any one) 1. Drug and Disease Management 2. Bioinformatics	MMI3T11	4	-	-	4	4	3	80	20	40	-	-	-
5	LAB 5	Practical V	MMI3P05	-	-	4	4	2	-	-	-	-	50	50	50
6	RP	Research Project/ Dissertation (Core)	MRP3P01	-	-	8	8	4	-	-	-	-	50	50	50
Total				16	-	12	**28**	**22**		**320**	**80**	**160**	**100**	**100**	**100**

Marks of Theory Component= 400 Marks of Practical Component= 200 TOTAL = 600
Min.Passing: 160+100=260

Semester IV

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total (Hrs)	Total Credit	Examination Scheme						
									Theory				Practical		
				(Th)	TU	P			Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Virology	MMI4T12	4	-	-	4	4	3	80	20	40	-	-	-
2	DSC	Microbial Fermentation & Techniques	MMI4T13	4	-	-	4	4	3	80	20	40	-	-	-
3	DSC	Medical Microbiology and Parasitology	MMI4T14	4	-	-	4	4	3	80	20	40	-	-	-
4	DSE	Elective 4 (Choose any one) 1. Vaccinology 2. Bioethics, Biosafety and IPR	MMI4T15	4	-	-	4	4	3	80	20	40	-	-	-
5	RP	Research Project / Dissertation (Core)	MRP4P02	-	-	12	12	6	-	-	-	-	100	100	100
Total				16	-	12	**28**	**22**		**320**	**80**	**160**	100	100	100

Marks of Theory Component= 400 Marks of Project Component= 200 TOTAL = 600

Min. Passing: 160+100=260

2 Years-4 Sem. PG Degree (88 credits) after Three Year UG Degree or
1 Year-2 Sem PG Degree (44 credits) after Four Year UG Degree

Total Credits for Four Semesters (Two Year Course): 4 * 22 = 88

Total Marks for Four Semesters (Two Year Course): 4 * 600 = 2400

Basket for ELECTIVE (DSE) Category Courses (Microbiology)

Semester	Course Category	Name of Course	Course Code
I	Elective 1	A. Advance Techniques in Microbiology B. Membrane Structure and Signal Transduction	MMI1T03
II	Elective 2	A. Microbial Metabolites B. Pharmaceutical Microbiology	MMI2T07
III	Elective 3	A. Drug and Disease Management B. Bioinformatics	MMI3T11
IV	Elective 4	A. Vaccinology B. Bioethics, Biosafety and IPR	MMI4T15

Abbreviations:

DSC: Discipline Specific Course, **DSE**: Discipline Specific Elective **SEE:** Semester End Examination**, CIE:** Continuous Internal Evaluation, **OJT:** On the Job Training (Internship/Apprenticeship), **FP:** Field Project, **RM:** Research Methodology, **RP**: Research Project

EVALUATION and DISTRIBUTION OF MARKS

(1) Continuous Internal Evaluation (CIE): Twenty (20) marks

a. Mid-Semester Examination: Maximum Marks 10, Duration of Examination: One Hour, Pattern of Question Paper: Multiple Choice Questions, Mode of examination: Online or offline.

b. Overall Participation: Maximum 10 Marks (Such as, Attendance in theory classes, seminar, assignment, quiz, participation in field tours, conferences, workshops, and the general behaviour in the department.)

Note: Total Marks of CIE will be 20 (i.e., 10+10). A candidate must have to secure minimum 50% marks (i.e., 10 out of 20 marks). Failing so, he/she shall not be allowed to appear in End Semester Examination.

(2) Semester End Examination (SEE)

a. Theory Paper: Maximum Marks: 80 (Eighty), Duration of Examination-Three Hours, The paper will be set so as to cover all units/sections of the syllabus as below:

Type of questions	Total Number of questions with Marks	No. of questions to be	Marks for Each Question	Total maximum marks
• Short answer questions • Long answer questions	**4 + 1 = 5** one long question from each unit (16 marks each) or two questions from each unit (8+8=16 marks each) + one short question on each unit (4 marks each)	**5**	**16**	**80**

3) General Scheme for Distribution of Marks in Practical Examination in Microbiology

Marks: 100 [SEE: 50 Marks] [CIE: 50 Marks]

a) **Continuous Internal Evaluation (CIE): Fifty (50) marks:** Attendance in practical classes, seminar, assignment, quiz, participation in field tours, conferences, workshops, and the general behaviour in the department

Note: Total Marks of CIE will be 50 marks. A candidate must have to secure minimum 50% marks (i.e., 25 out of 50 marks). Failing so, he/she shall not be allowed to appear in End Semester Examination

b) **Semester End Examination (SEE):** Time: 5-6 h (Two days Examination)

Exercise-1	15 Marks	- Evaluated jointly by Internal and External Examiner
Exercise-2	15 Marks	- Evaluated jointly by Internal and External Examiner
Record	10 Marks	- Evaluated by Internal
Viva-Voce	10 Marks	- Evaluated by External
Total	**50 Marks**	

4) General Scheme for Distribution of Marks in Project Examination in Microbiology

The project work will carry total 100 marks (SEE=50 + CIE=50) in Semester III and 200 marks (SEE=100 + CIE=100) in Semester IV and will be evaluated by both external and internal examiners in the Department. The examiners will evaluate the project work considering the coverage of subject matter, presentation, literature etc.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Syllabus

for

Two year Post Graduate Programme

M. Sc. (Microbiology)

(As per NEP 2020 Structure Effective from 2023-2024)

M. Sc. Semester-I
Discipline Specific Core Course (DSC-1)-MICROBIOLOGY –Paper I
(MMI1T01) (MICROBIAL METABOLISM)

Course Outcomes: At the end of the course the students will be able to
1. Understand the biochemical basis of life forms
2. Learn the energy transformations in biological processes
3. Understand the synthesis of biomolecules
4. Understand synthesis and breakdown mechanisms in bacteria

DSC-1 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Carbohydrates and Lipids	Carbohydrates as informational molecules:-Sugar code, Plant Lectins: - ConA, GS4, WGA. Animal:- Galectin A, MBP-1.Viral:- HA, VPI. Bacterial:- LT,CT. Reverse TCA cycle, Biosynthesis of cell wall polysaccharides and bacterial peptidoglycan. Biosynthesis of microbial exopolysaccharides (alginate) Lipid:- Membrane lipids, biosynthesis of membrane phospholipids, Steroid transformation		**15 Hrs**
	Unit-II		
Proteins and Nucleic acids	**Proteins: C**haracteristics of alpha-helix and β-sheets. Ramachandran plot, Concept of protein domain and motif, common motifs and their role in metabolism, protein folding and denaturation curves, role of Chaperones and chaperonins. Biosynthesis of amino acids (only Aromatic, Acidic and Basic amino acid). Determination of primary structure of polypeptide (N-terminal, C-terminal determination, method of sequencing of peptides), **Nucleic acids:-** Structural details of Duplex DNA, Unusual structures: palindrome, inverted repeats, mirror repeats, triplet DNA, G tetraplex, secondary structure of RNA, purine and pyrimidine biosynthesis, degradation and regulation, salvage pathway, Inhibitors. DNA sequencing. (Maxam–Gilbert and Sanger dideoxy method)		**15 Hrs**

Unit III		
Photosynthesis	**Anoxygenic photosynthesis:-**Green sulphur bacterial, non-sulphur bacterial, purple phototrophic bacteria. **Oxygenic photosynthesis:-**Cyanobacteria. **Chemolithotrophy:-** Hydrogen oxidation and autotrophy in hydrogen bacteria. Oxidation of reduced sulphur compounds and Iron. **Bioluminiscence;** Biochemical pathway in bacteria	**15 Hrs**
Unit IV		
Nitrogen and Sulphur metabolism and methanogenesis	**Biochemical Mechanisms:** Nitrification and Anammox. Nitrate reduction and Denitrification. Nitrogen fixation: Symbiotic, nonsymbiotic. Sulphate reduction. Methanogenesis, Acetogenesis, Acetate use and autotrophy	**15 Hrs**

Suggested Books:

1. D. L. Nelson and M. M. Cox. 'Lehninger Principles of Biochemistry', Macmillan Int.

2. J. M. Berg, J. L. Tymoczko and L. Stryer. 'Biochemistry' 6 th edition, W. H Freeman and Company.

3. S. C. Rastogi. 'Biochemistry'. Tata McGraw Hill Publishing Company, New Delhi.

4. Gottschalk G. 'Bacterial Metabolism'. Springer, New York.

5. Doelle H.W. 1969. Bacterial Metabolism. Academic Press

6. Sandikar B. M. 'Basic Biochemistry and Microbial Metabolism'. Himalaya Publishing House, Mumbai.

7. Conn E. E. and Stmph P. K. 'Outlines of Biochemistry' John Wiley & Sons, New Delhi.

8. Sokatch JR. 1969. Bacterial Physiology and Metabolism. Academic Press

9. Brock Biology of Microorganisms, Thirteenth Edition by Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark, Benjamin Cummings, 1301 Sansome Street,San Francisco, CA 94111.

10. Voet D. and Voet J. G. (2011). Biochemistry. United Kingdom: Wiley.

M. Sc. Semester-I

Discipline Specific Core Course (DSC-2)-MICROBIOLOGY –Paper 2 (MMI1T02)

(ENZYMOLOGY AND TECHNIQUES)

Course Outcomes:

1. Students will be able to understand general characteristics of enzymes
2. Students will learn the different mechanisms of enzyme catalysis.
3. Students will be able to Gain an understanding of enzyme kinetics and regulation.
4. Students will be able to understanding the various biochemical techniques based on enzymes like biosensors

DSC-2 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Fundamentals of Enzymology	Concept of enzyme specificity, Mechanism of enzyme action: Models, catalysis by proximity effect, acid-base catalysis, electrostatic interaction, metal ion catalysis, nucleophilic and electrophilic catalysis, preferential binding. Mechanism of action of lysozyme and serine proteases. Multienzyme complexes; Concept and mechanism of fatty acid synthase and pyruvate dehydrogenase complexes Isoenzyme; concept and Lactate dehydrogenases as marker enzymes Enzyme regulation; Allosteric (example ATCase), chemical modification and calmodulin mediated regulation.		**15 Hrs**
	Unit-II		
Enzyme Kinetics	Significance of Michaelis-Menten equation and its transformations. kinetics of enzyme inhibition, Kinetics of bisubstrate reaction & multistep reactions Allosterism: Kinetic analysis of allosteric enzymes. Covalent Modification, Feed -back inhibition**.**		**15 Hrs**

Unit III		
Enzyme Techniques	Techniques for isolation and purification of enzymes, methods for enzyme assays. Protein: ligand binding studies: association and dissociation constants, co-operative ligand binding MWC or concerted model, sequential model. Enzyme biosensors: General concept, glucose biosensor. Industrial applications of enzymes (Amylase, Protease, Cellulase) Protein engineering- Objectives & strategies of enzyme engineering. Methods of enzyme engineering. Protein engineering applications.	**15 Hrs**
Unit IV		
Immobilised enzymes	Immobilization techniques for cells (physical adsorption, ionic binding, covalent binding, lattice entrapment, membrane entrapment, micro encapsulation) and enzymes (covalent binding, entrapment, micro encapsulation, cross-linking, adsorption, ionic binding, affinity binding, chelation, disulfide bonds) Immobilized enzyme kinetics, Immobilized bioreactors Applications of immobilized enzymes	**15 Hrs**

Suggested Books:

1) Fundamentals of Enzymology- Nicholas Price and Lewis Stevens, Oxford Univesrity press
2) Biochemistry -Albert L. Lehninger, Kalyani Publishers
3) Outlines of Biochemistry- Conn & Stumph
4) Enzymes & Enzyme Technology - Anilkumar, MV Learning
5) "Enzymology and Enzyme Technology" by Bhatt S M .
6) Enzyme Technology" by S Shanmugam and T Sathishkumar …
7) The Biochemistry of copper By: Jack Peisach, Phillip Aisen.
8) Metabolic Pathways By:-David M.Greenberg.
9) Harper's Biochemistry By: Robert K.Myrray.
10) Enzymes: By Trevor Palmer.
11) Methods in Enzymology By: S. Berger, A. Kimmel.
12) Immobilization of Enzymes and cells By: Gordon Bickerstaff.
13) Enzymes -Biotechnology Hand book-by NIIR Board of Consultants & Engineers
Asia Pacific Business Press Inc,106-E ,Kamla Nagar,Delhi-110007

M. Sc. Semester-I
Discipline Specific Elective Course (DSE-1)-MICROBIOLOGY- Paper 3 (MMI1T03) (ADVANCE TECHNIQUES IN MICROBIOLOGY)

Course outcome: At the end of the course the students will be able to

1. Learn the basic biophysical techniques
2. Understand the design and working principle of various microscopes
3. Understand the bimolecular separation and identification techniques
4. Learn the advanced molecular techniques

DSE-1 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Biophysical Techniques-I	Determination of size, shape and Molecular weight of Macromolecules:-by Viscosity, CD/ORD, Light scattering, diffusion sedimentation and Centrifugation techniques. X-ray crystallography: Principle, instrumentation and applications		**15 Hrs**
	Unit-II		
Biophysical Techniques-II	**Electrophoresis:** Agarose Gel, SDS-page, two-dimensional gel electrophoresis, capillary electrophoresis, immune-electrophoresis, Pulse field gel electrophoresis. **Chromatography**: Principle, instrumentation and applications of GLC, GC-MS and HPLC		**15 Hrs**
	Unit III		
Biophysical technique III	Blotting techniques: Western, Southern, Northern, Radioimmunoassay. NMR and its biological importance. Infrared spectroscopy, FTIR Spectroscopy and its application. Radiography : Basic concept, Autoradiography		**15 Hrs**
	Unit IV		
Microscopical Techniques.	Electron Microscopy: SEM, TEM, Staining procedures and microscopy. Fluorescent Microscopy: Staining procedures and Microscopy, FISH. Laser scanning, confocal microscopy, Atomic force microscopy. Cryoelectron microscopy.		**15 Hrs**

Suggested Books:

1. Biophysical Chemistry by Upadhyay, Upadhyay, Nath
2. Boyer R. F. (2000). Modern experimental biochemistry. India: Pearson Education.
3. Chakravarty R., Goel S. and Cai W. (2014). Nanobody: the "magic bullet" for molecular imaging? Theranostics. 4(4): 386-398.doi:10.7150/thno.8006
4. Dennison C. (2013). A guide to protein isolation. Netherlands: Springer Netherlands.
5. Desiderio D. M., Kraj A. and Nibbering N. M. (2009). Mass spectrometry: instrumentation, interpretation and applications. United Kingdom:Wiley.
6. Feldheim D. L. and Foss C. A., Jr. (Editors). (2002) Metal nanoparticles synthesis and characterization and applications. Taylor &Francis
7. Hofmann A., Walker J. M., Wilson K. and Clokie S. (2018). Wilson and Walker's Principles and techniques of biochemistry and molecular biology. United Kingdom: Cambridge University Press.
8. Narayanan P. (2007). Essentials of biophysics. India: New Age International.
9. Nölting B. (2013). Methods in modern biophysics. Germany: Springer Berlin Heidelberg.
10. Rutherford T. (2019). Principles of analytical biochemistry. Alexis Press LLC. New York.
11. Segel I. H. (2010). Biochemical calculations. 2nd Edition. India: Wiley India Private. Limited.

M. Sc. Semester-I
Discipline Specific Elective Course (DSE-1)-MICROBIOLOGY- Paper 3 (MMI1T03) (MEMBRANE STRUCTURE AND SIGNAL TRANSDUCTION)

Course Outcome:

1. Students will understand the structures and components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how the transport of molecules through cell membrane.
3. Students will understand different advance technique used for cell membrane study.

At the end of the course, the student has a strong foundation on the functions of the cell.

DSE-1 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Structure and organization of membranes	Prokaryotic and Eukaryotic Cell structure, Structure and function of Mitochondria, and Endoplasmic reticulum, prokaryotic membrane, Membrane junctions (Gap & tight junctions), Techniques for membrane study: Electron microscopic method, membrane vesicles, differential scanning colorimetry, flouroscence, photo bleaching recovery, flow cytometry		**15 Hrs**
	Unit-II		
Membrane Transport	Active and Passive transport, Uniport, ATP powered pumps, non-gated ion channels, co transport by symporters and antiporters, transepithelial transport.		**15 Hrs**
	Unit III		
Signal Transduction	General concept of cell signaling, G-protein coupled receptors and their effectors. RTK and MAP Kinases-Down regulations of pathways. Cytokine receptors and their mechanism (JAK-STAT pathway).		**15 Hrs**
	Unit IV		
Bacterial signal transduction	Basic two component system. Histidine kinase pathway. Sporulation as a model of bacterial signaltransduction. Osmoregulatory pathways. Heat shock proteins. Mating types of yeast. Bacterial Biofilm: Composition, formation and role.		**15 Hrs**

Suggested Books:

1. Principles of Biochemistry, A. L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing.
2. Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell,McGraw Hill/ Appleton and Lange.
3. Biochemistry (Fifth Edition), Lubert Stryer.
4. V. Voet and J. G. Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
5. Molecular Cell Biology by Bruce Albert.
6. Molecular Biology by Lodish, Darnell and Baltimore.
7. Molecular Biology of the gene by Watson et al 4th ed.
8. Cell and molecular biology by Gerald Karp.
9. Cell biology by Pollard and Earnshaw

M. Sc. Semester-I
MICROBIOLOGY - Paper-4 (MMI1T04)
(RESEARCH METHODOLOGY)

Course Outcomes:

After learning research methodology course, students will be able to

1. Identify and describe the characteristics of different types of research, including basic, applied, and patent-oriented research.
2. Apply scientific thinking and problem identification techniques in the research process.
3. Apply descriptive and inferential statistical analysis techniques to analyze and interpret research data and understand the concept of hypothesis and its importance in research, and apply appropriate research methods.
4. Develop skills in technical writing, research reporting, and the proper structure and organization of research documents and gain awareness of research ethics, academic integrity, and the importance of avoiding plagiarism and academic malpractice.

RM-THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Research basics & objectives	1.1 Definitions; research, research methodology, discovery, invention & innovation. 1.2 General & specific characteristics of research. Types of research- Descriptive & analytical, Applied & fundamental, Qualitative & quantitative, Conceptual and empirical. 1.3 Steps of action- Genesis of problem, defining of problem & formulation of the problem. 1.4 Literature survey- Importance of literature survey in defining the problem-Primary & secondary sources-reviews , monographs, patents, web as a source of literature. 1.5 Identifying gaps in present knowledge. Research questions & development of working hypothesis.		**15 Hrs**

Unit-II		
Research Design	**2.1** Features of good research **2.2** Definition of hypothesis, assumption, postulates. Qualities of good hypothesis, Null Hypothesis and Alternative Hypothesis **2.3** Definition & types research methods, characteristics of survey methods their types & advantages. **2.4** Experimental method- definition, basic assumption, types of variables in experiment. Steps of experimental method.	**15 Hrs**
Unit III		
Bio-statistics & its application in research	**3.1** Definition of statistics & bio-statistics, population & types of population, individual, attribute, variate, frequency & frequency distribution, class interval, methods of grouping or class interval, class width & boundary, Accuracy and Precision. **3.2** Methods of data collection-Sampling , sampling errors, non sampling errors **3.3** Central tendency & measures of central tendency- mode, median, arithmetic mean of grouped & ungrouped data geometric mean, harmonic mean. **3.4** Measures of variance or dispersion- standard deviation or root mean deviation **3.5** Test of comparision - Chi square test, Student's t-test. **3.6** Correlation analysis. Linear regression. **3.7** Introduction to ANOVA, Use of statistical software. Application of Microsoft Excel in statistical analysis (statistical functions and spreadsheets in MS-Excel). **3.8** Presentation of statistical data- Tables , Charts (bar charts, pie charts) & diagrams (histograms & dendrogram) & diagrams (bar charts, pie charts, histograms & dendrograms)	**15 Hrs**

Unit IV		
Technical, and research reporting, research ethics and plagiarism	**4.1** Research report-Concept and need of research report and scientific writing. Structure of thesis, structure of project report, structure of project proposal. Importance of abbreviations and acronyms. Significance of report writing . **4.2** Structure of Research paper, Types of scientific publications- magazines, journals, reviews, news-letters, various reference styles. Annotated bibliographies. **4.3** Academic integrity (Research Ethics), skills (rules) for good academic practice, understanding plagiarism and academic malpractice/ Copy write, plagiarism checker. **4.4** Impact Factor, Cite Score, *h*-Index, i10-Index, Citation Index. **4.5** Intellectual Property Rights (IPR) Introduction to IPR (Patents, Trademarks, Geographical indicators, and Copyright). **4.6** Online research tools; N-list, Zotero /Mendley, and Software for paper formatting like LaTeX tools; N-list, Mendley, plagiarism checker and LaTeX.	**15 Hrs**

Suggested Books:

1. Shanti Mishra, & Alok, S. (2011). *Handbook of Research Methodology: A Compendium for Scholars & Researchers*. Educreation Publishing.
2. Singh, Y. kumar. (2006). *Fundamentals of Research Methodology and Statistics*. New Age International Publishers.
3. Walliman, N. (2010). *Research Methods The Basics*. Routledge Taylor and Francis Group.

M. Sc. Semester-I

MICROBIOLOGY – PRACTICAL-1 (MMI1P01)

Course outcomes:

1.This course explains the enzyme activity determination of important hydrolytic enzymes.
2. Students will earn about the effect of different physical factors.
3. Students will able to isolate and purify the enzyme.
4. Students will able to isolate and identify Nitrogen fixing bacteria.
5. Students will be able to isolate Siderophore producing bacteria.

LAB-1	**Hours: 06 Hours /Week**	**Marks: 50+50=100**	**Credit: 03**
	Perform minimum 08 from following practical's		
	1) Detection of Urease enzyme activity, 2) Determination of kinetic constant of amylase: -Amylase activity, Vmax. Km. 3) Effect of pH and temperature on amylase activity. 4) Effect of inhibitors on amylase activity. 5) Estimation of protein by Lowry's method. 6) Production, isolation and purification of enzyme and determination of its activity. (any one enzyme) 7) Estimation of sucrose in presence of glucose. 8) Determination of UV absorption maxima of proteins, DNA and RNA. 9) Isolation of Siderophore producing bacteria. 10) Determination nitrate reduction and denitrification of microorganism 11) Determination of blood sugar by using glucose biosensor. 12) Titration curve of amino acid and determination of pK value. 13) Immobilization of enzyme and estimation of its activity.		**45 Hrs**

M. Sc. Semester-I
MICROBIOLOGY – PRACTICAL-2 (MMI1P02)

Course outcomes: After successful completion of this course, students will be able :

1. This course explains the techniques of protein biology
2. Students will learn about Subcellular organelles and isolation of Marker enzymes.
3. The performance of various molecular techniques will be understood
4. Students will learn various techniques of protein isolation and analysis techniques
5. Students will learn about techniques for Isolation and screening of industrially important microorganisms
6. Students will learn about statistical analysis of research data

LAB-2	Hours: 06 Hours /Week	Marks: 50+50=100	Credit: 03

Perform minimum 10 from following practical's and Experiment number 15, 16 and 17 are compulsory

45 Hrs

1) Separation of DNA by agarose gel electrophoresis
2) Separation of amino acids/sugars by paper chromatography.
3) Separation of serum proteins by paper electrophoresis.
4) Separation of amino acids by Thin layer chromatography.
5) SDS-Page of proteins.
6) Performance of affinity chromatography.
7) Performance of Gel filtration chromatography.
8) Demonstration of blotting technique [Western /Southern/Northern].
9) Ion exchange chromatography
10) Separation of Subcellular organelles and isolation of Marker enzymes
11) Demonstration of HPLC and GC.
12) Isolation and screening of industrially important microorganisms.
13) Determination of thermal death point and thermal death time of microorganisms.
14) Measurement of bacterial population by turbidometry method
15) Determination of Statistical averages / central tendencies. a) Arithmetic mean b) Median c) Mode.

	16) Representation of Statistical data by a) Histograms b) Pie diagrams c) Use of statistical software (SPSS). 17) Determination of measures of Dispersion a) Mean deviation b) Standard deviation and coefficient of variation. 18) Tests of Significance-Application of following a) ChiSquare test b) t-test c) Standard error 19) Determination and interpretation of data by one and two way ANOVA.	

Suggested Books for Lab 1 & 2:

1) Microbes in Action: Seely, Wander Mark Tarporewala, Bombay

2) A Manual of Microbiology: A.J. Salle.

3) Microbiology Methods: Collins

4) Bacteriological Techniques: F.J.Baker

5) Introduction to Microbial Techniques: Gunasekaran

6) Biochemical methods: Sadashivam & Manickam

7) Laboratory Fundamentals of Microbiology: Alcamo, I.E., Jones and Bartlett Publishers

8) Biochemical techniques by Wilson and Walker.

9) Experimental Biochemistry by B. Sashidhar Rao and Vijay M. Deshpande.

10) Practical Biochemistry by David Plummer

11) An Introduction to Practical Biochemistry, 3rd Edition, Plummer D.T

12) Experiments in Microbiology, 4th Ed., Aneja K.R.

13) Handbook of Techniques in Microbiology, Karwa A S., Rai, MK and Singh HB

14) Methods in Enzymology By: S.Berger, A. Kimmel.

15) Laboratory Manual on Biotechnology-P. M. Swamy

16) Essentials of biostatistics & research methodology by Indranil, Saha, Bobby Paul.

M. Sc. Semester-II
Discipline Specific Core Course (DSC-3)-MICROBIOLOGY –Paper 5 (MMI2T05) (ENVIRONMENTAL MICROBIAL TECHNOLOGY)

Course Outcomes:

1. Be able to acquaint with microbial communities and their interaction.
2. Be able to know about role of microorganisms in treatment of waste materials.
3. Be able to know about the factors responsible for global warming.
4. Be able to know about restoration of degraded ecosystem.

DSC-3 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Biodeterioration, Biomagnification and Eutrophication	Biodeterioration: Definition and concept of biodeterioration, biodeterioration of woods, textile clothing and pharmaceutical products. Biodeterioration of stone monuments and approach for its restoration. Biomagnification: concept and consequences, Biomagnifications of heavy metals, chlorinated hydrocarbons and pesticides and mitigation methods. Eutrophication: Consequences of . waste water and sewage discharge in natural water bodies, Causes of eutrophication, Microbial changes induced by discharge of organic and inorganic pollutants, factors influencing eutrophication process and control of eutrophication.		**15 Hrs**
	Unit-II		
Biotransformation, Biodegradation and Bioleaching	Biotransformations: Mechanism of biotransformation, Metals and metalloids, mercury, pesticides such as hexachlorobenzene and DDT transformations. Biodegradation: Biodegradation of plastics, lignin, aliphatic, aromatic and asphalts hydrocarbons. Bioleaching of ores, leaching techniques and applications.		**15 Hrs**
	Unit III		
Restoration of degraded ecosystems	Concept of Reclamation, revegetation, Management of mine spoil dumps and tailing sites, Wastewater management using high rate transpiration systems, Concept of phytoremediation and applications. Case studies related to restoration of wasteland ecosystems using integrated biotechnological approach.		**15 Hrs**

Unit IV		
Global Environmental Problems	Global warming and climate change, Ozone depletion, UV-B, green house effect, acid rain, their impact and biotechnological approaches for management. Acid mine drainage and associated problems.	**15 Hrs**

Suggested Books:

1. Application of Microbes in Environmental and Microbial Biotechnology. Editors: Inamuddin, Mohd Imran, Ahamed, Ram Prasad, Copyright: 2022

2. Recent Advances in Microbial Degradation. Editors: Inamuddin, Mohd Imran Ahamed, Ram Prasad, Copyright: 2021

3. Environmental Pollution and Remediation, Editors: Ram Prasad Copyright: 2021

4. Advances in the Domain of Environmental Biotechnology

5. Recent Developments in Microbial Technologies. Editors: Ram Prasad, Vivek Kumar, Joginder Singh, Chandrama Prakash Upadhyaya, Copyright: 2021

6. Microbial Technology For Sustainable Environment Editors: Pankaj Bhatt, Saurabh Gangola, Dhanushka Udayanga, Govind Kumar

7. Microbial Ecology: Fundamentals and Applications (4th Edition) **Author:** Ronald M. Atlas, Richard Bartha

8. Brock Biology of Microorganisms (14th Edition) **Author:** Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl, Thomas Brock

9. Environmental Microbiology 3rd Edition **Author:** Ian L. Pepper, Charles P. Gerba, Terry J. Gentry

10. Soil Microbiology 3rd Edition **Author:** Robert L. Tate III

11. Environmental Microbiology: From Genomes to Biogeochemistry 2nd Edition **Author:** Eugene L. Madsen

12. Manual of Environmental Microbiology **Author:** Cindy H. Nakatsu, Robert V. Miller, Suresh D. Pillai

M. Sc. Semester-II
Discipline Specific Core Course (DSC-4)-MICROBIOLOGY –Paper 6 (MMI2T06) (IMMUNOLOGY AND IMMUNODIAGNOSTICS)

Course outcome:

1. This course gives an overview on the immune system including organs, cells and receptors
2. The students learn about molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions.
3. The course develops in the student an appreciation for principles of immunology andits applications in treating human diseases.

DSC-4 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Overview of the Immune system and CMI	Cells involved in Immune system: Hematopoiesis, Lymphocytes, mononuclear phagocytes, Antigen Presenting cells, Granulocytes. Lymphoid organ: Lymphatic system, Primary and Secondary lymphoid organs. Complement System: Pathways of complement activation, regulation of complement system, Biological functions of complement system. Inflammation: Intracellular cell adhesion molecules, Mechanism of cell migration, Inflammation. Pathways of antigen processing and presentation. Cell Mediated Immunity: General properties of effector T cells, Cytotoxic T Cells, Natural Killer cells, Antibody-Dependent cell mediated cytotoxicity. T-Cell dependent and T-cell independent defense mechanisms.		**15 Hrs**
	Unit-II		
Specific Immune Response	Cancer and the Immune system: Origin and Terminology, Malignant Transformation of cells, oncogenes and cancer induction, Tumor Antigens, Immune surveillance theory, Tumor evasion of theImmune system, Cancer Immunotherapy. Transplantation Immunology: Immunological basis of Graft Rejection, Mechanism of Graft rejection. Immunosuppressive therapy: General and specific. Clinical Transplant. Tolerance: Central and peripheral tolerance to self antigens, Mechanism of induction of natural tolerance.		**15 Hrs**

Unit III		
Immune Dysfunction	Immunodeficiency disorders:- Phagocytic cell defect (Chediak-Higashi syndrome); B-cell deficiency (Bruton's X-linked hypogammaglobulinemia); T-cell deficiency disorder (DiGeorge Syndrome); Combined B-cell & T-cell deficiency disorder (SCID-Severe combined immunodeficiency diseases, Wiskott-Aldrich syndrome); Complement deficiencies and secondary immunodeficiency conditions carried by drugs, nutritional factors & AIDS. Autoimmunity and autoimmune diseases:-General consideration, Etiology, Clinical categories, Diagnosis and treatment. RA (Rheumatoid arthritis); SLE (Systemic Lupus Erythematosus); Guillain- Barre Syndrome; Multiple sclerosis; Mysthenia gravis; Grave's disease; Goodpasture syndrome, Autoimmune haemolytic disease; Pernicious anaemia. Hypersensitivity :- Type I, Type II, Type III & Type IV	**15 Hrs**
Unit IV		
Immuno-diagnostics	Precipitation reactions: Immunodiffusion, immunoelectrophoresis, Agglutination reactions: Bacterial Agglutination, Heamagglutination, Passive agglutination, Reverse passive agglutination and agglutination inhibition. Immunodiagnostic techniques: Radio-Immuno assay, ELISA, Chemiluminiscence immunoassay, Western blotting technique, Complement fixation test, Immunofluorescence, Immunoelectron microscopy.	**15 Hrs**

Suggested Books:

1. Essentials of Immunology by Riott I .M. 1998. ELBS, Blackwell Scientific Publishers, London.
2. Immunology 2nd Edition by Kuby J. 1994. W.H. Freeman and Co. New York.
3. Immunology - Understanding of Immune System by Claus D. Elgert. 1996. Wiley -Liss, New York.
4. Fundamentals of Immunology by William Paul.
5. Cellular and Molecular Immunology. 3rd Edition by Abbas.
6. Immunobiology: The Immune System in Health and Disease. 3rd Edition by Travers.
7. Immunology- A short Course. 2nd Edition by Benjamin.
8. Manual of Clinical Laboratory and Immunology 6th Edition. 2002 by Noel R. Rose, Chief Editor: Robert G. Hamilton and Barbara Detrick (Eds.), ASM Publications.
9. Pocket Guide to Clinical Microbiology. 2nd Edition. 1998 by Patrick R. Murray, ASM Publications.
10. Immunology, 6th Edition Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne, Freeman, 2002.
11. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.
12. Fundamental of Immunology, Paul, 4th edition, Lippencott Raven, 1999.
13. Monoclonal antibodies Goding, , Academic Press. 1985.

M. Sc. Semester-II
Discipline Specific Elective Course (DSE-2)-MICROBIOLOGY- Paper 7 (MMI1T03) (MICROBIAL METABOLITES)

Course Outcomes

1. Acquaint with basics of microbial metabolites, newer bioactive molecules and Immunomodulators.
2. Understand structure and mode of action of secondary metabolites. Knows the concept of Quorum sensing.

DSE-2 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Introduction of metabolites	Metabolites: General account of metabolites, secondary metabolites. Classification, structure and mode of action of secondary metabolites. Plants secondary metabolites: Digitoxine, Salicylic acid, Mycotoxins- Aflatoxin, Ochratoxin, Patulin. Biopolymers: Polypeptides (collagen, casein and serum albumin), Polynucleotides and polysaccharides (amylose, amylopectin, alginate, cellulose) and other biopolymers like chitin, Xanthan, dextrin, Gellan, Pullulan, curdlan and hyluronic acid. Polyamines: Brief outline and functions of polyamines. Synthesis of linear polyamine-putrescine, cadoverine, spermidine and spermine. Secondary Metabolite Production by Cyanobacteria, Enzyme inhibitors and Immunomodulators		**15 Hrs**
	Unit-II		
Antimicrobial drugs: Secondary metabolites	Antibiotics: History and discovery of antibiotics, Antibiotic resistance, Mechanisms of antibiotic resistance. Structure and mode of action of antibiotics: Aminoglycosides (Amikacin), Carbapenems (Imipenim), Microlids (Azithromycin), Nitrofuran (Nitrofurantoin), Penicillin (Amoxicillin), Quinolones (Gatifloxacin /Ciprofloxacin), Sulphonamides (Sulfamethoxazole), Tetracyclines (Doxycyclines), Chloramphenicol, Fucanazole. New Molecules- Angucyclines (baikalomycins A–C), rabelomycin and 5-hydroxy-rabelomycin		**15 Hrs**

Unit III		
Pigments as metabolites	General account of pigments. Microbial pigments: Bacteriochlorophylls, Carotenoids of prokaryotes, rhodopsin and accessory pigments (Pulcherrimin and indigoidin) Defensive role of pigments. Vaso-relaxants or contractants, Diuretics or laxatives Marine bacteria synthetizing bio-pigment- prodigiosin, astaxanthin, violacein, zeaxanthin, lutein or lycopene Industrial Importance of Pigmented Compounds	**15 Hrs**
Unit IV		
Microbial vitamins	Antioxidants. Characteristics of fats and water soluble vitamins. Structure, function and chemistry of: Retinol (vitamin A), Riboflavin (vitamin B2), Cynocobalamine(Vitamin B12) and ascorbic acid (vitamin C). Deficiency diseases in humans:Xerophthalmia, BeriBeri, Pellegra, Scurvey, Keratomalacia, osteoporosis, Osteomalacia, Cheilosis,Glossitis, Pernicious anemia and Erythroid hypoplassia.	**15 Hrs**

Suggested Books:

1. General Microbiology by Hans G. Schlegel, C. Zaborosch. Publisher: Cambridge University Press
2. Biotechnology. A Textbook of Industrial Microbiology, by W. Crueger and A. Crueger.
3. Publisher :Sinauer Associates.
4. Industrial microbiology by G. Reed, Publishers: CBS
5. Biology of Industrial microorganisms By A. L. Demain.
6. Stanbury P.F.A. Whitaker and Hall. Principles of fermentation technology
7. Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment by H.C. Vogel, C.L. Todaro, C.C. Todaro. Publisher: Noyes Data Corporation/ Noyes Publications.
8. New Products and New Areas of Bioprocess Engineering (Advances in Biochemical
9. Engineering/Biotechnology, 68) by T. Scheper. Publisher : Springer Verlag. New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Secondary Metabolites Biochemistry and Applications byVijai G. Gupta (editor), Anita Pandey (editor)
10. Biotechnology of Antibiotics and Other Bioactive Microbial Metabolites by Giancarlo Lancini, Rolando Lorenzetti
11. Bacterial physiology and metabolism by Kim B.H. and Gadd G.M. 2008. Publisher: Cambridge University Press, Cambridge.

M. Sc. Semester-II
Discipline Specific Elective Course (DSE-2)-MICROBIOLOGY- Paper 7 (MMI2T07) (PHARMACEUTICAL MICROBIOLOGY)

Course Outcomes:

1) Students will gain the knowledge regarding Drug discovery and drug development

2) Students will get knowledge about production of various types of enzymes antibiotic resistance and development of new therapeutic drugs to the students.

3) Students will have a deep insight into the antimicrobial agents and their mode of action.

4) Students get knowledge about Regulatory practices, biosensors applications in Pharmaceuticals and Quality Assurance

DSE-2 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Introduction to Chemotherapeutic agents	History and development of chemotherapeutic agent, Properties of antimicrobial agents, Types of chemotherapeutic agents – Synthetic, Semisynthetic, Natural Antibiotics Antimicrobial agents: antibacterial, antifungal, antiviral, antiprotozoal and anti cancer antibiotics and drugs and their mode of action.		**15 Hrs**
	Unit-II		
Preservation, Antibiotic resistance and development of new therapeutics	Principles of preservation: objectives of preservation, the ideal preservative, rational development of a product preservative system etc. Preservative stability and efficacy. methods of Preservative evaluation and testing Development of antibiotic resistance, Mechanism of antibiotic resistance, Antimicrobial Peptides: History, properties, sources, mode ofaction, application. Phage therapy: introduction to phages, lytic cycle, types of phages involved in phage therapy Plant based therapeutic agents		**15 Hrs**
	Unit III		
Microbial production and Spoilage of pharmaceutical Products	Microbial contamination and spoilage of pharmaceutical products (sterile injectibles non injectibles, ophthalmic preparations and implants) and their sterilization. Manufacturing procedures and in process control of pharmaceuticals. Other pharmaceuticals produced by microbial fermentations (streptokinase,streptodornase), New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials		**15 Hrs**

Unit IV		
Regulatory practices, biosensors applications in Pharmaceuticals and Quality Assurance	Introduction to pharmacopoeia: Food and Drug Administration (FDA) regulation and Indian Pharmacopoeia (IP), British Pharmacopoeia (BP), United States Pharmacopoeia(USP) Good Laboratory Practices (GLP) Good Manufacturing Practices (GMP) and Current Good Manufacturing Practices (cGMP), Government regulatory practices and policies, FDA perspective. Rational drug design. Biosensors in pharmaceuticals Application of microbial enzymes in pharmaceuticals. Regulatory aspects of quality control. Quality assurance and quality management in pharmaceuticals ISO, WHO and US certification. Sterilization control and sterility testing (heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization) Design and layout of sterile product manufacturing unit. (Designing of Microbiology laboratory) Safety in Microbiology laboratory.	**15 Hrs**

Suggested Books:

1. Pharmaceutical Microbiology – Edt. byW.B.Hugo&A.D.Russell Sixth edition. Blackwell scientific Publications.
2. Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II.Academic Press New York.
3. Prescott's Microbiology 8th Edition by Willey, Joanne, Sherwood, Linda, Woolverton, Chris
4. Pharmaceutical Microbiology by AshutoshKar
5. Quinolinone antimicrobial agents – Edt. by David C. Hooper, JohnS.Wolfson .ASM Washington DC.
6. Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.
7. Biotechnology – Edt. By H.J.Rehm &G.Reed, Vol 4. VCH Publications, Federal Republic of Germany.
8. Pharmaceutical Biotechnology by S.P.Vyas &V. K. Dixit. CBS Publishers& Distributors, New Delhi.
9. Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H.Willig, Murray M.Tuckerman, William S.Hitchings IV. Mercel Dekker NC New York.
10. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association by Paine Webber.Gulf Publishing Company Houston.
11. Drug Carriers in biology & Medicine Edt. by Gregory Gregoriadis.Academic Press New York.
12. Quality Assurance in Microbiology by Rajesh Bhatia, Rattan lalIhhpunjani. CBS Publishers & Distributors, New Delhi.

M. Sc. Semester-II
MICROBIOLOGY – PRACTICAL-3 (MMI2P03)

Course Outcomes:

1. Be able to perform techniques in environmental microbiology
2. Be able to understand different parameters in environment microbiology

LAB-3	Hours: 06 Hours /Week	Marks: 50+50=100	Credit: 03
Perform minimum 10 from following practical's			
	1. Determination of Colour, Turbidity, temperature as physical characteristics of water and sewage 2. Determination of pH, alkalinity and acidity of water and sewage 3. Determination of total solids of waste water. 4. Determination of hardness of sewage, oil and grease. 5. Determination of oil and grease contents in water and sewage 6. Determination of Dissolve oxygen in sewage 7. Determination of Chemical Oxygen Demand in sewage. 8. Determination of nitrate nitrogen in water and sewage by UV - spectrophotometric method 9. Determination of the concentration of sulphate in water and sewage by using turbidometric method, 10. Determination of the concentration of chloride in water and sewage by Mohr's titrimetric method, 11. Determination of the concentration of phosphorus in water and sewage by stannous chloride method 12. Sample (water and sewage) preparation for metal analysis, 13. Determination of the concentration of mercury in water and sewage by spectrophotometric method, 14. Determination of the concentration of lead in water and sewage by spectrophotometric method, 15. Determination of the concentration of copper in water and sewage by spectrophotometric method 16. Determination of Microbiological characteristics of water and sewage 17. Determination of Microbiological analysis of soil: 18. Screening of antibiotic producing microorganism from soil, 19. To demonstrate ammonification process in soil 20.To demonstrate nitrification process in soil 21. To demonstrate denitrification process in soil	**45 Hrs**

Suggested Books:

1. Environmental Science and Biotechnology by A. G. Murugesan and C. Rajkumari ISBN 10: 8180940098 / ISBN 13: 9788180940095 Editorial: MJP Pub, Chennai, 2005
2. Practical Manual of Wastewater by Barbara Hauser CRC Press 2019
3. Standard Methods for the Examination of Water and Wastewater, 24th edition APHA AWWA, 2023.
4. Handbook Of Water And Wastewater Analysis Hardcover – 1 January 2007 by Kanwaljit Kaur

5. Handbook of Methods in Environmental Studies: Water and Waste Water Analysis by S.K. Maiti, Oxford Book Company 2011
6. Water and Wastewater Laboratory Techniues by Roy- Keith Smith Water Environment Federation, Second Edition.
7. Industrial Water Analysis Handbook Author: Natarajan Manivasakam, Chemical Publishing Book 2011
8. Methods of Soil Analysis, Part 2: Microbiological and Biochemical Properties: 12 (SSSA Book Series) by Peter J. Bottomley, J. Scott Angle, R. W. Weaver, 2014

10. Soil Microbiology, Ecology, and Biochemistry by Paul and Clark, 1989

11. Advanced Techniques in Soil Microbiology by Ajit Varma and Ralf Oelmuller 2007 Springer Publication

M. Sc. Semester-II
MICROBIOLOGY – PRACTICAL-4 (MMI2P04)

Course Outcomes:

1. Be able perform various diagnostic technique in immunology.
2. Be able to gain knowledge of different bacterial diseases and their diagnosis

LAB-4	**Hours: 06 Hours /Week**	**Marks: 50+50=100**	**Credit: 03**
Perform minimum 10 from following practical's			
	1) Determination of concentration of antigen in the serum sample by Immunodiffusion technique 2) Perfromance of Immunoelectrophoresis technique to separate immunoglobulins 3) Determination of Blood grouping and Rh type 4) Detection of typhoid antigen using Widal [slide and tube] tests. 5) Detection of Syphilis using TRUST [Toludine Red Unheated Serum Test] 6) Performance of Australian latex antigen test. 7) Performance of Antistreptolysin 'O'test [ASO] 8) Performance of Pregnancy test. 9) Performance of Rheumatoid arthritis test [RA] 10) Detection for the presence of antibodies to Syphilis by RPR [rapid plasma reagin] test. 11) Performance of *Treponema pallidum* haemagglutination test (TPHA). 12) One step test for Qualitative detection of HBs. 13) ELISA [Enzyme Linked Immunosorbent Assay]-HIV and HBs. 14) Serological detection of tuberculosis by Quanti FERON – TB Gold test 15) Isolation & Identification of Rosettee cells. 16) Total and Differential counting of WBC.		**45 Hrs**

Suggested Books:

1. Hudson, L. and Hay, F.C. (1989). Practical Immunology. 3rd Edition, Blackwell scientific Publications, Oxford.
2. Myers, R.L. (1989). Immunology: A Laboratory Manual. Wm. C.Brown Publishers. Dubuque, Lowa.
3. Rastogi, S.C. (1996). Immunodiagnostics Principles and Practice. New Age International (P) Ltd., New Delhi.
4. Talwar, G.P. (1983). A Hand Book of Practical Immunology. Vikas Publishing House Pvt. Ltd., New Delhi.
5. Talwar, G.P. and Gupta, S.K. (1992). A Hand Book of Practical and Clinical Immunology. Vol. 1 - 2. CBS Publishers & Distributors, Delhi.
6. Turgeon, M.L. (1990). Immunology and Serology in Laboratory Medicine. The C.V. Mosby Company, Baltimore.
7. Frank C. Hay, Olwyn M. R. Westwood (2008) Practical Immunology, 4th Edition Wiley-Blackwell Publisher
8. Ray Edwards (1999) Immunodiagnostic –A Practical Approach by Oxford University Press
9. *Imunodiagnostics* Principles and *Practice*. A Hand *Book* of *Practical* and Clinical *Immunology*. Vol. 1 -2 , New Age International (P) Ltd.
10. Garvey, J.S., Cremer, N.E. and Sussdorf, D.H. (1977). Methods in Immunology. A Laboratory Text for Instruction and Research. 3rd Edition. The Benjamin Cummings Publishing Company Advanced Book Program, London.
11. Praful B. Godkar (Author), Darshan P. Godkar (2018) Textbook Of Medical Laboratory Technology Clinical Laboratory Science And Molecular Diagnosis 2 Vol Set, 3rd Ed Bhalani Publishing House

M. Sc. Semester-III
Discipline Specific Core Course (DSC-5) -MICROBIOLOGY- Paper 8
(MMI3T08) (MICROBIAL DIVERSITY, EVOLUTION AND ECOLOGY)

Course Outcomes

1. Students should gain understanding of major concepts in microbial ecology.
2. Students will understand contemporary techniques used to analyze microbial communities and community function.
3. Students should understand microbial evolution and ecosystem management.

DSC-5 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Study of microbial diversity	Distribution, Abundance, Ecological Niches. Types-Bacterial, Archael, Eucaryal, Characteristics and Classification of Archae Thermophiles classification, habitat and thermophilic adaptations. Commercial aspects of thermophiles and application of thermoenzymes. Acidophiles- Classification, life at low pH, acido-tolerance, applications. Alkaliphiles- Isolation, habitat distribution and taxonomy, Enzymes of alkaliphiles and their applications. Psychrophiles- Microbial diversity at cold ecosystem, cold sensing, cold adapted enzymes, cryoprotectants and ice binding proteins, role of exopolymers in microbial adaptations to sea ice. Halophiles- Classification, Halophilicity and Osmotic protection, Hypersaline Environments, Prokaryotic halophiles: Halobacteria – osmo-adaptations or halotolerance mechanism, Applications of halophiles and their extremozymes. Barophiles- Classification, high pressure habitat adaptation to high pressure, life under pressure, applications of barophiles.		**15 Hrs**

Unit-II		
Methods of studying microbial diversity	Introduction to Species richness, Total number of species, Species evenness and Distribution of species. Methods of biodiversity analysis: Biochemical Methods -1. Plate Count: Selective plating & Direct viable counts 2. Community physiological profiling (CLPP) 3. Fatty acid methyl ester analysis (FAME), advantages & disadvantages of biochemical methods. Molecular based methods : 1. G+C content 2. Nucleic acid re-association and hybridization 3. DNA Microarrays 4. DNA Cloning & Sequencing 5. PCR-based methods DGGE/TGGE, Single strand conformation polymorphism (SSCP), Restriction fragment length polylymorphism (RFLP), Terminal restriction fragment length polymorphism (T-RFLP) Ribosomal intergenic spacer analysis (RISA) / Automated ribosomal intergenic spacer analysis (ARISA). Highly repeated sequence characterization or microsatellite regions, advantages & disadvantages of molecular methods. Study of Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Rank abundance diagrams, community similarity analysis, Jaccard Coefficient, Sorensen coefficient, cluster analysis.	**15 Hrs**
Unit III		
Study of Microbial Evolution	Evolution of earth and early life forms. Primitive life forms:-RNA world, molecular coding, energy and carbon metabolism, origin of Eukaryotes, endosymbiosis. Methods for determining evolutionary relationships:-Evolutionary chronometers, Ribosomal RNA sequencing, signature sequences, phyllogenetic probes, microbial community analysis. Derivation of Microbial Phyllogeny:-characteristics of domain of life, classical taxonomy, chemotaxonomy, bacterial speciation. Genetic structure of population:-Genotype frequency, allele frequencies. Hardy-Weinberg Law: -Assumptions, predictions, derivation, extension and natural selection.	**15 Hrs**

Unit IV		
Microbial Interactions and Ecosystem Management	Population, guilds, communities, homeostatis, Environment and microenvironment. . Terrestrial environment, deep, surface ecosystems. Fresh water environment, lake and river microbiology. Marine Microbiology and Hydrothermal vents. Microbial Interactions: Competition and coexistence, Gause hypothesis, syntrophy, commensalism and Mutualism, predation, parasitism, and antagonism, Interaction with plants and animals. Management and improvement of waste land/barren land. Oil spills, damage and management petroleum and oil shore management.	**15 Hrs**

Suggested Books:

1. Advances in applied microbiology. Vol.X, edited by Wayne W. Umbreit and D. Pearlman Academic Press.

2. Brock biology of Microorganisms. XI edition. By Michael T. Madigan, John M. Martinko. Pearson Education International.

3. Extreme environment. Metabolism of microbial Adaptation. Milton R., Heinirich Academic Press.
4. Extremophiles by Johri B.N. 2000. Springer Werlag, New York.

5. Microbial diversity by Colwd D., 1999, Academic Press.

6. Microbial ecology. Fundamental and applications by Ronald M. Atlas and Richard Bartha. II and IV edition.

7. Microbial Ecology. Ii edition by R. Campbell. Blackwell scientific publication. 8. Microbial life in extreme Environment. Edited by D.J. Kushner. Academic Press.

9. Microbiology : Dynamics and Diversity by Perry.

10. Microbiology of Extreme Environment . Edited by Clive Edward. Open University Press. Milton Keynes.

11. Microbiology of extreme Environment and its potentials for Biotechnology. Edited by N. S. Da Coasta, J. C. Duarata,, R.A.D. Williams. Elsisver applied science, London

12. Thermophiles. General, Molecular and applied Microbiology. Thomas D.Brock. Wiley Interscience publication.

13. Microbial Ecology: Fundamentals and Applications. 4th ed. (Addison-Wesley) Atlas, R.M., and R. Bartha. 1998.

M. Sc. Semester-III
Discipline Specific Core Course (DSC-6) -MICROBIOLOGY- Paper 9
(MMI3T09) (MOLECULAR BIOLOGY AND GENETICS)

Course Outcomes: At the end of the course the students will be able to

1. Demonstrate knowledge of the central dogma of biology
2. Understand the DNA proof reading and repair system of DNA.
3. Know about DNA regulation and post translation modification to became functional proteins
4. Basic understanding of genetics and hereditary

DSC-6 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
Unit-I			
Genome organization and Gene Regulation	Structural organization of genome (prokaryotes and eukaryotes), Cot curve analysis, C-value paradox. Regulation of gene expression : An overview on levels of regulation, terminology and operon concepts, enzyme induction and repression; positive and negative regulation in E. coli- lac and ara operons; regulation by attenuation – his and trp operons; antitermination – N protein and nut sites in Lambda phage. Organization and regulation of nif and nod gene expression in bacteria; gal operon in yeast. Global regulatory responses-heat shock response, stringent response and regulation by small molecules such as cAMP and PPGP		**15 Hrs**
Unit-II			
DNA Replication and DNA Repair	General principles, Characteristics of replication, various modes of replication. relation between cell cycle and DNA synthesis, enzymology of DNA replication in prokaryotes and eukaryotes, Mechanism of DNA replication in prokaryotes and eukaryotes, inhibitors of DNA replication. Types of DNA damage-deamination, oxidative damage, alkylation and pyrimidine dimers; repair pathways – mismatch, short patch repair, nucleotide/base, excision repair, recombination repair and SOS repair system.		**15 Hrs**

Unit III		
Protein Biosynthesis and DNA binding proteins	Central dogma theory and flow of genetic information, genetic code and its elucidation, structure and composition of prokaryotic and eukaryotic ribosomes, structural features of rRNA, mRNA and tRNA in relation to function, steps of protein biosynthesis (activation of amino acids, initiation, elongation, termination) in prokaryotes and eukaryotes; post translational modification of proteins and their sorting and targeting; regulation of translation; inhibitors of protein biosynthesis DNA binding proteins: Enhancer sequences and control of transcription. Identification of protein – binding sites on DNA, control of transcription by interaction between RNA polymerases and promoter region, use of alternate sigma factors, controlled termination attenuation and anti termination	**15 Hrs**
Unit IV		
Genetics	Mendelian principles (Dominance, segregation, independent assortment, allele, multiple allele), Pseudoallele, codominance, incomplete dominance, pleiotrophy, genome imprinting, penetrance and expressivity, linkage and crossing over, sex linkage, Sex-limited and sex-influenced characters, linkage maps, gene mapping with molecular markers and by using somatic cell hybrid. Deviation from Mendelism: Complex patterns of inheritance, quantitative traits and inbreeding Non-Mendlian inheritance: Cytoplasmic inheritance and imprinting	**15 Hrs**

Suggested Books:

1. Molecular Genetics of Bacteria, 3rd ed. 1998. J.W. Dale. Wiley Publ.
2. Bacterial and Bacteriophage Genetics. 4th ed. 2000. By E.A. Birge. Springer.
3. Modern Genetic Analysis by Griffith.
4. Genetics by Gardner.
5. Molecular Cell Biology. 1995, 3rd ed. by Lodish et al. Scientific American books, W.H. Freeman and Company.

6. Molecular Biology. 1995, by David Freifelder, Narosa Publ. House. 9. Text Book of Molecular Biology. 1994, by Sivarama Sastry et al, Macmillan India Ltd.
7. Genes VIII. 1997. by B. Lewin. Oxford University Press. The Biochemistry of nucleic acids. 1992, 11th ed. by Adams et al, Chapman and Hall.
8. Biochemistry. 1995 by L. Stryer. W.H. Freeman and Co.Biochemistry, 1998, 4th ed. by G.L. Zubay. W.C.B. Publ.
9. Microbial Genetics. 1995, by David Freifelder. Narosa Publ. House.
10. Biochemistry and Molecular Biology. 1997, by W.H. Elliott & D.C. Elliott. Oxford University Press.
11. . Molecular biology of the Gene. 1998, 5th ed. Watson et al, Addison Wesley Longman.
12. Concepts of Genetics, Klug WS and Cummings MR – Prentice Hall

M. Sc. Semester-III

Discipline Specific Core Course (DSC-7) -MICROBIOLOGY- Paper 10 (MMI3T10) (RECOMBINANT DNA TECHNOLOGY AND NANOBIOTECHNOLOGY)

Course Outcomes: At the end of the course the students will be able to

1. Understand the application of recombinant DNA technology in biotechnological research.
2. Achieve a sound knowledge on methodological repertoire which allows them to innovatively apply these techniques in basic and applied fields of life science researches
3. Understand the Synthesis, characterization and application of nanomaterials in biological sciences

DSC-7 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Molecular Cloning Methods	**DNA cloning**: Enzymes used in recombinant DNA technology, High capacity cloning vectors (cosmid, YAC, BAC & PAC), genomic library, cDNA library and chromosome libraries, Transformation, Gene knockout techniques in bacterial and eukaryotic organisms. Screening and identification of genes, Expression vectors, heterologous probes, oligonucleotide probes, microarrays. RNA Analysis and Gene Expression- Methods for RNA isolation and purification. Analysis of gene expression. **PCR**:Steps, advantages,limitations,application,RT-PCR,		**15 Hrs**
	Unit-II		
Other molecular tools for study in Genes	Restriction mapping: DNA sequencing dideoxy and pyrosequencing, DNA fingerprinting. S1 Mapping, primer expressions, DNase footprinting, DMS footprinting. Nuclear run on transcription, reporter gene transcription. **Genome Editing** - Introduction to genome editing techniques-Principles and applications of genome editing techniques. CRISPR-Cas9, site-directed mutagenesis, and other genome editing methods.		**15 Hrs**
	Unit III		
Application of rDNA technology	Overview of the diverse applications of rDNA technology, Gene therapy and its potential in treating genetic disorders, Strategies for gene delivery in therapeutic applications, Production of biopharmaceutical (Somatostatin and anticancer drugs) using recombinant DNA technology, Industrial applications of genetic engineering, such as enzyme production (Proteases and lysozyme), biofuel production, and bioremediation. Introduction to synthetic biology and its integration with genetic engineering.		**15 Hrs**

Unit IV		
Nano-Biotechnology	Concept of Nano-Biotechnology, Properties of nanomaterials, Classification of nanomaterials. Synthesis of nanoparticles: Silver and Silver oxide nanoparticles, Zinc and Zinc oxide nanoparticles. Techniques for detection of nanoparticles: UV-Visible and Infra-red Spectroscopy, and XRD Applications of Nano-Biotechnology: Agriculture and food processing, Biosensors, Drug and gene delivery sysyem, Cancer diagnostic and treatment. Limitations of Nanoparticles	**15 Hrs**

Suggested Books:

1. Principles of Gene Manipulation and Genomics (2016) 8th ed., Primrose, SB, and Twyman, R, Wiley Blackwell, ISBN: 978-1405156660.
2. Gene Cloning and DNA Analysis: An Introduction (2019) 7th ed., Brown, TA, Wiley Blackwell, ISBN: 978-1119072560.
3. Benjamin Lewis, Genes VIII (3rd Ed.) Oxford University & Cell Press, NY.2004 .
4. Genome 4 (2017) 4th ed., Brown, TA, Garland Science, ISBN: 978-0815345084.
5. Brown T.A . Genomes, 2nd ed, 2002 , Taylor and Francis publishers, New York 5) Primrose S.B, Twyman R.m., and Old R.w.,
6. Principles of gene manipulations, 6th ed, 2002, Blackwell publishers, Oxford.
7. Walker M.J., and Raply R. Molecular biology and biotechnology 4th ed, 2000, Panima publishers, New delhi.,
8. Challa S. S. R. Kumar, Josef Hormes, Carola Leuschner , "Nanofabrication towards Biomedical Applications, Techniques, Tools, Applications and Impact", Wiley – VCH.
9. D.S. Goodsell, "Bionanotechnology: Lessons from Nature", Wiley Press.
10. Genomic Medicine: Principles and Practice (2014) 2nd ed., Ginsburg, GS, and Willard, HF, Oxford University Press, ISBN: 978-0199334468.
11. Molecular Genetics and Genomics (2020) 1st ed., Krebs, JE, and Goldstein, ES, Jones & Bartlett Learning, ISBN: 978-1284154544

M. Sc. Semester-III
Discipline Specific Elective Course (DSE-3)-MICROBIOLOGY- Paper 11
(MMI3T11) (DRUG AND DISEASE MANAGEMENT)

Course Outcomes: At the end of the course the students will be able to

1. Acquire knowledge of the terms prodrug, drug, and drug latentiation.
2. Learn about a variety of anti-infective drugs' mechanisms of action, including those of iodophores (providone-iodine), benzylkonium chloride, and genita violet.
3. Understanding the variety of antifungal, antitubercular, antiprotozoal, antimalarial, and antihistaminic medicines' mechanisms of action

DSE-3 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Drug latentiation and Prodrug	History, Prodrug design-Basic concept, Prodrugs to improve patient acceptability, carrier-linked prodrugs, (carrier linkages for various functional groups , carrier-linked bipartite prodrugs, macromolecular drug carrier systems) bioprecursors prodrugs (hydrolytic activation, elimination activation, oxidative activation, reductive activation, nucleotide activation, phosphorylation activation, sulfation activation and decarboxylation ac tivation). , carboxylic acids and alcohols, amines, carboxyl compounds. **Drug-microbe:** Host-parasite relationship, mechanism of drug action and drug resistance including MDR.		**15 Hrs**
	Unit-II		
Antimicrobial agents (chemistry & mode of action)	Anti infective agents:Iodophores (povidone-Iodine), Benzalkonium chloride, gentian violet, mercury compounds. **Antifungal agents:**Ketoconazole, Nystatin, Griseofulvin. Amphotericin B, Clotrimazole, Econazole, Fluoronazole, Miconazole,Tolnaftate, **Antitubercular agents:** Isoniazid, cycloserine Aminosalicylate sodium, Capreomycin, Ethambutol, Rifampicin.		**15 Hrs**

Unit III		
Anti-inflammatory agents (chemistry & mode of action)	**Histamines and Antihistaminic agents**: Cimetidine, Ranitidine, Omeprazole. **H_1 First-Generation:** Meclizine, Clemastine, Hydroxyzine, Brompheniramine, Dimetindene, Doxylamine **H_1 Second-Generation:**Loratadine, Cetirizine, levocetirizine, **H_2:** Ranitidine, Cimetidine, Famotidine, **Analgesic agents:** Paracetamol (acetaminophen) ibuprofen- or diclofenac- *Opioid* Morphine, and their derivatives **Anti-inflammatory analgesics**-Phenylbutazone and oxyphenbutazone, Prostagacetylated salicylates (aspirin), non-acetylated salicylates (diflunisal, salsalate), propionic acids (naproxen, ibuprofen, acetic acids (diclofenac, indomethacin), enolic acids (meloxicam, piroxicam) anthranilic acids	**15 Hrs**
Unit IV		
Anti Parasitic agents (chemistry & mode of action)	**Antiprotozoal agents:** 8-Hydroxyquinoline ,Hydroxychloroquine, Metronidazole Nifursemizone, Ornidazole Antimalarials: Quininesulphate, Atovaquone/Proguanil (Malarone) Chloroquine. Doxycycline.Mefloquine. Primaquine. Pyrimethamine.	**15 Hrs**

Suggested Books:

1. The Organic Chemistry of Drug Design and Drug Action, Silverman R. B., Academic Press.
2. Textbook of Drug Design and Discovery, Eds. Krogsgaard-Larsen P., Liljefors T., Madsen U., Taylor & Francis.
3. Drug Discovery – A History, Sneader W., Wiley.
4. Medicinal Chemistry: An Introduction, Thomas G, Wiley.
5. Drug Discovery – A History, Sneader W, John Wiley & Sons, Ltd.
6. Comprehensive Medicinal Chemistry, Series Ed., Hansch C., Pergamon Press.
7. Wilson and Gisvold's, Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott-Raven
8. Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins.
9. Drug Metabolizing Enzymes-Cytochrome P450 and Other Drug Metabolizing Enzymes in Drug Discovery and Development, Lee JS, Obach SR and Fisher MB, Marcel Dekker, Fontis India, 2003
10. Pharmaceutical Profiling in Drug Discovery for Lead Selection, Borchardt RT, Kerns EH, Lipinski CA, Thakker DR and
Wang B, AAPS Press, 2004
11. Drug Metabolism – Current Concepts, Ionescu C and Caira MR, Springer International Edition
12. Handbook of Drug Metabolism, Woolf TF, Marcel Dekker, 1999
13. Abby L .Parrill.M .Rami Reddy.Rational Drug Design.Novel Methodology and Practical Applications. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.
14. J. Rick Turner. New drug development design, methodology and, analysis. John Wiley & Sons, Inc., New Jersey.

M. Sc. Semester-III
Discipline Specific Elective Course (DSE-3)-MICROBIOLOGY- Paper 11
(MMI3T11) (BIOINFORMATICS)

Course Outcomes:

1. The program aims to utilize and understand biological databases to gather, store, retrieve, manage, analyze and integrate biological data for generating new knowledge
2. Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.
3. To introduce new age concepts of big data in the 'omics' era and their analysis

DSE-3 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Basic Concepts and Computer Coding	Basic Concept of Computer Organization, Internet, File Transfer Protocol, Browser, Home Page, Hyper text transfer protocol, Uniform Resource Locator, Hyperlink and Web Applications. Computer Coding:- Number system, decimal number system, binary number system, binary to decimal conversion, Binary arithmetic, octal number system, hexadecimal number system.		**15 Hrs**
	Unit-II		
Genomics and Proteomics	Genomics: Nucleotide sequence Databases, its Analysis and Identification Goals of the Human Genome Project, cloning vectors, concept of maps, physical maps, shotgun libraries, DNA polymorphism, nucleotides, DNA sequences. Dot Plots, Simple alignments, Dynamic programming global and local alignments BLAST,FASTA,Scoring matrices,and alignment scores. Multiple sequence alignments. Pattern of substitution within genes, substitution number estimations, molecular clocks. Protein Data bank (PDB), Nucleic Acid Data Bank (NDB),Molecular modeling Data Bank (MMDB)		**15 Hrs**

Unit III		
Phyllogenetics	Phylogenetic analysis:-Evolution, elements of phylogeny, methods of phylogenetic analysis, Phylogenetic tree of life, comparison of genetic sequence of organisms, phylogenetic analysis tools-Phylip, ClustalW. Parsimony,Inferred ancestral sequence, consensus tress,comparison of phyllogenetic methods.	**15 Hrs**
Unit IV		
Protein structure prediction	Protein Structure Prediction:- Homology modeling, prediction of protein structure from sequences, functional sites. protein identification and characterization:- AACompIdent, TagIdent, PepIdent and MultiIdent, PROSEARCH, PepSea, PepMAPPER, FindPept, Predicting transmembrane helices, Primary structure analysis and prediction, Secondary structure analysis and prediction, motifs, profiles, patterns and fingerprints search. Methods of sequence based protein prediction.	**15 Hrs**

Suggested Books:

1. DNA Sequencing: From Experimental Methods to Bioinformatics *Author(s): Luke Alphey*
2. Bioinformatics: The Machine Learning Approach *Author(s): P.Baldi and S. Brunak*
3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition *Author(s): Andreas D. Baxevanis and B. F. Francis Ouellette (Eds)*
4. Bioinformatics for Dummies *Author(s): Jean-Michel Claverie and Cedric Notredame*
5. Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis *Author(s): Ingvar Eidhammer, Inge Jonassen, William R.T. Taylor*
6. Bioinformatics: Genomics and Proteomics Vikas Publishing House (7 November 2014) Author Ruchi Singh

M. Sc. Semester-III
MICROBIOLOGY – PRACTICAL-5 (MMI3P05)

Course Outcomes:

1. Be able perform various diagnostic technique in immunology.
2. Be able to gain knowledge of different bacterial diseases and their diagnosis

LAB-5	Hours: 04 Hours /Week	Marks: 50+50=100	Credit: 02
	Perform minimum 10 from following practical's		
	1) Antibiotic Sensitivity Test by Kirby-Bauer Disk Diffusion method and Isolation of antibiotic resistant microbes. 2)Determination of purity and quantitification of DNA by UV absorption method 3)Determination of melting temperature (Tm) of DNA . 4)Quantification of RNA by orcinol method 5) Isolation of genomic DNA. 6)Analysis of G+C percentage in bacterial DNA 7)DNA fingerprinting by RAPD. 8)Restriction analysis of genomic DNA. 9)Southern blotting analysis of DNA. 10) Isolation of plasmid DNA and determination of molecular size of plasmid DNA. 11) Amplification of gene by PCR. 12) Isolation of RNA by agarose gel electrophoresis. 13)Ligation of DNA into plasmid vectors. 14)Preparation of competent cells. 15)Transformation of E. coli with standard plasmids. 16) Selection of recombinant clones by blue – White screening. 17) Synthesis of silver nanoparticles 18) Synthesis of ZnO nanoparticles through non-aqueous route. 19) To study antibacterial/antifungal activity of nanomaterial.		**30 Hrs**

Suggested Books:

1. Microbiology Laboratory Manual, 5th Edition, James G. Cappucciino and Natalie Sherman
2. Molecular Cloning A Laboratory Manual 1 3rd Edition, J. Sambrook, E.F Fristsch and T. Maniatis
3. Molecular Cloning A Laboratory Manual 2 2nd Edition, J. Sambrook, E.F Fristsch and T. Maniatis
4. Methods of General and Molecular Bacteriology, 1993. Edited by Philip. Gerhardt, ASM Publications.

M. Sc. Semester-IV
Discipline Specific Core Course (DSC-8)-MICROBIOLOGY –Paper 12
(MMI4T12) (VIROLOGY)

Course Outcomes: At the end of the course the students will be able to

1. Understand the role of different Viruses in the fields of Microbial science..
2. Understand have about Classification, Composition and the Nomenclature and at the end emerging fields of science with respect to Virology.
3. Develop practical skills to perform different test in identifying important Viruses

DSC-8 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Concept of Virology	History, Classification and composition of viruses Brief outline on discovery of viruses (Origin and evolution), Terminology, Differentiation with other groups of microorganisms. Nomenclature and classification of viruses (Regenmortel et.al.2005, 8th Report of ICTV). Genetic classification Morphology and structure of viruses (size and shape/ symmetry). Chemical composition of viruses (viral capsid, spikes, envelopes and types of viral nucleic acids). Assay of Viruses. Viroids and Prions (Definition, structure, properties and diseases) Interferon: Types and mechanism of action		**15 Hrs**
	Unit-II		
Bacterial viruses	Bacterial viruses Bacteriophages- Structural organization; life cycle (Extracellular phase; attachment, penetration of nucleic acid, transcription, translation, replication, maturation and release of phage particles) of ΦX174, T4, lambda, M13 and Mu Phages. Bacteriophage typing, One step growth curve.		**15 Hrs**
	Unit III		
Animal & Plant Viruses	Animal and Plant viruses**Life cycle, pathogenesis and laboratory diagnosis of following viruses.Animal Viruses**:-**RNA viruses:**Picorna, Orthomyxo, Rhabdovirus and HIV. **DNA viruses**: Pox, Herpes, Adeno and Hepatitis viruses. Oncogenic viruses: Papova viruses, EB virus, HTLV viruses. **Plant virus**: TMV, Cauliflower mosaic virus, potato virus.		**15 Hrs**

Unit IV		
Diagnostic virology	General methods of Diagnosis and antiviral drugs **Serological methods:** -Haemadsorption; Haemadsorption inhibition; haemagglutination; Haemagglutination inhibition(HAI); Complement fixation immunofluorescence methods. ELISA and Radioimmunoassays (RIA). **Antiviral agents:** Structure and Mechanism of action of: Amantadine, Rimantidine, Vidarabine, Acyclovir, Ganciclovir, Ribavirin, Foscarnet, Stavudine, Lamivudine. **NNRTIS** (non-nucleoside RT inhibitors) - Nevirapine; Delavirdine and Efavirenz. Protease inhibitors- Saquinavir, Indinavir and Ritonavir	**15 Hrs**

Suggested Books :

1. Virology :Principles and Application. John Carter and Venesia Saunders.
2. Introduction to Modern Virology, 7th Edition Nigel J. Dimmock, Andrew J. Easton, Keith N. Leppard.
3. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
4. Kathleen Park Talaro& Arthur Talaro - Foundations in Microbiology International edition 2002,| McGraw Hill.
5. Michael T. Madigan & J. M. Martin, Brock, Biology of Microorganisms 12th Ed.International edition 2006, Pearson Prentice Hall.
6. Plant Viruses, Diseases and Their Management .by Kajal Kumar Biswas

M. Sc. Semester-IV
Discipline Specific Core Course (DSC-9)-MICROBIOLOGY –Paper-13
(MMI4T13) (MICROBIAL FERMENTATION & TECHNIQUES)

Course Outcomes: At the end of the course the students will be able to

1. Design of bioreactor and its tools, fermentation kinetics.
2. Recovery, purification, packaging and storage of microbial products.
3. Production of different microbial products.

Laboratory management and operations, data preparation and regularly adopted practices in industries.

DSC- 9 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
Unit-I			
General Principles of Fermentation	General Principles of Fermentation, Bioreactors: Typical Bioreactor and designing of their tools, Fermentation kinetics and Monods Model:-Growth kinetics and Monod's Model, Substrate accelerated death, specific growth rate, stringent response (bacterial stress response), Ntr and Pho system, growth limiting substrate, maintenance energy, growth yield and product formation. Process optimization: factors of optimization, rheology of fermentation fluid, oxygenation, and oxygen transfer kinetics. chemostat, turbidostat.		**15 Hrs**
Unit-II			
Downstream Processing	Downstream Processing and scale up. Downstream processes: types of processing units and systems, Storage and packaging methods. Scale up; scale down: criteria involved therein. Productivity, power requirements, Basic control theory.		**15 Hrs**
Unit III			
Industrial Fermentation	Industrial Fermentation of Products - Biofuels (Conventional):- Hydrogen, Methane, Antibiotics:- Streptomycin, Cephalosporin. Probiotic: *Lactobacillus sakei*. Biopolymers:- Xanthan, Polyhydroxyalkanoates. Thermostable enzymes:-Proteases. Biosurfectants. Carotenoides Aminoacids:- Glutamic acid. Vitamins:-riboflavin. Fatty acids (Palmetate, oleate).		**15 Hrs**

Unit IV		
Pharmaceutical industry	Pharmaceutical industry: Laboratory management and design, Bio burden determination, Specified and objectionable microorganisms, Guidelines for preparing a laboratory information file, Assessment of pharmaceutical water systems and Endotoxin and pyrogen testing, Sterilization and sterility assurance, Cleaning and disinfection of production area, Clean rooms and environmental monitoring.	**15 Hrs**

Suggested Books:

1. Pelczar MJ Jr., Chan ECS and Kreig NR., "Microbiology", 5th Edition, Tata McGraw Hill, 1993.
2. Fermentation technology. (1994). Cassida
3. Bioprocess engineering: Down stream processing & recovery of bioproducts, safety in biotechnology and regulations. (1990). Behrens, D. & Kramer, P.(Ed).
4. Enzymes- a practical introduction to structure mechanism and data analysis (2000). Copeland, R.A. 8. Enzymes: Biochemistry, Biotechnology & clinical chemistry (2004). Palmer, T.
5. Encyclopedia of bioprocess technology. Vol 1-5. (1999). Flickinger, M.C. & Drew, S.W.(Ed).
6. Schuler &Kargi, Bio-process Engg. PHI
7. Bailey &Olis, Biochemical Engg. Fundamentals, McGraw-Hill, 1990
8. Mukhopadhyay, S.N. Process Biotechnology Fundamentals, Viva Books Pvt. Ltd. 2001
9. Perry, Chilton & Green, Chemical Engineers' Handbook, McGraw-Hill
10. Bioseparations: Principles & Techniques (2005). Sivasankar B.

M. Sc. Semester-IV
Discipline Specific Core Course (DSC-10)-MICROBIOLOGY –Paper-14
(MMI4T14) (MEDICAL MICROBIOLOGY AND PARASITOLOGY)

Course Outcomes: At the end of the course the students will be able to

1. Understand types and stages of infection, process of infection. Mechanism of microbial infection
2. learn about pathogenic bacteria, pathogenic fungi, Parasites &Helminths
3. Also learn about New emerging infections, community associated infection and Multidrug resistant microorganisms

DSC-10 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**

	Unit-I	
Infection	**Infection:** Definition, Types, stages of infection, process of infection. **Establishment of pathogenic microorganisms**: Entry, spread and tissue damage. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts, Aggresssins and toxins.	**15 Hrs**
	Unit-II	
Bacteriology	**Pathogenic Bacteria:** Morphological characteristic, Pathogenesis and Laboratory diagnosis including rapid methods of following pathogenic bacteria; *Klebsiella pneumoniae; Proteus vulgaris; Clostridium perfringes; Shigella dysenteriae, Pseudomonas aeruginosa: Vibrio cholerae;, Corynebacterium diphtheriae*	**15 Hrs**
	Unit III	
Mycology and Parasitology	**Pathogenic Fungi:** Morphological characteristics, pathogenesis and laboratory diagnosis of following pathogenic fungi:- *Microsporum; Trichophyton; Histoplasma capsulatum; Blastomyces dermatitidis; Candida albicans; Cryptococcus neoformans; Pneumocystis carinii.* **Parasites:** *Entamoeba histolytica; Giardia Lamblia; Leishmania donovani.* **Helminths***:Taenia saginata; Taeniasolium; Hymenolepis nana; Schitosoma haematobium*	**15 Hrs**
	Unit IV	
New emerging Infections	**New emerging infections:** -*Streptococcus suis; community associated Methicilin resistant Staphylococcus aureus*(MRSA), *Bordetella pertussis,* H1N1, *Multi-drugresistant tuberculosis. Candida auris, Vancomycin resistant enterococci*	**15 Hrs**

Suggested Books:

1. Medical Microbiology.By:G.F.Brooks,J.S.Butel,S.A.morse.
2. Text book of Microbiology.By:Ananthanarayan and Panikar.
3. Medical Microbiology.By:B.S.Nagoba and A.Pichare.
4. Clinical Microbiology and Infection control.By;Elaine Larson.
5. Bacterial Pathogenesis;Molecular and cellular mechanism.By;CamilaLocht and Michel Simonet.
6. Brock Biology of Microorganisms.By: Madigan M.T John M. Martinko and Parker J
7. Viruses and Interferon; current research. By:Karen Mossam
8. Lentiviruses and Macrophages:Molecular and Cellular intereactions. By:Moira Desporf.
9. Molecular Biology of the gene. By: J.D.Watson, N.h.Hoppkins, J.W.Roberts, J.A.Steitz & A.M.Weiner.
10. Essentials of Medical Microbiology: Apurba Sankar Sastry, Bhat Sandhya K.
11. Milestones in Microbiology: by Brock TD

M. Sc. Semester-IV
Discipline Specific Elective Course (DSE-4)-MICROBIOLOGY- Paper-15 (MMI4T15) (VACCINOLOGY)

Course Outcomes: At the end of the course the students will be able to

1. Know the basic concepts of immunity and infection prevention.
2. Know the various vaccination kinds and how they work.
3. Promote analytical and critical decision-making skills by asking questions and working through vaccination-related problems.
4. Establish a broad awareness of the advantages and disadvantages of vaccinations and the skills necessary to evaluate one's own and one's family members' risks

DSE-4 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
Basic concepts of vaccination	A:Introduction to vaccines: a) Historical background of vaccination b) Infections and mechanisms of disease induction c) Basic concepts of immunity (Active and passive immunization;) and protection against infection B. Types of Vaccine- Live, killed, recombinant DNA , DNA vaccines: merits and demerits and protein-based vaccines; Peptide vaccines, conjugate vaccines, RNA Vaccines merits and demerits, Hybrid vaccine; role and properties of adjuvants, antibody engineering- chimeric and hybrid monoclonal antibodies. Vaccine against cancer T cell based vaccine, edible vaccine merits and demerits and therapeutic vaccine; Success stories in vaccinology e.g. Hepatitis, Polio, Small pox, DPT		**15 Hrs**
	Unit-II		
Implementation of vaccination	A:Global vaccination programmes a) Extended Program of Immunization (EPI) for children b) Disease-eradication programs using vaccines c) Mother and child protection via vaccines Pandemic and seasonal influenza vaccination d) Mass immunization programmes B: Vaccination policy and implementation C: New approaches for vaccine delivery; Engineering virus vectors for vaccination; Vaccines for specific targets; Tuberculosis Vaccine; Malaria Vaccine; HIV vaccine.		**15 Hrs**

Unit III		
Vaccine development and application	**Vaccine development and application** A: Making a vaccine and its approval for use in human Biological basis of vaccine development, Novel strategies, Vaccine safety, Vaccine policy issues. a) Targets for vaccine development b) Assessment of new vaccines Approval processes for new vaccine B: Unmet vaccination needs in the public health a) Novel and new infection b) Vaccines for Cancer c) Animal vaccine needs for human health protection. d) Advances in Vaccine development and challenges faced for: HIV, Measles and Tuberculosis and Benefits of vaccination	**15 Hrs**
Unit IV		
Vaccine trials and good clinical practice	Phases of vaccine trials, development of a vaccine protocol, product management, data collection and management, outreach and awareness Overview of national and international regulatory requirements/ guidance for production, Quality control and Current Good Manufacturing Practices (cGMP) implementation. Importance and implementation of cGMP in the production of safe and efficacious biological products/ vaccines, andclean-in-place (CIP) cycle development for process equipment. Equipment cleaning and validation. Validation of sterilization equipment's. Toxicity and potency evaluation of bacterial and viral vaccines: overview of currently approved methods and alternative methods under development.	**15 Hrs**

Suggested Books:

1. *Vaccines,6thEdition*-ByStanleyA.Plotkinet al.Saunders,ISBN: 978-1-4557-0090-5(http://www.sciencedirect.com/science/book/9781455700905)

2. *HealthTopics–Vaccines.World Health Organization .Webaccess: http://www.who.int/topics/vaccines/en/*

3. Vaccines and immunization .US Center for Disease Control and Prevention (CDC) Webaccess: http://www.cdc.gov/vaccines/

4. Immunization against infectious disease (theGreenBook).PublicHealth England.Webaccess: https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book

5. Recombinant and synthetic vaccines 1994. G.P. 1 Taiwan K.V.S. Rao, V.S. Chauhan, Eds. PP. 528. Springer Scan Publication.

6.New Generation Vaccines. Fourth Edition, Myrone M. Levine , Myron M. Levine, Gordon Dougan , Michael F. Good , Margaret A. Liu , Gary J. Nabel , James P. Nataro, RinoRappuoli.

7.Vaccine Development and Manufacturing. Emily P. Wen (Editor), Ronald Ellis (Editor), Narahari S. Pujar (Editor).

8.Vaccines & Vaccine Technologies. Jose Ronnie Vasconcelos.

9.Indian Pharmacopeia.

M. Sc. Semester-IV
Discipline Specific Elective Course (DSE-4)-MICROBIOLOGY- Paper-15 (MMI4T15) (BIOETHICS, BIOSAFETY AND IPR)

Course Outcomes: At the end of the course the students will be able to

1. Comprehend biosafety regulations and guidelines governing the handling,containment and transport of hazardous materials and apply biosafety principles to ensure environmental and public safety.
2. Understand intellectual property(IP) and differentiate between patents, copyrights, trademark and trade secrets.

DSE-4 THEORY	**Hours: 04 Hours /Week**	**Marks: 80+20=100**	**Credit: 04**
	Unit-I		
History and Basic Concepts	Brief history of bioethics Past and current approaches to bioethics Principles of bioethics – respect of autonomy, non-maleficence, justice, beneficence Medical ethics Public health ethics Ecology and Environmental Ethics		**15 Hrs**
	Unit-II		
Bioethics and Biosafety I	Microbiology and biotechnology research ethics Biomedical Research Ethics Genetic engineering –safety, social, moral and ethical considerations Bioethics, bioweapons and the microbiologist - India's perspective Definition and history of biosafety Principles of biosafety Different levels of biosafety and guidelines		**15 Hrs**
	Unit III		
Bioethics and Biosafety II	Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, Cartagena protocol on biosafety, WTO agreements related to biosafety, Biosafety issues in germplasm Cross border movement Risk management issues - containment. General principles of biosecurity		**15 Hrs**

Unit IV		
IPR	General principles for the laboratory and environmental biosafety Biosafety issues in microbiology and biotechnology laboratories Trade-Related Aspects of Intellectual Property Rights Introduction to copyrights, trademarks, trade secrets, patents, geographical indications in IPR Indian patent act, amendments and patent filing Protection of plant variety and farmers right act Guidelines of IPR on the commercialization of biotechnology products	**15 Hrs**

Suggested Books:

1. Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten. (2010) Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press.
2. Biosafety in Microbiology and biomedical laboratories, 5th Ed. (2009): CDC, NIH publication. HHS publication (21-1112
3. * Rajul K Gupta (2017) Food Safety in the 21st Century: Public Health Perspective. Academic Press.
4. http://dbtbiosafety.nic.in/
5. Alexandra George (2006) Globalisation and Intellectual Property. Ashgate publishing company
6. David Pressman (2016) Patent It Yourself 18th edition, Nolo Publishers

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Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

SYLLABUS for M. Sc. CHEMISTRY

Choice Based Credit System (Semester Pattern)

With effect from 2023-24 as per NEP 2020

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

SYLLABUS for M. Sc. CHEMISTRY

As per National Education Policy (NEP)-2020

With effect from 2023-24

Pre-requisites to enrol for the M. Sc. Chemistry Programme:

The student who has completed the three-year B. Sc. course with Chemistry (or allied subject) as the major subject with not less than 50% of aggregate marks (45% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol for M. Sc. (Chemistry) course. However, the student who has completed four-year B. Sc. course [B. Sc. (Honours) as per NEP- 2020] with Chemistry (or allied subject) as the major subject with not less than 50% of aggregate marks (45% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol directly in semester III of M. Sc. (Chemistry) course.

Credit distribution structure for two years Post Graduate Programme in Chemistry*

Year (2 Yr PG)	Level	Sem. (2 Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem. I	14 (2 theory + 2 practical)	4	4			22	PG Diploma (after 3 Yr Degree)
		Sem. II	14 (2 theory + 2 practical)	4		4		22	
Cum. Cr. For PG Diploma/ 1 year of PG			28	8	4	4	-	44	
Exit option: PG Diploma 44 credits after three-year degree									
II	6.5	Sem. III	14 (3 theory + 1 practical)	4			4	22	PG Degree After 3 Yr UG or PG degree after 4-Yrs UG
		Sem. IV	14 (3 theory)	4			6	22	
Cum. Cr. For II year of PG			26	8			10	44	
Cum. Cr. For 2 year of PG degree			54	16	4	4	10	88	

*Source: [illegible]

Scheme of teaching and examination for M. Sc. CHEMISTRY (CBCS) As per NEP 2020

Structure and Credit Distribution of PG Degree Program for Two years

Choice Based Credit System (Semester Pattern)

With Effect from 2023-2024

M. Sc. CHEMISTRY Semester I

Course Category	Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
			Theory	Practical	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
								SEE	CIE		Theory	Practical
DSC	MCH1T01	Paper 1: Inorganic Chemistry	4	-	4	4	3	80	20	100	40	-
DSC	MCH1T02	Paper 2: Physical Chemistry	4	-	4	4	3	80	20	100	40	-
DSE	MCH1T03	Paper 3: Electives (Choose any one) (a) Bioinorganic Chemistry (b) Biomolecules (c) Foundations of Thermodynamics and Electrochemistry (d) Analytical Separation Techniques (e) Equivalent MOOC course	4	-	4	4	3	80	20	100	40	-
RM	MCH1T04	Paper 4: Research Methodology	4	-	4	4	3	80	20	100	40	-
DSC	MCH1P01	Practical 1: Inorganic Chemistry	-	6	6	3	3-8	50	50	100	-	50
DSC	MCH1P02	Practical 2: Physical Chemistry (Including Research Methodology)	-	6	6	3	3-8	50	50	100	-	50
		TOTAL	**16**	**12**	**28**	**22**	–	**420**	**180**	**600**	**160**	**100**

CIE – Continuous Internal Evaluation and SEE – Semester End Examination

M. Sc. CHEMISTRY Semester II													
Course Category	Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
			Theory	Practical	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
								SEE	CIE		Theory	Practical	
DSC	MCH2T05	Paper 5: Organic Chemistry	4	-	4	4	3	80	20	100	40	-	
DSC	MCH2T06	Paper 6: Analytical Chemistry	4	-	4	4	3	80	20	100	40	-	
DSE	MCH2T07	Paper 7: Electives (Choose any one) (a) Solid state and organometallic chemistry (b) Organic Reaction Mechanism (c) Quantum, Statistical and Nuclear Chemistry (d) Instrumental Methods of Analysis (e) Equivalent MOOC course	4	-	4	4	3	80	20	100	40	-	
OJT	MCH2P03	Practical 3: On Job Training/ Field Project	-	8	8	4	3-8	50	50	100	-	50	
DSC	MCH2P04	Practical 4: Organic Chemistry	-	6	6	3	3-8	50	50	100	-	50	
DSC	MCH2P05	Practical 5: Analytical Chemistry	-	6	6	3	3-8	50	50	100	-	50	
		TOTAL	12	20	32	22	-	390	210	600	120	150	

M. Sc. CHEMISTRY Semester III												
Course Category	Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
			Theory	Practical	Total		Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
								SEE	CIE		Theory	Practical
DSC	MCH3T08	Paper 8:Spectroscopy-I	4	-	4	4	3	80	20	100	40	-
DSC	MCH3T09	Paper 9: Advanced Organic Chemistry-I	4	-	4	4	3	80	20	100	40	-
DSC	MCH3T10	Paper 10: Advanced Inorganic Chemistry	4	-	4	4	3	80	20	100	40	-
DSE	MCH3T11	Paper 11: Elective (Choose any one) (a) Inorganic Chemistry Special I (b) Organic Chemistry Special I (c) Physical Chemistry Special I (d) Analytical Chemistry Special I (e) Equivalent MOOC course	4	-	4	4	3	80	20	100	40	-
DSE	MCH3P06	Practical 6: Based on Elective subject	-	4	4	2	3-8	50	50	100	-	50
RP	MCH3P07	Research Project (RP)	-	8	8	4	3-8	50	50	100	-	50
		TOTAL	**16**	**12**	**28**	**22**	-	**420**	**180**	**600**	**160**	**100**

M. Sc. CHEMISTRY Semester IV

Course Category	Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme				Minimum Passing Marks	
			Theory	Practical	Total		Duration in hrs.	Max. Marks		Total Marks	Theory	Practical
								SEE	CIE			
DSC	MCH 4T12	Paper 12: Spectroscopy-II	4	-	4	4	3	80	20	100	40	-
DSC	MCH 4T13	Paper 13: Advanced Organic Chemistry-II	4	-	4	4	3	80	20	100	40	-
DSC	MCH 4T14	Paper 14: Advanced Physical Chemistry	4	-	4	4	3	80	20	100	40	-
DSE	MCH 4T15	Paper 15: Elective (Choose any one) (a) Inorganic Chemistry Special II (b) Organic Chemistry Special II (c) Physical Chemistry Special II (d) Analytical Chemistry Special II (e) Equivalent MOOC course	4	-	4	4	3	80	20	100	40	-
RP	MCH 4P08	Research Project (RP)	-	12	12	6		100	100	200	-	100
		TOTAL	**16**	**12**	**28**	**22**	-	**420**	**180**	**600**	**160**	**100**

Elective papers:

In addition to the mandatory papers, the student has to opt for ONE elective paper in each semester from the basket of elective papers mentioned in the following table.

Basket for Elective Courses (4 Credits each)

Semester	Course Category	Name of the course	Course Code
I	Elective	(a) Bioinorganic Chemistry (b) Biomolecules (c) Foundations of Thermodynamics and Electrochemistry (d) Analytical Separation Techniques (e) Equivalent MOOC course	MCH1T03 (Paper 3)
II	Elective	(a) Solid state and organometallic chemistry (b) Organic Reaction Mechanism (c) Quantum, Statistical and Nuclear Chemistry (d) Instrumental Methods of Analysis (e) Equivalent MOOC course	MCH2T07 (Paper 7)
III	Elective	(a) Inorganic Chemistry Special I (b) Organic Chemistry Special I (c) Physical Chemistry Special I (d) Analytical Chemistry Special I (e) Equivalent MOOC course	MCH3T11 (Paper 11)
IV	Elective	(a) Inorganic Chemistry Special II (b) Organic Chemistry Special II (c) Physical Chemistry Special II (d) Analytical Chemistry Special II (e) Equivalent MOOC course	MCH4T15 (Paper 15)

The students can opt either the elective paper taught in the college in offline mode or any other equivalent online course of at least 4 credits offered by MOOC or any other such platform. The equivalence of such courses will be decided by the college committee comprising of the faculty members of the department and chaired by the Head, Dept. of Chemistry in that College.

EVALUATION and DISTRIBUTION OF MARKS

(1) Continuous Internal Evaluation (CIE): Twenty (20) marks in theory based on overall participation (Such as, Attendance in theory and practical classes, seminar, assignment, quiz, participation in field tours, conferences, workshops, and the general behaviour in the department.)

(2) Semester End Examination (SEE)

Theory Paper: Maximum Marks: 80, Duration of Examination-Three Hours. The paper will be set so as to cover all units/sections of the syllabus as below:

Type of questions	Total Number of questions	No. of questions to be answered	Marks for Each Question	Total maximum marks
• Short answer questions • Long answer questions • Numerical questions • Analytical questions	4 + 1 = 5 one question from each unit (4) + one question on all the units (1)	5	16	80

(3) General Scheme for Distribution of Marks in Practical Examination in Chemistry

Time: 6-8 h (One day Examination) Marks:100

Exercise-1	15 Marks	- Evaluated jointly by Internal and External Examiner
Exercise-2	15 Marks	- Evaluated jointly by Internal and External Examiner
Record	10 Marks	- Evaluated by Internal
Viva Voce	10 Marks	- Evaluated by External
SEE	**50 Marks**	
CIE	**50 Marks**	
Total	**100 marks**	

(4) General Scheme for Distribution of Marks in Project Examination in Chemistry

The project work will be evaluated by both external and internal examiners. The examiners will evaluate the project work considering the coverage of subject matter, presentation, literature etc.

Written Project work	-	Evaluated jointly by External and Internal
For Presentation	-	Evaluated jointly by External and Internal
For Viva-Voce	-	Evaluated by External Examiner
Internal Assessment	-	Evaluated by Internal Examiner

Sem-III: Total 100 Marks (50 CIE and 50 SEE)

Sem-IV: Total 200 marks (100 CIE and 100 SEE)

Teacher and research project supervisor:

The regular full-time subject teacher of the College / Approved Contractual teacher / Approved Adhoc faculty / Approved Contributory teacher /scientist of government or private research laboratory appointed by university as a contributory teacher and having M. Phil. or Ph. D. degree in Chemistry can supervise the research project of the student.

SEMESTER I

Paper 1

MCH1T01: Inorganic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students would be able to

1. *predict the nature of bond and its properties through various electronic structural methods; bonding models*
2. *design new coordination compounds based on a fundamental understanding of their electronic properties*
3. *develop the possible catalytic pathways leading to desired products*
4. *apply the principles of transition metal coordination complexes to derive reaction mechanisms.*

Unit I

Electronic spectra and MO theory of Transition Metal complexes

Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule, Hole formalism, Determination of the term symbol (ground and excited states) for d^1 to d^9 configurations, Electronic spectra of transition metal complexes, Laporte 'orbital' selection rule, spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of 10Dq, B, β parameters. Tanabe- Sugano Diagrams of octahedral complexes with d^2 and d^8 configuration. M.O. Theory for octahedral, tetrahedral and square planar complexes with and without π-bonding.

Unit II

A) Boron hydrides: Classification, nomenclature, structure, bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for higher boranes and their utilities. Chemistry of diboranes: Study of Carboranes and Metallocarboranes with reference to preparations and structures.

B) Metal-Metal bonds: Occurrence of metal-metal bond, Classification of metal clusters, Binuclear, trinuclear, tetranuclear, pentanuclear and hexanuclear with reference to halide, oxide, alkoxide and acetate clusters.

Unit III

A) Metal – Ligand Equilibria in Solution: Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodynamic origin. Determination of formation constant by:

(1) spectrophotometric method (Job's and Mole ratio method)

(2) Potentiometric method (Irving-Rossotti Method)

B) Reaction Mechanism of Transition metal complexes-I: Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution: Acid hydrolysis, factors affecting acid hydrolysis, Stereochemistry of intermediates in S_N1 and S_N2, Base

hydrolysis, Conjugate base mechanism, Direct and indirect evidences in favour of conjugate mechanism, Annation reaction, reaction without metal-ligand bond breaking.

Unit IV

A) Metal carbonyls: EAN concept and 18-electron rule for metal carbonyls, Structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls. Metal carbonyl clusters with reference to classification, synthesis and structures.

B) Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure elucidation, important reactions of transition metal nitrosyls, structure and bonding. Dinitrogen and dioxygen complexes.

References

1. S. F. A. Kettle, J. N. Murral and S. T. Teddler: Valency Theory
2. C. A. Coulson: Valency
3. J. E. Huheey: Inorganic Chemistry
4. F.A. Cotton and G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5thand 6th Editions.
5. A. F. Willims: Theoretical Approach in inorganic chemistry.
6. A. Mannas Chanda: Atomic Structure and chemical Bonding
7. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
8. J. J. Logowski: Modern Inorganic Chemistry
9. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
10. J. C. Bailar: Chemistry of coordination compounds.
11. W. L. Jolly: Modern Inorganic Chemistry
12. R. S. Drago: Physical methods in inorganic chemistry.
13. Waddington: Nonaqueous solvents.
14. Sisler: Chemistry of nonaqueous solvents.
15. A. K. Barnard: Therotical Inorganic Chemistry
16. Emeleus and Sharpe: Modern Aspect of Inorganic Chemistry.
17. F. A. Cotton: Chemical Applications of Group theory.
18. Jones: Elementary Coordination chemistry.
19. B. N. Figgis: Introduction to Ligand field.
20. S. F. A. Kettle: Coordination chemistry.
21. M.C.Day and J.Selbin: Theoretical Inorganic Chemistry.
22. J. Lewin and Wilkins: Modern Coordination Chemistry.
23. Gowarikar, Vishwanathan and Sheedar: Polymer science.
24. H. H. Jattey and M. Orchin: Symmetry in chemistry.
25. D. Schonaland: Molecular Symmetry in chemistry.
26. L. H. Hall: Group theory and Symmetry in chemistry
27. H. H. Jattey and M. Orchin: Symmetry in chemistry
28. R.L.Dutta and A.Symal: Elements of magneto chemistry
29. Inorganic Chemistry 4th Edition, P.Atkins, Oxford University Press.
30. Essential Trends in Inorganic Chemistry, D.M.P.Mingos, Oxford University Press.
31. Purcell and Kotz: Inorganic Chemistry, Cengage Publishers.
32. Puri, Sharma, Kalia: Principles of Inorganic Chemistry, Milestone Publishing.
33. Madan, Malik, Tuli, Selected topics in Inorganic Chemistry.
34. Agarwal and Kimtilal: Advanced Inorganic Chemistry, Pragati Prakashan.

SEMESTER I

Paper 2

MCH1T02: Physical Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Understand, analyze and exercise the principles of classical thermodynamics in various applications*
2. *Understand and execute the quantum mechanical problems and their applications*
3. *Understand the concept of adsorption and its application in surface chemistry*
4. *Analyze and understand the characterization techniques for polymer*
5. *Understand the principles of chemical kinetics and their applications in chemical dynamics*

UNIT I :CLASSICAL THEMODYNAMICS

A) Recapitulation of Laws of thermodynamics, Exact and inexact differentials, condition of exactness, Ptaff differential expression and equations, Applications of Ptaff differential equations to first and second law of thermodynamics, Carathéodory's principle and its equivalence to the Kelvin Plank and Clausius statement of the Second law of Thermodynamics, Homogeneous functions of degree 0 and 1, extensive and intensive properties, derivation of thermodynamic equations of state, Maxwell's relations .Third law of thermodynamics, Nernst Heat Theorem, unattainability of absolute zero, calculation of entropy based on third law of thermodynamics, residual entropy and its application, Numerical.

UNIT II :FORMULATION OF QUANTUM MECHANICS

A) Introduction of Quantum Mechanics, Wave Function, Acceptability of Wave Functions, Normalized and Orthogonal Wave Functions, Operators, Operator Algebra, Eigen Functions and Eigen Values of Quantum Mechanical Properties)e.g .Linear, Angular momentum, etc(., Hermitian Operators, Orbital and generalized Angular Momentum, Postulates of Quantum Mechanics, Problems on Operator algebra, Eigen Values and Average Values of quantities.

B) Application of Schrödinger Wave Equation to Simple Systems :Particle in a 3-Dimensional Box, Concept of degeneracy and breakdown in degeneracy, Rigid Rotor, Potential Well of Finite Depth)Tunneling Effect(, Simple Harmonic Oscillator, The Hydrogen Atom.

UNIT III :SURFACE CHEMISTRY AND MACROMOLECULES

A) Recapitulation of Surface tension, Adsorption :Freundlich adsorption isotherm, Langmuir theory, Gibbs adsorption isotherm, BET theory and estimation of surface area, enthalpy and entropy of adsorption .Surface film on liquids and catalytic activity, Electro-kinetic phenomena, Surface active agents, hydrophobic interactions, micellization, Critical Micelle Concentration)CMC(, mass action model and phase separation model of micelle formation, shape and structure of micelles, factors affecting CMC, micro-emulsion and reverse micelles.

B) Definition of macromolecule (Polymer), types of polymers, Number average and mass average molecular mass, molecular mass determination by Osmometery, Viscometry, Ultracentrifugation, light scattering and size-exclusion chromatography method, Numericals.

UNIT IV :CHEMICAL KINETICS

A(Temperature dependence of chemical reaction rates, Arrhenius equation, Energy of activation, pre-exponential factor and its limitations, Collision theory and its limitations, steric factors, Transition State theory of gas and liquid phase bimolecular reactions, comparison of three theories of reaction rates.

B(Bodeinstein steady state approximation and its application in consecutive reactions, Dynamics of unimolecular reactions **:**Lindeman**-**Hinshelwood mechanism, RRKM theory, Thermodynamic formulation of transition state theory, Enthalpy, Gibbs free energy and enthalpy of activation**.**

References

1. R **.**P **.**Rastogi and R **.**R **.**Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010**.**
2. P **.**W **.** Atkins and D **.**Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010**.**
3. E **.**N **.** Yenemin, Fundamentals of Chemical Thermodynamics, MIR, Publications**.**
4. G **.**K **.**Vemulapalli, Physical Chemistry, Prentice –Hall of India, 1997**.**
5. S **.** Glasstone and De Van No Strand, Thermodynamics for Chemists, 1965**.**
6. S **.**M **.**Blinder, Advanced Physical Chemistry,
7. D **.**Mcquarie and J **.**Simon, Physical Chemistry –A Molecular Approach, University Press, 2000
8. Ira N .Levine, Quantum Chemistry, 5th edition)2000(, Pearson educ., Inc.New Delhi
9. A.K.Chandra, Introductory Quantum Chemistry, 4th edition)1994(, Tata Mcgraw Hill, New Delhi.
10. M.W.Hanna, "Quantum Mechanics in Chemistry", Benjamin
11. L .Pualing and E .B .Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York)1935.(
12. R .K .Prasad, Quantum Chemistry, New Age International, Delhi .
13. R .K .Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
14. B .C .Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
15. G **.**M **.**Barrow, Physical Chemistry, Tata Mc**-**Graw Hill, V edition 2003**.**
16. H **.**K **.**Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010**.**
17. G. M. Panchenkov and V.P. Labadev, "Chemical Kinetics and catalysis", MIR Publishing
18. E.A .Moelwyn -Hughes, "Chemical Kinetics and Kinetics of Solutions", Academic
19. K. J .Laidler, Chemical Kinetics, Third Edition)1987(, Harper and Row, New York.
20. J. Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi)1993(

21. C .H .Bamford and C .F .H .Tipper, Comprehensive Chemical Kinetics, **Vol 1**., Elsevier Publications, New York, 1969.
22. C .H .Bamford and C .F .H .Tipper, Comprehensive Chemical Kinetics, **Vol 2**., Elsevier Publications, New York, 1969.
23. S .Glasstone, K .J .Laidler and H .Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
24. A .Findley, The Phase Rule and its Applications, Longmans Green and Co., Mumbai.
25. K .S .Birdi, Surface Chemistry Essentials, CRC Press, New York, 2014.
26. Eric KeightleyRideal, An Introduction to Surface Chemistry, Cambridge University Press, 1926.
27. D .M .Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley and Sons, NewYork, 1984.
28. A .W .Adamson, A .P .Gasi, Physical Chemistry of Surfaces, Wiley, 2007.
29. P .C .Hiemenz and R .Rajagopalan, Principles of Colloid and Surface Chemistry, CRC Taylor and Fransis, 2007.
30. P .D .Hede and S .P .Beier, Inorganic and Applied Chemistry, e-Book, 2007.
31. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
32. E.M .Mc Cash, Surface Chemistry, Oxford University Press, Oxford)2001.(
33. G .K .Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill, 1990.
34. N .B .Singh, N .S .Gajbhiye, S .S .Das, Comprehensive Physical Chemistry, New Age International, 2014.
35. K .L .Kapoor, Text Book of Physical Chemistry, Vol –I to Vol-VI, 2011.
36. Spectroscopic identification of organic compound-RM Silverstein,GCBassler and TC Morril, John Wally
37. Application of Spectroscopy to Organic Compound-J .R .Dyer, Printice Hall
38. Organic Spectroscopy-William Kemp, ELBS with McMillan
39. Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
40. Organic Spectroscopy-RT Morrison and RN Boyd
41. Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
42. Fundamentals of Molecular Spectroscopy-CN Banwell

NPTEL sources weblinks

For Quantum Chemistry Introduction:

- https://archive.nptel.ac.in/courses/104/108/104108057/
- https://onlinecourses.nptel.ac.in/noc20_cy27/preview
- https://nptel.ac.in/courses/104106083
- https://nptel.ac.in/courses/104108057
- https://www.digimat.in/nptel/courses/video/104108057/L11.html

For Chemical Kinetics

- https://archive.nptel.ac.in/courses/104/101/104101128/
- https://www.youtube.com/watch?v=uep2XeLCGkc

SEMESTER I

Paper 3 (Elective)

MCH1T03: (a) Bioinorganic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student would be able to

1. *apply the principles of transition metal coordination complexes in understanding functions of biological systems*
2. *identify the medicinal applications of inorganic compounds*
3. *understand mechanism of energy transfer processes in biological systems*
4. *develop the possible enzymatic pathways in biosystems*
5. *explain oxygen transport mechanisms in biosystems*

Unit I

A) Essential and trace metals in biological systems: Biological functions of inorganic elements, biological ligands for metal ions. Coordination by proteins, Tetrapyrrole ligands and other macrocycle. Influence of excess and deficiency of V, Cr, Mn, Fe, Co, Cu and Zn. Genetic defects in the absorption of trace elements. Regulation and storage of trace elements. Role of minerals. Toxic effects of metals.

B) Metal storage, transport and biomineralization with respect to Ferritin, Transferrin and Siderophores, Na+ /K+ pump. Role of Ca in transport and regulation in living cells.

C) Medicinal use of metal complexes as antibacterial, anticancer, use of cis-platin as antitumor drug, antibiotics and related compounds. Metal used for diagnosis and chemotherapy with particular reference to anti-cancer drugs.

Unit II

A) Bio-energetics and ATP cycle: DNA polymerization, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water, Model systems.

B) Electron transfer in Biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes and Fe-S proteins, Non-heme iron proteins; Rubredoxins, Synthetic models. Biological Nitrogen fixation (in vitro and in vivo)

Unit III

Transport and Storage of Dioxygen: Heme proteins and oxygen uptake, structure and functions of haemoglobin, myoglobin, hemocyanins and hemerythrin. Perutz mechanism showing structural changes in porphyrin ring system. Oxygenation and deoxygenation. Model compounds. Cyanide poisoning and treatment. Vanadium storage and transport.

Unit IV

Metallo-enzymes: Apoenzymes, Haloenzyme and Coenzyme. The principle involved and role of various metals in i) Zn-enzyme: Carboxyl peptidase and Carbonic anhydrase. ii) Fe-enzyme: Catalase Peroxidase and Cytochrome P-450 iii) Cu-enzyme: Super Oxide dismutase iv) Molybdenum: Oxatransferase enzymes, Xanthine oxidase, Co-enzyme Vit.B_{12}, Structure of vitamin B_{12}, Co-C bond

cleavage, Mutase activity of coenzyme B-12, Alkylation reactions of Methyl Cobalamin. Synthetic model of enzyme action, stability and ageing of enzyme.

References

1) Akhmetov, N.: General and Inorganic Chemistry
2) Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
3) Bertini, et al: Bioinorganic Chemistry
4) Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (John Wiley).
5) Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
6) Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
7) Fenton, David E.: Biocoordination chemistry, Oxford
8) Jolly, W. L. Inorganic Chemistry (4th edn) Addison-Wesley
9) Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions (J.Wiley)

SEMESTER I

Paper 3 (Elective)

MCH1T03: (b) Biomolecules

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Draw the structures of essential biomolecules*
2. *Understand the role of biomolecules in various life processes*
3. *Understand the way how drug can be administrated, absorbed, distributed and metabolized*
4. *Understand the relation of drug with different types of receptors, chemical messengers, binding site and DNA.*

Unit I:

Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars, configurations of aldoses and ketoses, general methods of structure and ring size determination with reference to maltose, lactose, sucrose, Structural features and applications of inositol, starch, cellulose, chitin and heparin

Unit II:

Amino acids, protein and peptides: Amino acids, structural characteristics, acid base property, stereochemistry of amino acids, optical resolution, Stecker synthesis, peptide and proteins structure of peptide and protein, primary, secondary, tertiary and quaternary structure. Reaction of polypeptide, structure determination of polypeptide, end group analysis, strategy of peptide bond synthesis: *N*-Protection and *C*-Activation, Solid phase peptide synthesis

Unit III:

Nucleic Acids: Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA. Purines and pyrimidine bases of nucleic acids and their preparation, Biosynthesis of DNA and RNA, Polymerase Chain Reaction (PCR) and RTPCR

Lipids: Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospholipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis Properties of lipid aggregates, micells, bilayers, liposomes and their biological functions, biological membranes, fluid mosaic model of membrane structure, Lipid metabolism, β-Oxidation of fatty acids

Unit IV: Enzyme chemistry

A) **Enzymes:** Introduction, chemical and biological catalysis, remarkable properties of enzymes likecatalytic power, specificity and regulation. Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Nomenclature and classification, Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker's yeast catalysed reactions

B) **Mechanism of Enzyme Action:** Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A

C) Vitamins and Co-Enzyme Chemistry: Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, lipoic acid, biotin as CO_2 carrier. Mechanisms of reactions catalyzed by the above cofactors

References

1) Bioorganic Chemistry :A Chemical Approach to Enzyme Action, Hermann Dugas and C .Penny, Springer-Verlag
2) Understanding Enzymes, Trevor Palmer, Prentice Hall
3) Enzyme Chemistry :Impact and Applications, Ed .Collin J .Suckling, Chapman and Hall
4) Enzyme Structure and Mechanism, A .Fersht, W .H .Freeman
5) Introduction to Medicinal Chemistry, A .Gringuage, Wiley-VCH
6) Wilson and Gisvold's Text Book of Organic Medical and Pharmaceutical Chemistry, Ed Robert F .Dorge
7) Strategies for Organic Drug Synthesis and Design, D .Lednicer, John Wiley

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Weblink to Equivalent MOOC on NPTEL/SWAYAM if relevant:

- Essentials of Biomolecules: Nucleic Acids and Peptides https://nptel.ac.in/courses/104/103/104103121/
- Biocatalysis in Organic Synthesis https://archive.nptel.ac.in/courses/104/105/104105032/
- Biochemistry https://archive.nptel.ac.in/courses/104/105/102105034/
- Organic Chemistry in Biology and Drug Development https://archive.nptel.ac.in/courses/104/105/104105120/

SEMESTER I

Paper 3 (Elective)

MCH1T03: (c) Foundations of Thermodynamics and Electrochemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Understand, the mathematical concepts used in chemistry*
2. *Understand the principle involved in fundamental physical chemistry*
3. *Understand the concept of ideal and non-ideal solutions*
4. *Understand the theories of electrolytes*

Unit-I: Mathematical concepts

Equation of a straight line and calculation of slope and intercepts, Differentiation, Derivative function, various differential formulas, Chain rule, finding minima and maxima, partial differentiation. Integration, methods of integration, integration by parts, integration formulas, permutation combination fundamentals, Vectors, Matrices, Determinants, Complex numbers, series expansions, Stirling approximation, Practice numerical based on these concepts.

Unit II :Thermodynamics and Phase Equilibria

Concept of fugacity, determination of fugacity, The Le-Chatelier's Principle and its quantitative treatment. Ideal solutions and Roult's law, non-ideal solutions (Henry's Law), Deviation from ideal behavior, Chemical potential in Non-ideal solutions, excess functions for non-ideal solutions, Partial molar quantities **:**Determination of partial molar quantities, chemical potential, partial molar volume, Gibbs- Duhem equation, Gibbs Duhem Mergules equation Entropy of mixing, Enthalpy of mixing, Fractional Distillation, Distillation of Azeotropic Mixtures.

Unit-III: The Phase Rule

Recapitulation of Gibbs Phase rule (Without Derivation), degrees of freedom, reduced phase rule, construction of phase diagram, one component systems **)**Water, Sulphur, carbon**(**, 1st and 2nd order phase transition, lambda line, Helium,system, Eutectic systems, two component systems forming solid solutions having congruent and incongruent melting point, Construction of a phase diagram, partially miscible solid phase, three component systems, graphical presentation, related Numerical

Unit-IV: Electrochemistry - I

Electrolytic conductance (Specific, Equivalent and molar), Variation of Eq./molar conductance with dilution, Transport number and its determination using Hittorf's method and Moving boundary method, Kohlrausch's law, calculation of molar ionic conductance, conductometric titrations, High frequency titrations, Ostwald dilution law, Determination of ionic mobility, numerical. Principle of potentiometry, Indicator electrodes: hydrogen electrode, quinhydrone electrode, antimony electrode and glass electrode. Reference electrodes: Calomel electrode and Ag/AgCl electrode. potentiometric titrations, Nernst equation, standard electrode potential, Determination of cell potential, n, Kf and Ksp. pH titrations.

References

1. R .P .Rastogi and R .R .Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
2. P .W .Atkins and D .Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
3. E .N .Yenemin, Fundamentals of Chemical Thermodynamics, MIR, Publications.
4. G .K .Vemulapalli, Physical Chemistry, Prentice –Hall of India, 1997.
5. S .GlasstoneandDe Van No Strand, Thermodynamics for Chemists, 1965.
6. S .M .Blinder, Advanced Physical Chemistry,
7. D .Mcquarie and J .Simon, Physical Chemistry –A Molecular Approach, University Press, 2000
8. Ira N .Levine, Quantum Chemistry, 5th edition)2000(, Pearson educ., Inc.New Delhi
9. G .M .Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.

A. Findley, The Phase Rule and its Applications, Longmans Green and Co., Mumbai.

10. N .B .Singh, N .S .Gajbhiye, S .S .Das, Comprehensive Physical Chemistry, New Age International, 2014.
11. K .L .Kapoor, Text Book of Physical Chemistry, Vol –I to Vol-VI, 2011.
12. Spectroscopic identification of organic compound-RM Silverstein, GCBassler and TC Morril, John Wally
13. Application of Spectroscopy to Organic Compound-J .R .Dyer, Printice Hall

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NPTEL sources Weblinks

For Classical Thermodynamics:

- https://archive.nptel.ac.in/courses/104/103/104103112/
- https://digimat.in/nptel/courses/video/104106094/L18.html

For Phase rule:

- https://www.youtube.com/watch?v=2LywAiZBQW4
- https://archive.nptel.ac.in/courses/113/104/113104068/
- https://archive.nptel.ac.in/courses/104/103/104103112/

For electrochemistry

- https://onlinecourses.nptel.ac.in/noc23_cy19/preview
- https://www.youtube.com/watch?v=XTt3gXB0a84

SEMESTER I

Paper 3 (Elective)

MCH1T03: (d) Analytical Separation Techniques

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. *Understand various separation technique based on sample and target analyte*
2. *Elaborate the working principles of various separation techniques.*
3. *Apply logic behind working and applicability of each technique.*
4. *Identify most suitable separation tool resolution of mixtures.*
5. *Develop separation methods for multicomponent analysis.*
6. *Evaluate efficiency of separation of mixture based on analysis parameters.*

Unit I: Column, paper and thin layer chromatography

Definition and general classification of chromatographic techniques**.** Normal and reverse phase chromatography. Terminology used in separation techniques.

Column chromatography: Basic principle, technique and applications in qualitative and quantitative analysis. Properties of good column adsorbents.

Paper chromatography: Basic principle, techniques and applications in qualitative and quantitative analysis. Calculations involving R_f values.

Paper electrophoresis: Principle and technique. Factors affecting migration of ions. Applications.

Thin layer chromatography: Principle and technique. Advantages over paper and column chromatography. Applications.

Unit II: Ion exchange and solvent extraction

Ion exchange: Principle and technique**.** Types of ion exchangers and their structures**.** Ion exchange equilibria and action of cation and anion exchange resins**.** Factors affecting ion exchange efficiency. Ion exchange capacity**.** Experimental determination of ion exchange capacities of cation and anion exchange resins. Effect of complexing ions**.** Zeolites as ion**-**exchangers**.** Applications of ion exchange.

Solvent extraction: Principle and techniques**.** Distribution ratio and distribution coefficient**.** Factors affecting extraction efficiency**:** Ion association complexes, chelation, synergistic extraction, pH**.** Numericals based on multiple extractions**.** Role of chelating ligands, crown ethers, calixarenes and cryptands in solvent extraction**.** Introduction to Solid phase extraction **(**SPE**)** and Microwave assisted extraction **(**MAE**)**, Applications**.**

Unit III: Gas Chromatography

Principle including concept of theoretical plates. Calculations involving number of theoretical plates and height equivalent of theoretical plates. Column resolution, retention factor and selectivity factor. van**-**Deemter equation. Factors affecting retention, peak resolution and peak broadening**.** Instrumental set up**-** carrier gas, sampling system, column and detector**.** Types of columns in GC: Packed and open tubular, their advantages and limitations**.** Detectors in GC analysis**.** Characteristics of ideal detectors.

Construction and working of thermal conductivity, flame ionization, electron capture and mass spectrometric detectors. Temperature programmed GC and its advantages**.**

Unit IV: Liquid Chromatography

HPLC**:** Principle of HPLC. Instrumentation including mobile phase injection system, sample injection system, column and detector. Types of columns and packing materials. Normal and reverse phase systems. Detectors in HPLC: Construction and working of UV detector, fluorescence detector, photodiode array detector**.** Principle and applications of size exclusion, gel permeation and ion retardation chromatography**.** Comparison of HPLC with GC

Supercritical fluid chromatography**:** Principle, advantages and applications.

References

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley, India**).**
4. Fundamentals of Analytical Chemistry: S. A. Skoog and D. W. West
5. Instrumental Methods of Analysis**:** Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
6. Introduction to Instrumental analysis: Robert Braun (Tata McGraw-Hill)
7. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
8. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
9. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
10. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
11. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
12. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
13. Instrumental Methods of Chemical Analysis: G. W. Ewing

Web link for related NPTEL courses

Analytical Chemistry: https://nptel.ac.in/courses/104105084

SEMESTER I

Paper 4

MCH1T04: Research Methodology

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *understand what research is and what is not.*
2. *raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method.*
3. *Introduce the concept at the heart of every research project – the research problem - and to discuss what a researchable problem is.*
4. *evaluate literature, form a variety of sources, pertinent to the research objectives.*
5. *identify and justify the basic components of the research framework, relevant to the tackled research problem.*
6. *explain and justify how researchers will collect research data.*
7. *discuss how to cite sources, and justify this choice.*
8. *put forward a credible research proposal, and*
9. *warn the common mistakes in the field of research methodology.*

Unit – I: Foundations of Research

Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific, method - Understanding the language of Research - Concept, Construct, Definition, Variable. Research Process. Problem Identification and Formulation - Research Question – Investigation, Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis Null Hypothesis and Alternative Hypothesis. Hypothesis Testing - Logic and Importance. Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent and Dependent variables. Qualitative and Quantitative Research: Qualitative research – Quantitative research - Concept of measurement, causality, generalization, replication. Merging the two approaches.

Unit – II: Statistical analysis for Chemists

Errors in chemical analysis. Classification of errors- systematic and random, additive and proportional, absolute and relative. Accuracy and precision. Mean, median, average deviation and standard deviation. Significant figures and rules to determine significant figures. Calculations involving significant figures. Confidence limit, correlation coefficient and regression analysis. Comparison of methods: F-test and T-test. Rejection of data based on Q-test. Least squares method for deriving calibration graph. Application of Microsoft Excel in statistical analysis (statistical functions and spreadsheets in MS-Excel). Validation of newly developed analytical method. Certified reference materials (CRMs). Numerical problems.

Unit – III:

A] Scientific Writing and Presentation

Scientific writing. Basics in Scientific grammar. Importance of abbreviations and acronyms. Types of scientific publications- magazines, journals, reviews, news-letters, structure of scientific paper. Various reference styles.

Report Writing, Significance of report writing, different steps in report writing, types of Journals and reports, layout of research paper.

Research Ethics (Issues relating to referencing and documentation, copyrights, plagiarism), Impact Factor, CiteScore, *h*-Index, i10-Index, Citation Index, references/bibliography, structuring the thesis, use of software in thesis writing.

B] Intellectual Property Rights (IPR)

Introduction to IPR (Patents, Trademarks, Geographical indicators, Copyright and neighbouring rights), Concept and theories, kinds of IPR, Economic analysis of IPR, Need for private rights versus public interests, Advantages and disadvantages of IPR.

Unit – IV: Use of tools / techniques for Research

Methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX, Beamer presentation, preparation of bibliography database, MS Word, MS Excel, Graph and chart preparation, MS Power Point, Microcal Origin, ChemSketch, ChemDraw, Other computational software like Guassian, Mathematica, Software for detection of Plagiarism.

References

1. Research Methodology- C. R. Kothari
2. Best and Kahn, Research Methodology, PHI Limited
3. Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/cole.
4. Patrick Carey, Katherine T. Pinard, Ann Shaffer, Mark Shellman, New Perspectives Microsoft Office 365 and Office 2019 Introductory, 2020.

SEMESTER I

Practical 1

MCH1P01: Inorganic Chemistry

6 h per week *100 Marks*

I. Preparation of Inorganic Complexes and their characterization by:

Elemental analysis and physico-chemical methods (Electronic and IR Spectra, magnetic susceptibility measurements, Thermal analysis and Molar conductance studies).

1. K_3 [Al $(C_2O_4)_3$]$(H_2O)_3$ 2. [VO (acac) $_2$] 3. Na [Cr $(NH_3)_2(SCN)_4$]

4. $K_3[Cr(SCN)_6]$. 5. [Mn (acac) $_3$] 6. K_3 [Fe $(C_2O_4)_3$]

7. Hg [Co (SCN) $_4$] 8. [Co (Py) $_2$ Cl_2] 9.$[Ni(NH_3)_6]Cl_2$ 10. [Ni (DMG) $_2$]

11. $[Cu_2 (CH_3COO)_4(H_2O)_2]$ 12. $[Cu(NH_3)_4(H_2O)_2]SO_4$

II. Quantitative Analysis:

Separation and determination of two metal ions from the following alloys involving:

Volumetric, Gravimetric and Spectrophotometric methods

i) Copper (II) and Nickel (II)

ii) Copper (II) and Zinc (II)

iii) Nickel (II)—Zinc (II) and

iv) Copper (II)—Iron (III)

III. Qualitative analysis of radicals:

Semimicro analysis of inorganic mixture containing four cations out of which two will be rare metal ions such as W, Mo,Se,Ti,Zr,Ce,Th,V and U.(Spot Test for individual cations shall be performed)

References

1. Practical Inorganic Chemistry - Pass
2. Practical Inorganic Chemistry - Marr and Rocket
3. Basic Concept Of Analytical Chemistry - Khopkar S. M.
4. Synthesis And Characterisation Of Inorganic Compounds – W. L. Jolly, Prentice Hall
5. Inorganic Experiments – J. Derck Woollins, Vch.
6. Practical Inorganic Chemistry – G. Marrand, B.W. Rockett, Van Nostrand
7. A Text Book Of Quantitative Inorganic Analysis – A.I. Vogel, Longoman.
8. Edta Titration – F. Laschka
9. Instrumental Methods Of Analysis – Willard, Merit And Dean (Cbs, Delhi)
10. Inorganic Synthesis – Jolly
11. Instrumental Methods Of Chemical Analysis – Yelri Lalikov
12. Fundamental Of Analytical Chemistry- Skoog D .A. And West D. M. Holt Rinehart And Winston Inc.
13. Experimental Inorganic Chemistry7 – W.G. Palmer, Cambridge

Practical 2

MCH1P02: Physical Chemistry including RM

6 h per week *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Understand the basic principle involved in physical chemistry.*
2. *Evaluate various physical parameters*
3. *Interprete the experimental results.*
4. *Calculation involved in inpreting results*

Understand the concept of Qualitative analysis

It is expected to perform minimum 14 experiments in a semester.

1. To study the variation of volume contraction with mole fraction of alcohol in alcohol -water system
2. To determine the activation parameters of viscous flow for a given liquid.
3. To Determine the critical micelle concentration)CMC (of a given surfactant /soap /shampoo by surface tension measurements .
4. Determination of molecular mass of a polymer by viscometry method.
5. To determine integral heat of KNO_3, at two different conc .and calculation of heat of dilution.
6. Effect of 1 %NaCl, 1 %succinic acid, 0.5 %naphthalene on CST in phenol-water systems.
7. Distribution of succinic acid in H_2O -benzene, H_2O-ether and comparison of distribution coefficient.
8. To construct the phase diagrams of two components system)phenol -urea, diphenyl aminebenzophenone; a-naphtyl amine-phenol (forming compounds with congruent melting points.
9. To study the mutual solubility of glycerol-m-toluidine and to determine congruent points.
10. To study kinetics of hydrolysis of an ester by NaOH reaction.
11. To determine equilibrium constant of the equation $KI+I_2=KI_3$ by distribution method.
12. To study the kinetics of the reaction between potassium persulphate and potassium iodide.
13. Determination of order of reaction of oxidation of ethyl alcohol by acid dichromate.
14. To titrate conductometrically monobasic and dibasic acids with NaOH and determine the strength of given acid.
15. To determine equivalent conductance of weak electrolyte at infinite dilution by kaulrausch's method.
16. Determination of heat of reaction, entropy change and equilibrium constant of the reaction between metallic zinc and Cu^{+2} ions in solution.
17. Determination of thermodynamic constants ΔG, ΔH, ΔS for $Zn^{+2}+H_2SO_4 \rightarrow ZnSO_4 + 2H^+$ by emf measurement.
18. Titration of Ferrous Ammonium Sulphate against ceric sulphate and hence the formal redox potential of $Fe^{2+} \rightleftharpoons Fe^{3+}$ and $Ce^{3+} \rightleftharpoons Ce^{4+}$ systems .
19. To determine the pH of a buffer solutions using a quinhydrone electrode
20. RM-1: Statistical Analysis using MS Excel program (mean, average deviation, standard deviation, variance, F-test, t-test, chi-square test, correlation coefficient, slope, intercept, etc).
21. RM-2: Graph plotting through least square method and

22. RM-3: Molecular designing through Chemsketch and ChemDraw softwares in 2D and 3D formats (simple organic compounds and ions)
23. RM-4: Reference formatting using Mendeley and Zotero.
24. RM-5: Preparation and formulation of questionair for survey
25. RM-6: Sample collection methods

References

1. Vogel A **:** A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A**.** Alberty, Experimental Physical Chemistry, Mc**-**Graw Hill, Fifth Edition, 1956**.**
5. John W**.** Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood **:**Quantitative Analysis
7. Merits And Thomas**:**Advanced Analytical Chemistry
8. Ewing, G**.** W**. :** Instrumental Methods of Chemical Analysis, Mcgraw**-**Hill
9. Drago, R**.**S**:**Physical Methoods In Inorganic Chemistry
10. Christain G**.**D**:**Analytical Chemistry
11. Khopkar S**.**M**.:**Basic Concept Of Analytical Chemistry
12. Koltath And Ligane**:**Polorography
13. Braun**:**Instrumental Methods Of Chemical Analysis
14. Willard, Merritt And Dean**:** Instrumental Methods Of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi;Llan And Wisin**:** Analytiacl Chemistry
16. Skoog S**.**A**.** And West D**.** W**.:**Fundamental of Analytical Chemistry
17. Dilts R**.**V**.:** Analytiacl Chemistry
18. Jahgirdar D**.**V **:**Experiments In Chemistry
19. Chondhekar T**.**K**:** Systematic Experiments In Physical Chemistry, Rajbog S**.**W**.**, Aniali Pubn**.**
20. Wlehov G**.** J**:** Standard Methods Of Chemicalanalysis 6th Ed

SEMESTER II

Paper 5

MCH2T05: Organic Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Implement rules of aromaticity to organic molecules*
2. *Sketch organic molecules in different projection formula and assign its configuration.*
3. *Apply their understanding about the organic reactions of industrial significance with respect to the chemo- selectivity, regioselectivity and enantioselectivity.*
4. *Analyze the product distribution and the stereochemistry of various organic products.*
5. *Evaluate the relationship between structure and reactivity*

Unit I:

A) Nature and Bonding in Organic Molecule: Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of π-molecules orbitals, annulenes, antiaromaticity, homoaromoaticity, Aromatic character and chemistry of cyclopentadienyl anion, tropylium cation, tropone and tropolone, Frost Circles (The Polygon Method) for drawing energy levels in cyclic pi systems**.**

B) Carbenes: Types of carbenes, Structure and reactivity of carbenes, Generation and reactions, insertion, addition, rearrangement reactions of carbenes, nucleophilic attack on carbenes, Simmons-Smith reaction, Reimer-Tiemann reaction, Carbylamine reaction, Shapiro reaction, Bamford-Stevens reaction and Wolff rearrangement

C) Nitrene: Generation, structure and reactions.

Unit II:

Stereochemistry: Elements of symmetry, Concept of chirality and molecular dissymmetry, molecules with more than one chiral center, meso compounds, threo and erythro isomers, method of resolution, optical purity, topicity of ligands, enantiotopic and distereotopic ligands and faces, prochirality, Cahn-Ingold-Prelog System to describe configuration at chiral centers**.** Inter conversion of Newman, Sawhorse and Fischer projection.

Conformational analysis of cycloalkanes (5-8 membered rings), substituted cyclohexanes, mono substituted, disubstituted and trisubstituted cyclohexanes, decalin system, effect of conformation on reactivity, Conformational analysis of *n*-butane and its derivatives, 1,2-diols, 1,2-dihaloethane and related compounds

Asymmetric synthesis, optical activity in absence of chiral carbon (biphenyl, spiranes and allenes), Chirality due to helical shape. Chirality of heteroatoms, stereospecific and stereoselective synthesis**.**

Unit III:

A) Reaction mechanism: Types of reaction, Types of mechanism, kinetic and thermodynamic control, Hammond**'**s postulate, Curtin-Hammett principle, Potential energy diagrams, transition states and

intermediates, methods of determining mechanisms, trapping of intermediates, checking for common intermediate, competition and cross-over experiments, isotope effects, Hard and soft acids and bases**.**

B) Reaction Kinetics: Reaction co-ordinate diagrams, rate laws and methods of determining concentration.

C) Effect of Structure on reactivity: Resonance and field effects, Steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants, Taft Equation.

D) Aromatic electrophilic substitution: The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The *o*/*p* ratio, ipso attack, orientation in benzene ring with more than one substituent, orientation in another ring system. Friedel-Crafts reaction, Vilsmeir-Hack reaction, Gatterman-Koch reaction, Pechman reaction, Diazonium coupling, Blanc chloromethylation, Kolbe–Schmitt reaction

Unit IV:

A) Aliphatic nucleophilic substitution: The S_N1, S_N2, mixed S_N1, S_N2 and SET and S_Ni mechanisms**.** Nucleophilicty, effect of leaving group, ambient nucleophiles and ambient substrates regiospecificity, substitution at allylic and vinylic carbon atoms, Mitsunobu reaction

B) Concept of neighbouring group participation: Anchimeric assistance with mechanism, neighboring group participation by π and σ bonds, classical and non-classical carbocations, Intramolecular displacement by hydrogen, oxygen, nitrogen, sulphur and halogen**.** Alkyl, cycloalkyl, aryl participation, participation in bicyclic system, migratory aptitude.

C**) Aromatic Nucleophilic Substitution:** A general introduction to different mechanisms of aromatic nucleophilic substitution SNAr, S_N1, benzyne and SRN1 mechanisms, arynes as reaction intermediate, Reactivity - effect of substrate structure leaving group and attacking nucleophile. The Von Richter and Smiles rearrangements, Chichibabin amination reaction. Benzyne: Structure, methods of generations and reactions

Combined References of Organic Chemistry for Semester I and II:

1. Advanced Organic Chemistry –Reaction mechanism and structure, Jerry March, John Wiley
2. Advanced Organic Chemistry -F.A .Carey and R .J .Sunberg, Plenum
3. A Guidebook to Mechanism in Organic Chemistry-Peter Skyes, Longman
4. Structure and Mechanism in Organic Chemistry-C.K .Gold, Cornell University Press
5. Organic Chemistry, R.T .Morrison Boyd .Prentice Hall
6. Modern Organic Chemistry-H.O .House, Benjamin
7. Principal of Organic Chemistry-R.O.C .Norman and J. M. Coxon, Blackie Academic and Professional
8. Reaction Mechanism in Organic Chemistry-S.M .Mukharji and S.P .Singh, Macmilan
9. Stereochemistry of Organic Compounds -D .Nasipuri, New Age International
10. Stereochemistry of Organic Compounds -P .S .Kalsi, New Age International
11. Frontier Orbitals and Organic Chemical Reactions-I .Fleming

12. Orbital Symmetry –R .E .Lehr and A .P .Marchand
13. Reactive Intermediate in Organic Chemistry-N .S .Isaacs
14. Stereochemistry of Carbon Compounds -E .L .Eliel
15. Physical Organic Chemistry-J .Hine
16. Name Reaction in Organic chemistry –Surrey
17. Advanced Organic Chemistry –L .F .Fieser and M .Fieser .
18. Organic Chemistry Vol .I and II -I .L .Finar
19. Modern Organic Chemistry -J.D .Roberts and M .C .Caserio
20. The Search for Organic Reaction Pathways)Longmann(, Peter Skyes
21. Organic Chemistry 5th Edition)McGraw Hill(, S .H .Pine
22. Organic Chemistry)Willard Grant Press Botcon(, John Mcmurry
23. A Textbook of Organic Chemistry -R .K .Bansal New Age International
24. Organic Chemistry, J .Clayden, N .Greeves, S .Warren and P .Wothers, Oxford University Press
25. Organic Chemistry, 4th Edition, G Marc Loudon, Oxford University Press

Weblink to Equivalent MOOC on NPTEL/SWAYAM if relevant:

- Introductory Organic Chemistry I- https://nptel.ac.in/courses/104106119
- Mechanisms in Organic Chemistry- https://onlinecourses.nptel.ac.in/noc22_cy42
- Mechanisms in Organic Chemistry: https://onlinecourses.nptel.ac.in/noc20_cy26/preview
- Stereochemistry- https://nptel.ac.in/courses/104105086
- Stereochemistry and Applications- https://nptel.ac.in/courses/104106127
- Structure, Stereochemistry and Reactivity of Organic Compounds and Intermediates: A Problem-solving Approach- https://nptel.ac.in/courses/104105127

SEMESTER II

Paper 6

MCH2T06: Analytical Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to-

1. *Select a specific analytical technique based on sample and target analyte*
2. *Develop analytical ability and critical thinking in selection of statistics and their use in making interpretation meaningful and productive.*
3. *Explain the logic behind working of indicator used in each type of titration*
4. *Elaborate interaction of radiation with matter and its application in chemical analysis.*
5. *Develop spectral methods of analysis for desired analytes.*
6. *Apply electroanalytical techniques based on conductance and emf measurements.*

Unit I:

Introduction to analytical chemistry: Types of analysis-qualitative and quantitative. Classification of analytical methods- classical and instrumental, basis of their classification with examples. Classification of analysis based on sample size (macro, semimicro, micro and ultramicro) and constituent type (major, minor, trace and ultratrace).

Volumetric Calculations: Stoichiometric and substoichiometric volumetric analysis. Concentration units: Unified atomic mass unit and the mole, Molarity, Normality, Weight and volume percent, Mole fraction, Formality, etc and their interrelation. Standard solutions. Primary standards and secondary standards. Numerical problems based on standard solution preparation, titrimetric analysis and gravimetric analysis. Calculations involved in acid-base, precipitation, redox and complexometric reactions.

Unit II: Classical methods of analysis

Volumetric analysis**:** General principle**.** Criteria for reactions used in titrationsTheory of indicators. Types of titrations with examples- Acid-base, precipitation, redox and complexometric. Titration curves for monoprotic and polyprotic acids and bases. Indicators used in various types of titrations. Masking and demasking agents.

Gravimetric analysis**:** General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Steps involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, aging and peptization phenomena. Ignition of precipitates.

Unit III: Optical methods of analysis-I

Spectrophotometry and Colorimetry: Principle of colorimetry. Beer's law, its verification and deviations. Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity

and analytical significance of molar extinction coefficient and λ_{max}. Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions. Ringbom plot and Sandell's sensitivity. Photometric titrations. Determination of pK value of indicator. Simultaneous determination. Composition and stability constant of complex by Job's and mole ratio methods. Derivative spectrophotometry. Numerical problems.

Flame photometry: Principle. Instrumentation and types of burners. Factors affecting flame photometric determination. Limitations of flame photometry. Interferences in flame photometry. Applications.

Unit IV: Electrochemical methods of analysis-I

Conductometry: Concepts of electrical resistance, conductance, resistivity and conductivity. Specific, molar and equivalent conductance and effect of dilution on them. Measurement of conductance. Kohlrausch's law, Applications of conductometry in determination of dissociation constant, solubility product. Conductometric titrations. High frequency titrations. Numerical problems.

Potentiometry: Circuit diagram of simple potentiometer. Indicator electrodes: hydrogen electrode, quinhydrone electrode, antimony electrode and glass electrode. Reference electrodes: Calomel electrode and Ag/AgCl electrode. Theory of potentiometric titrations. Nernst equation, standard electrode potential, Determination of cell potential, n, K_f and K_{sp}. pH titrations. Buffers and buffer capacity. pH of buffer mixtures based on Henderson-Hasselbalch equation and calculations.

References

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Instrumental Methods of Analysis**:** Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Sample Pre-treatment and Separation: R. Anderson (John Wiley and Sons)
6. Stoichiometry: B.I.Bhatt and S.M. Vora, 2nd Edition (Tata Mc-Graw Hill publication)
7. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
10. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
11. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
12. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
13. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
14. Fundamental of Analytical Chemistry: S. A. Skoog and D. W. West
15. Instrumental Methods of Chemical Analysis: G. W. Ewing
16. Polarography: Koltoff and Ligane
17. Electroanalytical Chemistry: Sane and Joshi (Quest Publications)

Web link for related NPTEL courses

Analytical Chemistry: https://nptel.ac.in/courses/104105084

SEMESTER II

Paper 7 (Elective)

MCH2T07: (a) Solid state and organometallic chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student would be able to

1. *Understand the structures of various types of solids.*
2. *Establish structure-property correlation in solids.*
3. *unravel and interpret the structural aspects of metal clusters.*
4. *Explain structures and applications of organotransition compounds,*
5. *predict the mechanism of complex reactions.*
6. *establish the thermodynamic and kinetic stability of reactants and products in complex reactions.*

Unit I

Solid State Chemistry: Ionic Crystals and their structures, radius ratio rule, effect of polarization on crystals. Covalent structure type: Sphalerite and Wurtzite. Geometry of simple crystal AB type: NaCl, CsCl and NiAs. AB_2 type: Fluorite, antifluorites, Rutile structures. Li_2O, Na_2O, $CdCl_2$, CdI_2 structures. Ternary Compounds ABO_3 type: Perovskite, Barium titanate, lead titanate, $CaTiO_3$, Tolerance factor, charge neutrality and deviation structures $FeTiO_3$.

Solids of AB_2O_4 type: Normal and inverse,2-3 and 4-2 spinel, packing of oxygen in tetrahedral and octahedral sites, sites occupancy number of sites surrounding each oxygen, application of charge neutrality principles, site preferences in spinel, distorted spinel. Hausmannite (Jahn-Teller distortions), Factors causing distortion in spinel.

Unit – II

(A) Metal – Ligand Bonding in Transition Metal Complexes: Recapulization of Crystal Field Theory, Application of CFT to Tetragonal, square-planer, Trigonal bipyramidal complexes, Jahn-Teller effect, Nephelauxetic effect, Limitations of crystal field theory.

(B) Magnetic Properties of Transition Metal complexes: Abnormal magnetic properties, orbital contributions and quenching of orbital angular momentum, spin-orbit coupling. Magnetic moment, electronic spectra and structure of tetrahalocobalt (II) complexes, tetrahedral and octahedral Ni(II) complexes. High spin-low spins crossover.

Unit III

Reaction mechanism of Transition Metal Complexes-II: Substitution reaction in square planar complexes: the trans effect, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect of temperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes. Electron transfer reactions. Types of electron transfer reactions, conditions of electron transfer, and mechanism of one-electron transfer reactions, outer sphere and inner sphere mechanisms, two electron transfer reactions complimentary and non-

complimentary reactions. Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated mechanism.

Unit-IV

Organotransition Metal Chemistry: Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability and decomposition pathways of alkyls and aryls of transition metals. Organocopper in Organic synthesis. Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes and carbynes–synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on ligands, role inorganic synthesis.

References

1. J.E.Huheey: Inorganic Chemistry
2. F.A.Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th and 6th Editions.
3. A.F. Willims: Theoretical Approach in inorganic chemistry.
4. Mannas Chanda: Atomic Structure and chemical Bonding
5. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
6. J. J. Logowski: Modern Inorganic Chemistry
7. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
8. J C. Bailar: Chemistry of coordination compounds.
9. W. L. Jolly: Modern Inorganic ChemistryJones: Elementry Coordination chemistry.
10. B. N. Figgis: Introduction to Ligand field.
11. M.C.Day and J.Selbin: Therotical Inorganic Chemistry.
12. J. Lewin and Wilkins: Modern Co-ordination chemistry.
13. Purcell and Kotz: Inorganic Chemistry.
14. D. Banerjea: Co-ordination chemistry, Tata Mc. Graw. Pub.
15. A.F. Wells: Structural inorganic chemistry, 5th Edition, Oxford.
16. S. G. Davies: Organotransition metal chemistry applications to organic synthesis.
17. R. C. Mehrotra: Organometallic chemistry Tata McGraw Hill. Pub.
18. G. S. Manku: Thereotical priciples of inorganic chemistry
19. A. B. P. Lever: Inorganic electronic spectroscopy.
20. R.H.Crabtree:The Organometalic chemistry of Transition metals, John Wiley.
21. D.N.Styanaryan:Electronic Absorption Spectroscopy and related techniques, University Press.
22. R. S. Drago: Physical methods in inorganic chemistry
23. F.Basolo andG.Pearson: Inorganic Reaction Mechanism
24. Organometallics II and I complexes with transition metal- carbon bonds: Manfred Bochmann-
25. Oxford Press.
26. Advanced Inorganic Chemistry Vol I and II – Satyaprakash, Tuli, Bassu and Madan- S Chand.
27. A.E.Martel; Coordination Chemistry-VolIandII,VNR.

SEMESTER II

Paper 7 (Elective)

MCH2T07: (b) Organic Reaction Mechanism

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Predict the orientation and stereochemistry of the product of addition and elimination reaction*
2. *Apply enolate chemistry to achieve molecular complexity*
3. *Design organic reactions in order to achieve the required product(s)*
4. *Formulate green chemistry synthesis to increase atom economy*
5. *Application of free radicals in functional group transformation*

Unit-I

A) Addition to carbon-carbon multiple bond: Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, Orientation and stereochemistry of common reactions, Addition to cyclopropanes, Hydrogenation of double bond and triple bonds. Hydrogenation of aromatic rings, hydroboration-oxidation, epoxidation, Michael addition

B) Elimination reactions: The E1, E2 and E1CB mechanisms, Stereochemistry of E2 elimination, Orientation of the double bond, Saytzeff and Hoffman's rule, Effect of substrate structure, attacking base, leaving group and medium, Mechanism and orientation in pyrolytic elimination involving selenium oxide, Cope and Chugaev elimination

Unit II:

Addition to carbon-hetero atom multiple bond: Ionization of carbon hydrogen bond and prototopy, Base and acid catalysed halogenation of ketones, keto-enol equilibria, structure and rate in enolisation, concerted and carbanion mechanism for tautomerism, geometry of carbanions, kinetic and thermodynamic control in the generation of enolates, Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters, and nitriles, Wittig reaction, Mechanisms and synthetic applications of condensation reactions involving enolates- Aldol, Knoevengel, Claisen, Mannich, Benzoin, Perkin, Stobbe reaction, Robinson annulation, Hydrolysis of esters and amide, Baylis-Hillman reactions, Ugi and Passerini reaction.

Unit III:

Free radical reactions: Generation of free radicals, Type of free radical reactions, free radical substitution, mechanism at an aromatic and aliphatic substrate, reactivity at a bridgehead position. The reactivity and selectivity principle of halogenation at an alkyl carbon, allylic carbon (NBS), hydroxylation at an aromatic carbon by means of Fenton's reagent. Auto-oxidation, chlorosulphonation (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, Hunsdiecker reaction, Barton reaction, Hoffmann-Loefler-Freytag reaction, McMurry coupling, Samarium(II) iodide reagents for functional group transformations and C-C bond formation.

Applications of tributytin hydride: Reduction of halides, alcohols and acids, addition to carbon-carbon double bond, cyclization of free radical intermediates, tandem radical cyclization reactions, fragmentation reactions

Unit IV

Molecular rearrangements: Definition and classification. Mechanism, stereochemistry and synthetic applications of Pinacol-Pinacolone, Wagner- Meerwein, Tiffenev–Demjnov ring expansion, Arndt-Eistert synthesis, Dienone-phenol rearrangement, rearrangement due to electron deficient nitrogen: Hofmann, Lossen, Curtius, Schmidt and Beckmann rearrangements, Baeyer-Villiger oxidation, Dakin oxidation, [1,2]-Wittig rearrangement, Base catalysed rearrangements: Benzilic acid, Favourski, Neber, Sommlett-Hauser and Smiles rearrangement, Stevens rearrangement

Fragmentation reactions: Electron push and pull requirement, Beckmann fragmentation, Eschenmoser fragmentation, Alicyclic-Grobb rearrangement

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Weblink to Equivalent MOOC on SWAYAM if relevant:

- Essentials of Oxidation, Reduction and C-C Bond Formation. Application in Organic Synthesis- https://nptel.ac.in/courses/104101127
- Principles of Organic Synthesis- https://nptel.ac.in/courses/104103110
- Introductory Organic Chemistry II- https://onlinecourses.nptel.ac.in/noc21_cy46/preview

SEMESTER II

Paper 7 (Elective)

MCH2T07: (c) Quantum, Statistical and Nuclear Chemistry

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Understand, the concept of statistical thermodynamics and their uses.*
2. *Understand the quantum mechanical applications in actual practice and in spectroscopy*
3. *Understand the thermodynamics of real processes*
4. *Understand the distribution laws and their applications*
5. *Understand the fundamentals of Nuclear sciences*

UNIT I: QUANTUM MECHANICS - II

Approximate methods, variation principle, its application in Linear and non-linear functions, MO theory applied to H_2^+ molecule and H_2 molecule (calculation of energy), Introduction to perturbation theory (First order correction to wave function and energy), Application to He atom.

Electronic structure of atoms: Russel Sanders terms and coupling schemes, term separation energies of the p^n configuration, term separation energies for d^n configuration, magnetic effects: spin orbit coupling and Zeeman splitting.

Hybridization, hybrid orbitals in terms of wave functions of s and p orbitals, sp and sp^2 hybridizations, Simple Hückel theory applied to: ethylene, butadiene and cyclobutadiene.

UNIT II :STATISTICAL THERMODYNAMICS

Statistical thermodynamics :Lagrange's Method of Undetermined Multipliers)Conditional Maximization(, Stirling Approximation, Concept of Distribution, Thermodynamic Probability and most probable distribution, Maxwell Boltzmann, Bose Einestein, Fermi Dirac statistics, comparison between three statistics.

Partition function, Translational partition function, Rotational partition function, Vibrational partition function, Electronic partition function, Applications of partition functions, Numerical.

UNIT III :STATISTICAL MECHANICS OF ENSEMBLES AND NON-EQUILIBRIUM THERMODYNAMICS

Atomic and Molecular quantum levels, Significance of Boltzmann Distribution law, partition Functions and ensembles, ensemble averaging, postulates of ensemble averaging, canonical, grand canonical and micro canonical ensembles, corresponding distribution laws using Lagranges method of undetermined multipliers. Ortho and para hydrogen, principle of equipartition of energy, calculation of average energy.

Nonequilibrium Thermodynamics :Conservation of mass and energy in time dependent closed and open systems, Thermodynamic criteria of irreversibility, rate of entropy production and entropy exchange in irreversible processes .The generation of the concept of Chemical Affinity and the extent of

advancement of chemical reactions, Thermodynamic constraints on the signs of chemical affinity and the velocity of chemical reaction, application to any one coupled reaction.

UNIT IV :NUCLEAR CHEMISTRY

Introduction, radioactive decay and equilibrium, thermonuclear reactions, photonuclear reactions, Radiometric titration, isotopic dilution analysis, NAA.

Nuclear models: Fermi gas model, shell model, liquid drop model, application of liquid drop models semiempirical mass equation.

Counters: proportional counter, GM counter, scintillation counter, ionization chamber counter.

References

1) Ira N .Levine, Quantum Chemistry, 5th edition)2000(, Pearson educ., Inc.New Delhi
2) A. K. Chandra, Introductory Quantum Chemistry, 4th edition)1994(, Tata Mc-graw Hill, New Delhi.
3) M.W. Hanna, "Quantum Mechanics in Chemistry", Benjamin
4) L .Pualing and E .B .Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York)1935.(
5) R .K .Prasad, Quantum Chemistry, New Age International, Delhi .
6) R .K .Prasad, Quantum Chemistry through problems and solutions, New Age International, New Delhi, 2009.
7) B .C .Reed, Quantum Mechanics, Jones and Bartlett, New Delhi, 2010.
8) R .P .Rastogi and R .R .Mishra, An Introduction to Chemical Thermodynamics, Vikas Publication, Gorakhpur, 2010.
9) P .W .Atkins'and D .Paula, Physical Chemistry, 8th Edition, Oxford University Press, 2010.
10) G .K .Vemulapalli, Physical Chemistry, Prentice –Hall of India, 1997.
11) S .Glasstone, An Introduction to Electrochemistry, East-West Press Pvt .Ltd., New Delhi, 2004.
12) H .K .Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
13) S .O .Pillai, Solid State Physics, New Age International, New Delhi, 2102.
14) N .B .Hanny, Treaties in Solid State Chemistry,
15) M .C .Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub .Corp., New York,
16) I Prigogine and R .Defay, Chemical Thermodynamics, Longmans, London, 1954.
17) S .R .DeGroot and P .Mazoor, Non-Equilibrium Thermodynamics, North-Holland Co., Amsterdam, 1969.
18) G .Lebon, D .Jou and Casa Vazquez, Understanding Non-equilibrium Thermodynamics, Springer, 2008.
19) I.Prigoggine, "An Introduction to Thermodynamics of Irreversible Processes, "Wiley-Interscience.
20) R .P .Rastogi, Introduction to Non-equilibrium Physical Chemistry, Elsevier, Amsterdam, 2008.
21) G .A .Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.

22) M .C .Gupta, Statistical Thermodynamics, New Age International.
23) K .Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
24) Andrew Maczek, Statistical Thermodynamics, Oxford University Press Inc., New York)1998.(
25) C.N. Rao .Nuclear Chemistry
26) B .G .Harvey, Introduction to Nuclear Physics and Chemistry, Prentice Hall, Inc) .1969.(
27) H.J .Arnikar, Essentials of Nuclear Chemistry, 4th Edition)1995(, Wiely-Eastern Ltd., New Delhi.
28) L .E .Smart and E .A .Moore, Solid State Chemistry-An Introduction, CRC Tylor and Fransis, 2005.
29) D .D .Sood, A .V .R .Reddy, Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, 2007.
30) C .N .R .Rao and Gopalakrishnan, "New Directions in Solid State Chemistry" Second Edition, Cambridge University Press.
31) Anthony R .West, "Solid State Chemistry and its Applications "Wiley India Edition.
32) C .Kalidas and M .V .Sangaranarayana, Non-Equilibrium Thermodynamics.

NPTEL sources weblinks:

- Quantum Chemistry: https://archive.nptel.ac.in/courses/104/105/104105128/
- https://www.youtube.com/watch?v=InNx7cYE9DI
- https://onlinecourses.nptel.ac.in/noc22_cy02/preview
- For statistical Thermodynamics: https://onlinecourses.nptel.ac.in/noc23_me69/preview
- https://nptel.ac.in/courses/104103112
- For Nuclear Chemistry: https://onlinecourses.nptel.ac.in/noc23_cy21/preview
- https://www.youtube.com/watch?v=iMhDYarsfII
- https://archive.nptel.ac.in/courses/112/103/112103243/

SEMESTER II

Paper 7 (Elective)

MCH2T07: (d) Instrumental Methods of Analysis

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to -

1. *Understand the importance of sampling and sample treatment.*
2. *Select appropriate sampling technique based on sample and target analyte.*
3. *Explain principle and instrumentation involved in AAS.*
4. *Deduce the necessity to remove interferences in AAS and methods involved .*
5. *Select proper technique among the available techniques.*
6. *Formulate experiments based on optical and electroanalytical techniques.*

Unit-I:

Sampling and sample treatment: Criteria for representative sample. Techniques of sampling of gases (ambient air and exhaust gases), liquids (water and milk samples), solids (soil and coal samples) and particulates. Hazards in sampling. Safety aspects in handling hazardous chemicals. Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples.

Detection and quantification: Concepts and difference between sensitivity, limit of detection and limit of quantification, role of noise in determination of detection limit of analytical techniques. Methods of quantification: Absolute method, comparison method, calibration curve method, standard addition method and internal standard method.

Unit-II: ***Atomic absorption spectroscopy***

Principle**.** Atomic energy levels**.** Grotrian diagrams**.** Population of energy levels**.** Instrumentation**.** Sources**:** Hollow cathode lamp and electrodeless discharge lamp, factors affecting spectral width**.** Atomizers**:** Flame atomizers, graphite rod and graphite furnace**.** Cold vapour and hydride generation techniques**.** Factors affecting atomization efficiency, flame profile**.** Monochromators and detectors**.** Beam modulation**.** Detection limit and sensitivity**.** Interferences and their removal**.** Comparison of AAS and flame emission spectrometry**.** Applications of AAS**.**

Unit-III: Polarography and amperometry

Polarography: Principle of DC polarography. Instrumentation in polarography. Advantages and limitations of DME. Types of currents- residual current, migration current, diffusion current, limiting current, adsorption current, kinetic current and catalytic current. Ilkovic equation-diffusion current constant and capillary characteristics. Derivation of equation of polarographic wave and half wave potential. Experimental determination of half wave potential. Reversible, quasi reversible and irreversible electrode reactions. Polarographic maxima and maximum suppressor. Oxygen interference and deaeration. Introduction to pulse, a.c. and oscillographic techniques and their advantages. Applications of polarography in determination of dissolved oxygen, metal ion quantification and

speciation, simultaneous determination of metal ions, analysis of organic compounds. Limitations of polarography.

Amperometric titrations: Principle, types and applications in analytical chemistry.

Unit-IV: Miscellaneous techniques

Fluorometry and phosphorimetry: Principles of fluorescence and phosphorescence. Jablonski diagram. Concentration dependence of fluorescence intensity. Fluorescence quenching. Instrumentation. Applications.

Nephelometry and turbidimetry: Principle, instrumentation and applications.

Photoacoustic spectroscopy: Theory. Instrumentation. Advantages over absorption spectroscopy. Chemical and surface applications of PAS.

References

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Instrumental Methods of Analysis**:** Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Sample Pre-treatment and Separation: R. Anderson (John Wiley and Sons)
6. Stoichiometry: B.I.Bhatt and S.M. Vora, 2nd Edition (Tata Mc-Graw Hill publication)
7. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
10. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
11. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
12. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
13. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
14. Fundamental of Analytical Chemistry: S. A. Skoog and D. W. West
15. Instrumental Methods of Chemical Analysis: G. W. Ewing
16. Polarography: Koltoff and Ligane
17. Electroanalytical Chemistry: Sane and Joshi (Quest Publications)

Web link for related NPTEL courses

- Analytical Chemistry: https://nptel.ac.in/courses/104105084

SEMESTER II

Practical 3

MCH2P03: On Job Training/Field Project

120 h (8 h per week) *100 Marks*

On job training or a Field Project is a skill based practical program. It has to be carried out in accordance

Annexure III of General Guidelines for M.Sc. program.

1. Every student admitted to M.Sc. Second Semester is compulsorily required to undergo this course bearing 4 credits.
2. During second semester, all students will have to undergo OJT/Internship/FP of 120 Hours.
3. Each student will be required to submit a detailed report to the Department/ College/ Institute for the work undertaken during this period **within 7 days of completion of the training** following which the evaluation and assessment for OJT/Internship/FP will be done by the college/institute concerned. The Report submitted must be according to the Learning outcomes and in tune with the rubric for evaluation.
4. College/Institute is required to assign Supervisor/Mentor to students for OJT/Internship/FP who will guide the students in attaining the outcomes of this course.
5. The Internal Examiner and External Examiner shall jointly evaluate the report submitted by the student and her/his seminar and shall immediately submit the evaluation report in the prescribed format provided along with.

SEMESTER II

Practical 4

MCH2P04: Organic Chemistry

6 h per week *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Handling of the hazardous chemicals by safely*
2. *Predict and analysis of the major and minor products of a variety of organic reactions*
3. *Monitoring of the chemical reactions*
4. *Calculation of yield, percentage yield of the chemical reactions*
5. *Understand the concept of Qualitative analysis*

a. **Organic preparations:** Student is expected to carry out minimum of 7-10 single stage preparation and 3-4 two stage organic preparation from the following lists (**Total 10 preparations**). During preparation of organic compounds, the techniques such as crystallization, distillation, solvent extraction, TLC and column chromatography should be demonstrated.

2. Oxidation :Adipic acid by chromic acid oxidation of cyclohexanol.
3. Benzophenone → benzhydrol
4. Aldol condensation :Dibenzal acetone from benzaldehyde .
5. Sandmeyer reaction :p -chlorotoluene from p-toluidine
6. Cannizzaro reaction
7. Friedel Crafts Reaction :β-Benzoyl propionic acid from succinic anhydride and benzene.
8. Benzoin → 2,4,5-triphenyl imidizole
9. Sucrose → Oxalic acid
10. Methyl acetoacetate → 5-methyl-isoxazol-3-ol
11. Ethyl acetoacetate → 4-aryl-6-methyl-3,4-dihydro-2)1*H*-(pyrimidinone ester
12. Ethyl acetoacetate → Diethyl 1,4-dihydro-2,6-dimethyl-4-phenylpyridine-3,5-dicarboxylate
13. Dye preparation :Sulphanilic acid → Methyl orange
14. Dye preparation :p-nitroaniline → *p*-red
15. Acetanilide → *p*-nitroacetanilide →*p*-nitroaniline
16. Aniline → 2,4,6-tribromo aniline → 2,4,6-tribromoacetanilide
17. Nitrobenzene →m-dinitrobenzene →*m*-nitroaniline
18. toluene → *p*-nitrotoluene →*p*-nitrobenzoic acid
19. Glycine → Benzoyl glycine → 4-benzilidene-2-phenyl oxazole
20. Benzaldehyde → chalcone → chalcone dibromide
21. *Any other suitable preparation of organic molecules depending on availability of chemicals*

B) Qualitative Analysis : Separation, purification and identification of the mixture of two organic compounds)binary mixture with two solid, one solid one liquid and two liquids (using chemical methods or physical techniques. **Minimum 6-10 mixtures to be analyzed**.

References

1) Practical organic chemistry by FG Mann and BC Saunders
2) Text book of practical organic chemistry –by Vogel
3) The synthesis, identification of organic compounds –Ralph L. Shriner, Christine K.F. Hermann, Terence C. Morrill and David Y. Curtin
4) Compendious Practical Organic Chemistry : Preparations, Isolation, and Chromatography by Basavarajaiah S M, Nagesh G Y, Ramakrishna Reddy K
5) Advanced Practical organic chemistry by N.K.Vishnoi

SEMESTER II

Practical 5

MCH2P05: Analytical Chemistry

6 h per week *100 Marks*

Course Outcomes: *At the end of the course, student will be able to*

1. *Carry out calibration of glassware available in the laboratory.*
2. *Analyze the data obtained through experiments using statistical analysis parameters.*
3. *Estimate quantitatively analyte present in different samples using classical and instrumental methods of analysis.*
4. *Design experiments based on classical and instrumental techniques.*
5. *Understand the principles involved in visual and instrumental volumetric techniques.*
6. *Formulate experiments based on optical and electroanalytical techniques.*

Section (A): Classical methods and separation techniques:

Calibration, validation and computers

1. Calibration of pipette and burette.
2. Statistical analysis of data.
3. Use of MS-Excel in statistical analysis of data and curve fitting.

Volumetry

1. Determination of Na_2CO_3 in washing soda.
2. Determination of NaOH and Na_2CO_3 in a mixture.
3. Estimation of nickel in given solution by direct complexometric titration with EDTA using bromopyrogallol red.
4. Estimation of nickel in given solution by complexometric back-titration with EDTA.
5. Estimation of chloride in given solution by Mohr's titration.
6. Estimation of chloride in given solution by Volhard's titration.
7. Determination of volume strength of commercial hydrogen peroxide by redox titration with $KMnO_4$.
8. Estimation of phenol/ aniline by bromination method.
9. Estimation of glucose.
10. Estimation of acetone.
11. Estimation of formaldehyde.
12. Estimation of Mn in the presence of Fe using masking phenomenon (ferromanganese alloy).

Gravimetry

1. Estimation of barium as barium sulphate.
2. Estimation of calcium as calcium oxalate/ calcium carbonate/ calcium oxide.

Separation techniques

1. Qualitative separation of metal ions by paper chromatography for 2/3 components.
2. Determination of ion-exchange capacity of resin.
3. Separation of ions by ion exchange.

Section (B): Instrumental techniques: Electroanalytical techniques

1. Analysis of commercial vinegar by conductometric titration.
2. Estimation of phenol by conductometric titration with NaOH.
3. Determination of strength of HCl and CH_3COOH in a mixture conductometrically.
4. Determination of strength of HCl and oxalic acid in a mixture conductometrically.
5. Determination of strength of oxalic acid and CH_3COOH in a mixture conductometrically.
6. Determination of degree of dissociation and dissociation constant of acetic acid conductometrically.
7. Estimation of phenol in dilute solution by conductometric titration with NaOH.
8. Determination of strength of HCl and CH_3COOH individually and in a mixture potentiometrically.
9. Determination of Fe(II) by potentiometric titration with $K_2Cr_2O_7$.
10. Determination of three dissociation constants of H_3PO_4 by pH-metric/ potentiometric titration.

Optical methods

1. Determination of pK of indicator by colorimetry.
2. To estimate the amount of NH_4Cl colorimetrically using Nesseler's Reagent.
3. To study the complex formation between Fe(III) and salicylic acid and find the formula and stability constant of the complex colorimetrically (Job's method).
4. To determine the dissociation constant of phenolphthalein colorimetrically.
5. Estimation of iron in wastewater sample using 1,10-phenanthroline.

References

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Experiments and calculations in Engineering Chemistry- S. S. Dara (S. Chand and Co.)
5. Experiments in Chemistry-D. V. Jahagirdar (Himalaya)

SEMESTER III

Paper 8

MCH3T08**: Spectroscopy-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course, student will be able to*

1. *Understand the symmetry properties of molecules*
2. *Interpret the structure of simple organic molecules using mass spectrometry*
3. *Correlate the presence of functional groups with IR frequencies*
4. *Apply the IR and Raman spectroscopy to simple molecules*

Unit - I: Symmetry properties of molecules and group theory:

Symmetry elements and symmetry operations. Properties of group. Point groups and Schoenflies symbols. Symmetry operations as a group. Matrix representations of groups. Multiplication table for C_{2v}, C_{3v} and C_{2h}. Reducible and irreducible representations. Similarity transformation. Classes of symmetry operations. Great Orthogonality Theorem. Derivation of character tables for H_2O and NH_3 using Great Orthogonality Theorem. Application of character tables in selection rules of IR, Raman and Electronic spectroscopy.

Unit - II:

A] **Mass spectrometry:** Theory, ion production(EI, CI, FD, FAB), ion analysis, ion abundance, isotopic contribution, Nitrogen-rule, types of fission processes, high resolution mass spectrometry, metastable peak, molecular ion peak, McLafferty rearrangement, mass spectral fragmentation of organic compounds alkanes, alkenes, alkynes, alcohols, amines, amides, acids, aldehydes, ketones, halides, Structure determination of organic molecules by mass spectrometry, problem based on mass spectral data

B] **Mössbauer spectroscopy**: Basic principle, experimental techniques, recoil emission and absorption, source, absorber, isomer shift, quadrupole interaction, magnetic hyperfine interaction, applications in determining electronic structure, molecular structure, crystal symmetry, magnetic structure, surface studies, biological applications.

Unit - III:

A] **Microwave spectroscopy**: Classification of molecules on the basis of M.I., rigid and non-rigid rotor, effect of isotopic substitution on transition frequencies, stark effect, microwave spectrometer, application in deriving: molecular structure, dipole moment, atomic mass and nuclear quadrupole moment.

B] **ESR spectroscopy**: Introduction, principle of ESR, ESR spectrometer, hyperfine coupling, zero field splitting, factors affecting g values, Kramer's degeneracy, application of ESR spectra to study free radicals like hydrogen, methyl radical, 1,4-semibenzoquinone, naphthalene, transition metal complexes, biological systems.

Unit IV:

A] Infrared spectroscopy: Diatomic molecules: Molecules as harmonic oscillator, Morse potential energy function, vibrational spectrum, fundamental vibrational frequencies. Force constant, zero point energy, isotope effect. The Anharmonic oscillator, the interactions of rotations and vibrations. P,Q,R branches, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone and combination frequencies. Structure determination of organic molecules by IR spectroscopy, problem based on IR spectral data

B] Raman Spectroscopy: Rayleigh scattering. Raman Scattering, classical and quantum theories of Raman effect. Rotational Raman Spectra for linear and symmetric top molecules. Vibrational Raman Spectra, rotational fine structure. Selection rules, coherent anti-Stokes Raman spectroscopy, Structure determination from Raman and Infra-red spectroscopy.

References

1. Spectroscopic identification of organic compound-RM Silverstein, GC Bassler and TC Morril, John Wiley
2. Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiley
3. Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
4. Organic Spectroscopy-William Kemp, ELBS with McMillan
5. Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
6. Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
7. Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
8. Fundamentals of Molecular Spectroscopy-CN Banwell
9. Spectroscopy in Inorganic Chemistry-CNR Rao and JR Ferraro
10. Photoelectron Spectroscopy-Baber and Betteridge
11. Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
12. NMR –Basic Principle and Application-H Guntur
13. Interpretation of NMR spectra-Roy H Bible
14. Interpretation of IR spectra-NB Coulthop
15. Electron Spin Resonance Theory and Applications-W Gordy
16. Mass Spectrometry Organic Chemical Applications, JH Banyon

SEMESTER III

Paper 9

MCH3T09**: Advanced Organic Chemistry-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Identify a pericyclic reaction and categorize it as a cycloaddition, a group transfer reaction, a sigmatropic rearrangement, or an electrocyclic reaction,*
2. *Apply frontier molecular orbital (FMO) theory to rationalize selectivity and reactivity aspects of pericyclic reactions.*
3. *Understand the reaction mechanism of various common reagents employed in organic synthesis*
4. *Understand the reactivity of sulphur, silicon and phosphorous elements.*
5. *Apply pericyclic reactions for the synthesis of complex organic molecules*

Unit I: Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene, allyl system, classification of pericyclic reaction. FMO approach, Woodward-Hoffman correlation diagram method and Perturbation of Molecular Orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions Electrocyclic reactions, conrotatary and disrotatary motion for 4n and (4n+2) systems, Cycloaddition reaction with more emphasis on [2+2] and [4+2], Cycloaddition of ketenes, Secondary effects in [4+2] cycloaddition. Stereochemical effects and effect of substituents on rate of cycloaddition reaction, Diels-Alder reaction, 1,3-dipolar cycloaddition and chelotropic reaction. Sigmotropic rearrangement, suprafacial, and antarafacial shift involving carbon moieties, retention and inversion of configuration, [3,3] and [5,5] sigmotropic rearrangements, Claisen, Cope, Sommelet-Hauser rearrangements, Ene reaction

Unit II: Oxidation

Oxidation of alkanes, aromatic hydrocarbons and alkenes, Dehydrogenation with S, Se, Fremy's salt, DDQ, chloranil, Oxidation with SeO_2, Epoxidation of olefins, application of epoxides, Sharpless asymmetric epoxidation, Dihydroxylation of olefins using $KMnO_4$, OsO_4, Woodward and Prevost dihydroxylation, Oxidative cleavage of olefins, Ozonolysis, Etard Reaction

Oxidation of alcohols: Chromium reagents, pyridinium chlorochromate (PCC), pyridinium dichromate (PDC), Collin and Jones reagent, Combination of DMSO with DCC, $(COCl)_2$, NCS, SO_3 and $(CH_3CO)_2O$ for oxidation of alcohols, Oxidation with MnO_2, Oppenauer oxidation, CAN, Tetrapropyl ammonium peruthenate, Fetizon's reagent, Chemistry and synthetic applications of $Pb(OAc)_4$, Dess-Martin periodane, IBX and related hypervalent iodine based oxidations

Conversion of ketones to α, β-unsaturated ketones and α-hydroxy ketones, Baeyer-Villiger oxidation, Dakin oxidation, Tamao-Fleming Oxidation, Oxidations with Dimethyl dioxirane (DMDO) and 2-sulfonyloxaziridines and chiral version

Unit III: Reduction

Catalytic heterogeneous and homogeneous hydrogenation, Hydrogenation of alkenes, alkynes and arenes, Selectivity of reduction, Mechanism and stereochemistry of reduction, Raney Ni-catalyst, Adam catalyst, Lindlar catalyst, Wilkinson catalyst

Reduction by dissolving metals, Reduction of carbonyl compounds, conjugated systems, aromatic compounds and alkynes. Birch reduction, Hydrogenolysis

Reduction by hydride transfer reagents, Meerwein-Pondorff-Verley reduction, Reduction with $LiAlH_4$ and $NaBH_4$, stereochemical aspects of hydride addition, Derivatives of $LiAlH_4$ and $NaBH_4$, Selectivity issues, Diisobutylaluminium hydride (DIBAL-H), Sodium cyanoborohydride, Reduction with boranes and derivatives Reduction of carbonyl group to methylene, Reduction with diimide and trialkylsilanes

Unit IV: Chemistry of P, S, Si, and Boron compounds

1) Phosphours and sulphur ylide: Preparation and their synthetic application along with stereochemistry

2) Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3-dithiane, ethylmethylthiomethylsulphoxide, *bis*-phenylthiomethane, metallated enol ethers, alkylidene dithiane, ketone thioacetals, 2-propenethiobismethyl thioallyl anion, thiaminehydrochloride based generation of acyl anion

3) Organoboranes- preparation and properties of organoborane reagents e.g. RBH_2, R_2BH, R_3B, 9-BBN, catechol borane. Thexylborane, cyclohexylborane, $ICPBH_2$, IPC_2BH, Hydrboration mechanism, stereo and regioselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, alkenes, Synthesis of *EE, EZ, ZZ* dienes and alkyenes. Mechanism of addition of IPC_2BH. Allylboranes-synthesis, mechanism and uses

4) Organosilicon compounds in organic synthesis, Me_3SiCl, Me_3SiH and Peterson reaction, Synthesis and reactions of alkenyl, alkynyl and aryl silanes

References

1. Organic Chemistry, J .Clayden, N .Greeves, S .Warren and P .Wothers, Oxford University Press
2. Some Modern Methods of Organic Synthesis-W .Carruthers
3. Principles of Organic Synthesis by R. O. C. Norman and James M. Coxon (Nelson Thornes Ltd)
4. Advance Organic Chemistry Part-B-F .A .Caray and R .J .Sundberg Plenum Press
5. Modern Organic Synthesis: An Introduction by G. S. Zweifel and M. H. Nantz (Wiley)
6. Organic Synthesis by Michael Smith , 4th Edition (Academic Press)
7. Pericyclic Reactions by I. Fleming, Oxford University Press, 1999
8. S. Sankararaman, Pericyclic Reactions – A textbook. Wiley-VCH, 2005.
9. Organic synthesis: The roles of boron and silicon by S. E. Thomas (Oxford Chemistry Primers)
10. The Chemistry of Organophosphorous-A .J .Kirbi and S.G .Warren
11. Organosilicon Compound-C .Eabon
12. Organic Synthesis via Bora- H. C. Brown
13. Organoborane Chemistry-T .P .Onak
14. Organic Chemistry of Boron-W Gerrard

Weblink to Equivalent MOOC on SWAYAM if relevant:

- Organic Photochemistry and Pericyclic Reactions: Dr. N.D. Pradeep Singh Department of Chemistry IIT Kharagpur, https://nptel.ac.in/courses/104105038
- Pericyclic Reactions and Organic Photochemistry: Prof. Sankararaman, IIT Madras https://nptel.ac.in/courses/104/106/104106077/
- Essentials of Oxidation, Reduction and C-C Bond Formation. Application in Organic Synthesis https://nptel.ac.in/courses/104/101/104101127/
- Reagents in organic synthesis: Prof. Subhas C. Pan, IIT Guwahati https://archive.nptel.ac.in/courses/104/103/104103111/
- Principles of Organic Synthesis: Prof. T. Punniyamurthy, IIT Guwahati, https://archive.nptel.ac.in/courses/104/103/104103110/

SEMESTER III

Paper 10

MCH3T10**: Advanced Inorganic Chemistry**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Understand the crystal structures of simple inorganic molecules.*
2. *Understand the industrial applications of catalysis.*
3. *Apply the mechanism of metallo-enzyme actions in various life processes.*
4. *Apply simple methods of synthesis and characterization to nanomaterials.*

Unit I: Solid State Chemistry

Ionic Crystals and their structures, radius ratio rule, effect of polarization on crystals. Covalent structure type: Sphalerite and Wurtzite. Geometry of simple crystal AB type: NaCl, CsCl and NiAs. AB_2 type: Fluorite, antifluorites, Rutile structures. Li_2O, Na_2O, $CdCl_2$, CdI_2 structures.

Ternary Compounds ABO_3 type: Perovskite, Barium titanate, lead titanate, $CaTiO_3$, Tolerance factor, charge neutrality and deviation structures $FeTiO_3$.

Solids of AB_2O_4 type: Normal and inverse,2-3 and 4-2 spinel, packing of oxygen in tetrahedral and octahedral sites, sites occupancy number of sites surrounding each oxygen, application of charge neutrality principles, site preferences in spinel, distorted spinel. Hausmannite (Jahn-Teller distortions), Factors causing distortion in spinel.

Unit II: Organometallic Chemistry

Introduction of Organometallic Chemistry, counting of electrons, 16-18 rule, Ligand substitution reactions, Oxidative Addition: Concerted, S_N2 and radical mechanism, Reductive elimination, Migratory insertion and elimination reactions, Migration and insertion reactions Alpha-Migratory insertion and Alpha-Elimination Reactions, beta-migratory insertion, Beta-Elimination Reaction, Alpha-Abstraction and Beta-Abstraction, 4-Center Reactions [2+2] Reactions, External Attack by a Ligand and Reductive Coupling

Hydrogenation Reaction [mobohydride and dihydride catalyst] Stereoselective hydrogenation reaction, Wilkinson catalyst, Schrock-Osborn catalysts for hydrogenation, Carbonylation Reaction: Monsanto Acetic Acid Process, Hydroformylation, Hydrocarboxylation and Hydrocyanation, Ziegler-Natta polymerization

Palladium catalyzed cross-coupling reactions-Heck reaction, carbonylation, Wacker oxidation, Kumada, Stille, Sonogashira, Negishi and Suzuki coupling reactions and their importance, Applications of $Co_2(CO)_8$**,** $Ni(CO)_4$, $Fe(CO)_5$ and in organic synthesis. Transition metal carbenes, Fischer and Schrock carbenes, Olefin metathesis by I^{st} and II^{nd} generation catalyst, Schrock and Grubbs catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, application in the synthesis of homo and heterocyclic compounds, polymerization and synthesis of small organic molecules.

Unit -III

A) Metallo enzymes: The principle involved and role of various metals in i) Zn-enzyme: Carboxyl peptidase & Carbonic anhydrase. ii) Fe-enzyme: Catalase Peroxidase & Cytochrome P-450 iii) Cu-enzyme: Super Oxide dismutase iv) Molybdenum: Oxatransferase enzymes, Xanthine oxidase, Co-enzyme vitamin B_{12}, Structure of vitamin B_{12}. Co-C bond cleavage, Mutase activity of co- Enzyme B-12, Alkylation reactions of Methyl Cobalamin.

B) Electron transfer in biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes and Fe-S proteins, non-heme iron proteins; Rubredoxins, Synthetic models. Biological nitrogen fixation (*in-vitro* and *in-vivo*).

Unit-IV: Nanomaterials and Microscopic Techniques

A) Nanoparticles and nanostructure materials: Introduction, methods of synthesis: conventional and biogenic synthesis. Molecular Precursor routes to inorganic solids: Nanoporous Materials: Zeolites, metal oxides, composites & molecular sieves, composition-structure, preparation & applications.

B) Carbon-based nanomaterials: Introduction, synthesis methods: CNT, graphene-based materials, graphitic carbon nitride, quantum dot, carbon dot.

C) Techniques for nanomaterials authentication: X-Ray diffraction, Fourier Transform Infrared Spectroscopy, UV-Diffuse Reflectance Spectroscopy, X-ray Photoelectron Spectroscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Energy Dispersive X-Ray Analysis, Brunauer-Emmett-Teller analysis, Thermogravimetric Analysis.

References

1. Inorganic Chemistry, Third Edition, Shriver and Atkins, Oxford University Press.
2. Inorganic Chemistry, Fourth Edition, Catherine E. Housecroft and Alan G. Sharpe, Pearson, England.
3. Principles of Inorganic Chemistry, thirty third edition, B. R. Puri, L. R. Sharma, K. C. Kalia, Milestone Publisher & Disruptors, Delhi.
4. Organometallic Chemistry, Revised Second Edition, R. C. Mehrotra, A. Singh, New Age International Publication, New Delhi.
5. Basic Inorganic Chemistry, Third Edition, F. Albert Cotton, Geoffrey Wilkinson, John Wiley & Sons Inc.
6. Essentials of Bio-Inorganic Chemistry, Neerja Gupta, Monal Singh, Pragati Edition, Meerut.
7. Inorganic Chemistry, Gary L. Miessler and Donald A. Tarr, Pearson Education International, New York.
8. Inorganic Chemistry, Fourth Edition, James E. Huheey, Ellen A. Keitler, Richard L. Keitler, Pearson Education International, New York.

9. Emerging Nanomaterials and Their Impact on Society in the 21st century, N. B. Singh, Md. A.B. Hasan Susan, R.G. Chaudhary, Material Research Forum, Millerville, USA.
10. Concept and Models of Inorganic Chemistry, Third Edition, B. Douglas, D. McDaniel, J. Alexander, John Wiley & Sons Inc., New York.
11. Inorganic Chemistry, K. F. Purcell, J. C. Kotz, Cengage Learning, Delhi.
12. Nanoscale Materials in Chemistry, K. I. Kalbunde, John Wiley, New York.
13. Biogenic Sustainable Nanotechnology, R. P. Singh, A. R. Rai, A. Abdala, R. G. Chaudhary, Elsevier, Amsterdam, Netherland.
14. Introduction To Nanoscience and Nanotechnology, Chris Binns, John Wiley & Sons Inc., New York.
15. Carbon nanomaterials: synthesis, structure, properties and applications, R. Mathur, B. Singh, S. Pande, Taylor & Francis, Boca Raton.
16. Nanomaterials and Nanocomposites: Synthesis, Properties, Characterization Techniques, and Applications, R. K. Goyal, Taylor & Francis, Boca Raton.

SEMESTER III

Paper 11

MCH3T11**: Elective (a) Inorganic Chemistry Special-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course, student would be able to*

1. *Understand structure and bonding in transition metal pi complexes*
2. *Elaborate advance materials including supramolecules and advanced nanomaterials.*
3. *Classify and characterize the coordination polymers*
4. *Understand mechanism of photophysical and photochemical processes*
5. *Explain various redox processes in complexes.*

Unit-I

Transition Metal Pi Complexes-Carbon multiple bonds. Nature of bonding, structural characteristics and synthesis, properties of transition metal pi- Complexes with unsaturated organic molecules, alkenes alkynes, allyl, diene, dienyl, arene and trienyl complexes. Application of transition metal, organometallic intermediates in organic synthesis relating to nucleophilic and electrophilic attack on ligands, role in organic synthesis.

Unit-II

A) Supramolecular chemistry: Definition, intermolecular bonds, concepts and perspectives, cationic recognition, anionic recognition, neural molecular recognition: self-assembly concept and its application in molecular and supramolecular chemistry, supra molecular chemistry, supramolecular devices and machines.

B) Inorganic pharmaceuticals: Lithium drugs, gold antiarithritic drugs, Bismuth drugs in the treatment of gastric ulcers, Cyclams as anti-HIV agents, Radio-diagnostic agents, contrast agents for MRI and X-ray imaging.

C) Nano structural materials: Nanofibres, MXenes (two-dimensional inorganic compounds), Molecular Precursor routes to Nanoporous Materials: Zeolites and molecular sieves, porous lamellar solids, composition-structure, preparation and applications.

Unit-III

A) **Coordination Polymers**: Coordination polymers and their classification. Synthesis and applications of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Organosilicon polymers. Synthesis and their uses.

B) **Characterization of coordination polymers on the basis of**:

i) Spectra (UV, Visible, IR and NMR)

ii) Magnetic and thermal (TGA, DTA and DSC) studies

Unit-IV

A] Photophysical and photochemical properties of Gold(I) complexes: Introduction, Binuclear and trinuclear complexes, Mixed metal Systems, Photochemical reactivity, Solid state studies, Mononuclear Gold(I) complexes, Mononuclear three coordinate Gold(I) complexes

B) Redox reactions by Excited Metal Complexes: Energy transfer under conditions of weak interaction and strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2- bipyridine and 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium(II); role of spin-orbit coupling, lie time of these processes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to high energy products, chemical energy in to light.

C) Excited States of Metal Complexes: Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, methods for obtaining charge transfer spectra.

References

1. Anderson J.C.,LeverK.D.,Alexander J.M and Rawlings,R.D.,ELBS
2. GrayG.W.Ed.Thermotropic Liquid Crystals,John Wiley
3. Kelkar and Hatz Handbook of Liquid Crystals,ChemieVerlag.
4. Kalbunde K.I.,Nanoscale Materials in Chemistry,JohnWiley,NY.
5. Shull R.D.,McMichael R.D. and SwartzendrubL.J.,Studies of Magnetic Properties of Fine particles and their relevance to Mataerials Science, Elsevier Pub. Amsterdam
6. Optoelectronic Properties of Inorganic Compounds, D. Max Roundhill and John P. Fakler, Jr. Plenum Press, New York

SEMESTER III

Paper 11

MCH3T11**: Elective (b) Organic Chemistry Special-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Learn the important aspects of steroids and terpenoids.*
2. *Understand the biosynthesis of natural products.*
3. *Analyze the enzyme reactions involved in various life processes*
4. *Illustrate the structure elucidation of unknown naturally occurring organic compound*
5. *Apply the knowledge of organic reactions for the total synthesis of useful natural products*

Unit I

A) Terpenoids: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Geraniol, α-terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-carotene, Vitamin A.

B) Genesis of biological isoprene unit, Biosynthesis (**ONLY**) of the following tepenoids: myrecene, linalool, geraniol, α-terpeneol, limonene, camphor, α-pinene, β-pinene, farnesol, β-bisabolene and squalene.

Unit- II

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, generalmethods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring,role of alkaloids in plants Structure, stereochemistry, and total synthesis of the following: Ephedrine, (+)-coniine, Nicotine, Atropine, Quinine, Reserpine and Morphine.

Biosynthesis (**ONLY**) of the followings: hygrine, tropinone, nicotine, pelletierine, conine.

Unit-III

Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and total synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone and Aldosterone. Biosynthesis of steroids (lanosterol)

Unit IV

A) Plant Pigments: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and The Shikimate pathway: Biosynthesis of Cinnamic acids, lignans and lignin, coumarins, flavonoids and stilbens, isoflavanoids.

B) Prostaglandins: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2 (E. J. Corey and Gilbert Stork synthesis only) and iodolactonization reaction.

References

1. Organic Chemistry Vol. II - I. L. Finar
2. Chemistry of Plant Natural Products: Sunil Kumar Talapatra and B. Talapatra (Springer)
3. Classical Methods in Structure Elucidation of Natural Products: *R. W. Hoffmann*, Wiley-VCH
4. A Fragrant Introduction to Terpenoid Chemistry: Charles S Sell (RSC)
5. Chemistry of Alkloids-S .W .Pelletier
6. Chemistry of Steroids-L .F .Fisher and M .Fisher
7. The Molecules of Nature-J .B .Hendricsion
8. Biogenesis of Natural Compound -Benfield
9. Natural Product Chemistry and Biological Significance -J .Mann, R .S Devison, J .B .Hobbs, D .V .Banthripde and J .B .Horborne
10. Introduction to Flavonoids-B .A .Bohm, Harwood
11. Chemistry of Naturally Occurring Quinines-R .H .Thomson
12. The Systematic Identification of Flavonoids -Marby, Markham, and Thomos

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Weblink to Equivalent MOOC on SWAYAM if relevant:

- Classics in total synthesis: Prof. Krishna P. Kaliappan, IIT Bombay (Useful for total synthesis of alkaloids, steroids and prostaglandins) https://archive.nptel.ac.in/courses/104/101/104101133/

SEMESTER III

Paper 11

MCH3T11**: Elective (c) Physical Chemistry Special-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Understand, the concept of statistical function, and applications*
2. *Understand the applications of electrochemistry in various fields*
3. *Understand the theories of advanced chemical dynamics*
4. *Understand the various photophysical processes and their applications*

UNIT I: ELECTRICAL AND THERMAL PROPERTIES OF SOLIDS

A**)** Classical free electron theory, electrical conductivity, thermal conductivity, Wiedemann-Franz Law, Lorenz number, Electronic distribution in solids using Fermi Dirac Statistics, The Fermi Distribution function and effect of temperature, Quantum theory of free electrons, periodic potential, The Kronig-Penney Model, Brillouin Zones, Distinction between metals, insulators and intrinsic semiconductors based on above theory**.**

B**)** Thermal Properties**:** Specific heat of solids, Classical theory, Einstein**'**s theory of heat capacities, Debye theory of heat capacities or Debye T-cubed law.

UNIT II: ELECTROCHEMISTRY OF SOLUTION

A**)** OHP and IHP, potential profile across double layer region, potential difference across electrified interface; Structure of the double layer: Helmholtz-Perrin, Gouy Chapman model, Stern region, Graham Devanathan- Mottwatts, Tobin, Bockris, Devnathan Models**.**

B**)** Over potentials, exchange current density, derivation of Butler Volmer equation under near equilibrium and non-equilibrium conditions, Tafel plot

C**)** Electrical double lever, theories of double layer, electro-capillary phenomena, electro-capillary curve**.** Electro-osmosis, electrophoreses**.** Streaming and Sedimentation potentials**.** Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential**.**

UNIT III: CHEMICAL DYNAMICS - I

A**)** Dynamics of complex reactions**:** reversible, parallel, consecutive, concurrent and branching reactions, free radical and chain reactions, reaction between Hydrogen – Bromine and Hydrogen – Chlorine **(**thermal and photochemical**)**, decomposition of ethane, acetaldehyde, N_2O_5, Rice Herzfeld mechanism, Oscillatory autocatalytic and Belousov-Zhabotinsky reactions, Lotka-Volterra mechanism, the brusselator and the oregonator**.**

B**)** **Fast Reactions:** relaxation methods, flow methods, flash photolysis, magnetic resonance method, relaxation time and numerical**.**

UNIT IV: PHOTOCHEMISTRY

A**)** **Photophysical phenomenon:** Introduction, photo and photochemical excitation and de-excitation, fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching**:** concentration

quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems. Stern-Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisions, quenching and Stern-Volmer equation.

B) **Photochemical reactions:** photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photosensitization, chemiluminescence, photochemistry of environment: Greenhouse effect.

References

1. G. M. Panchenkov and V. P. Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, "Chemical Kinetics and Kinetics of Solutions", Academic
3. K. J. Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J. Raja Ram and J. C. Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi (1993)
5. J.G. Calvert and J.N. Pitts, Jr., Photochemistry, John Wiley and Sons, New York (1966).
6. K. K. Rohtagi-Mukherjee, Fundamentals of Photochemistry, New Age International, New Delhi(1986).
7. R. P. Wayne, Principles and Applications of Photochemistry, Oxford University Press, Oxford(1988).
8. N. J. Turro, Modern Molecular Photochemistry, Univ. Science Books, Sansalito (1991).
9. J. F. L. Lakowicz, Principles of Fluorescence Spectroscopy, 2nd Edition (1999), PlenumPublishers, NewYork.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics". AddisonWesley
11. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
12. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
13. N. J. Turro, V. Ramamurthy and J. C. Scaiano, Principles of Photochemistry – An Introduction, Viva Books, New Delhi, 2015.
14. G. A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
15. M. C. Gupta, Statistical Thermodynamics, New Age International.
16. K. Huang, Statistical Mechanics, Wiley, New Delhi, 2003.
17. Andrew Maczek, Statistical Thermodynamics, Oxford University Press Inc., New York (1998).
18. B. K. Agarwal and M. Eisner, Statistical Mechanics, Wiley Eastern, New Delhi (1988).
19. D. A. McQuarrie, Statistical mechanics, Harper and Row Publishers, New York (1976).
20. J.O.M.Bokris and A.K.N.Reddy, "Modern Elcrtrochemistry". Wiley
21. S. Glasstone, "Introduction to Electrochemistry" Affilisated East West Press, New Delhi.
22. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
23. D. R. Crow, " The Principle of electrochemistry", Chapman Hall
24. G. K. Agrawal, Basic Chemical Kinetics, Tata-Mc-Graw Hill Pvt., Ltd. 1990

25. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.
26. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.

NPTEL sources weblinks:

- Electrochemistry of solutions: https://archive.nptel.ac.in/courses/104/106/104106129/
- Chemical Dynamics https://nptel.ac.in/courses/104101128
- https://onlinecourses.nptel.ac.in/noc20_cy22/preview
- https://nsdl.niscpr.res.in/bitstream/123456789/251/1/Photochemistry%20revised.pdf

SEMESTER III

Paper 11

MCH3T11**: Elective (d) Analytical Chemistry Special-I**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *Explain the principles involved in radiation chemistry.*
2. *Compare various detectors used in radiochemistry and select among them for desired analysis.*
3. *Compare various voltammetric techniques for given type of analysis.*
4. *Understand the electrodes used in different voltammetric techniques and their comparison.*
5. *Design experiments for water quality assessment based on parameter under study.*

Unit-I: Radioanalytical Chemistry

Radioactivity, Law of radioactive decay, Half life and mean life, Elementary principles of GM and proportional counters, Gamma Ray Spectrometer, Ionization chamber, HPGe detector, NaI(Tl) detector**.** Preparation of some commonly used radioisotopes (^{22}Na, ^{60}Co, ^{131}I, ^{65}Zn, ^{32}P)**,** Use of radioactive isotopes in analytical and physico-chemical problems, Neutron Activation Analysis, Isotope Dilution Analysis, Radiometric titrations (Principle, Instrumentation, applications, merits and demerits), Radiochromatography, Carbon dating, Numericals based on above.

Unit-II: Stripping voltammetry

Stripping Voltammetry**:** Principle and technique in anodic and cathodic stripping voltammetry, applications to metal ion analysis, limitations**.**

Adsorptive stripping voltammetry: Principle, technique, applications to metal ions and organic analysis**.** Advantages over anodic stripping voltammetry**.** Catalytic effects in voltammetry**.**

Working electrodes: Mercury electrodes, carbon electrodes, film electrodes**.**

Electrochemical sensors (*Chemically modified electrodes****):*** Biosensors, catalytic sensors and gas sensors**.** Comparison of voltammetry with AAS and ICP**-**AES**.**

Unit-III: Electroanalytical methods

Electrogravimery: Theory of electrolysis. Electrode reactions. Decomposition potential. Overvoltage. Characteristics of deposits and completion of deposition. Instrumentation. Application in separation of metals.

Cyclic voltammetry**:** Principle and technique**.** Randles**-**Sevcik equation**.** Interpretation of voltammogram**-** reversible, irreversible and quasi**-**reversible systems**.** Applications of cyclic voltammetry in study of reaction mechanism and adsorption processes**.**

Unit IV: Water pollution and analysis

Sources of water pollution, composition of potable water, importance of water analysis, sampling and sample preservation, physico-chemical analysis of water. Mineral analysis (temperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphates, hardness), Demand analysis

(DO, BOD, COD, TOC), nutrients (nitrogen-total, nitrate, nitrite, phosphate) and heavy metals (As, Cd, Cr, Hg and Pb). A brief idea of coagulation and flocculation. Water treatment plants: Sand filters and other types of filters.

References

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
4. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
5. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
6. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
7. Vogel's Text Book of Quantitative Inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Atomic Absorption Spectroscopy: Robinson (Marcol Dekker)
10. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
11. Analysis of Water: Rodier
12. Laboratory manual of water analysis: Moghe and Ramteke (NEERI)
13. Electroanalytical chemistry: Joseph Wang
14. Electroanalytical stripping methods: Brainina and Neyman (Wiley-Interscience)
15. Trace analysis: S. Lahiri (Narosa Publishing House)
16. Electroanalytical Chemistry: Bard (Marcel-Dekker)
17. Chemistry in Engineering and Technology- Vol I and II: J.C. Kuriacose and J. Rajaram (Tata-McGraw Hill)

SEMESTER III

Practical 6

Practical based on Elective Paper (Any one of the four special practicals)

MCH3P06: Elective (a) Inorganic Chemistry Special Practical

4 h per week *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *Prepare various complexes by wet chemical methods.*
2. *Carry out characterization of prepared complexes.*
3. *Interpret the electronic and magnetic properties of complexes.*
4. *Elucidate the spin states of various complexes using susceptibility studies.*
5. *Deduce the structures of crystalline solids.*
6. *Carry out photochemical reactions in complexes*

A) Complex preparations: Preparation and characterization of following complexes/organometallic compound including their structural elucidation by the available physical methods**. (**element analysis molecular weight determination, conductance and magnetic measurement and special studies**)**

1. Preparation of *cis* and *trans* potassium dioxalatodiaquochromate(III)
2. Preparation of hexa-aminecobalt(III) chloride
3. Preparation of *tris* (acetylacetonato) manganese(III)
4. Preparation of N-N *bis* (salicyldehyde) ethylene diaminonato nickel(II)
5. Preparation of trinitrotriaminocobalt(III)
6. Preparation of chloropentammine cobalt(III) chloride
7. To prepare copper(II) acetylacetonate complex
8. To prepare *cis* and *trans* bis (glycinato) Cu(II) monohydrate complex
9. To prepare dipyridineiodine(I) nitrate
10. Preparation of ammonium nickel(II) sulphate
11. *Any other complex depending on availability of chemicals.*

* Minimum 5 complexes should be prepared.

B. Nanomaterials and Synthesis Techniques

1. Preparation of Metal oxides and mixed oxides Nanomaterials by Conventional Methods (NiO, ZnO, TiO_2, CuO, Fe_2O_3, Fe_3O_4, Co_3O_4, $ZnFe_2O_4$, $ZnMn_2O_4$, $CuAl_2O_4$ and $NiFe_2O_4$)
2. Preparation of Metal oxides and mixed oxides Nanomaterials by Biogenic Methods (NiO, ZnO, TiO_2, CuO, Fe_3O_4, Fe_2O_3, Co_3O_4, $ZnFe_2O_4$, $ZnMn_2O_4$, $CuAl_2O_4$ and $NiFe_2O_4$)
3. Preparation of graphene oxide via *Hummer's* Method.
4. Preparation of graphitic carbon nitride using Urea, Thiourea, Melamine.

C) Separation techniques

1. Paper and thin layer chromatography

2. Ion exchange
3. Solvent extraction

D) Bioinorganic Chemistry

1. Extraction and absorption spectral study of chlorophyll from green leaves of student choice.

2. Separation of chlorophyll and their electronic spectral studies.

3. Preparation of plant extract using different parts of different biological sources.

References

1. Advanced Inorganic Analysis, S. K. Agarwal, K. Lal, Pragati Edition, Meerut.
2. Practical Inorganic Chemistry, G. Pass, H. Sutcliffe, Springer.
3. Practical Inorganic Chemistry - Marr & Rocket
4. Basic Concept of Analytical Chemistry - Khopkar S. M.
5. Vogel A: A Textbook of Quantitative Inorganic Analysis, Longman
6. Preparation And Properties of Solid-State Materials – Wilcox, Vol. IV & II, Dekker
7. The Structure and Properties of Materials – Vol IV, John Wulff, Wiley Eastern
8. Dutt P. K.: General And Inorganic Chemistry (Sarat Book House)
9. Fenton, David E.: Biocoordination Chemistry, Oxford
10. Jolly, W. L.: Inorganic Chemistry (4^{Th} Ed) Addison-Wesley
11. Bertini, et al: Bioinorganic Chemistry (Viva)
12. Katakis, D. And Gordon, G: Mechanism of Inorganic Reactions (J. Wiley)
13. Nanomaterials and Nanocomposites: Synthesis, Properties, Characterization Techniques, and Applications, R. K. Goyal, Taylor & Francis, Boca Raton.
14. Biogenic Sustainable Nanotechnology, R. P. Singh, A.R. Rai, A. Abdala, R. G. Chaudhary, Elsevier, Amsterdam, Netherland.

SEMESTER III

Practical 6

MCH3P06: Elective (b) Organic Chemistry Special Practical

4 h per week *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Understand the types of reactions involved in organic synthesis.*
2. *Realize the various functional groups which are commonly present in simple organic molecules.*
3. *Develop skills to understand the reactions of different functional groups by the hands-on experience.*
4. *Characterize the synthesized compounds using IR spectroscopy*
5. *Draw the structures using Chem-Draw*

A) Organic preparations: Student is expected to carry out 4-7 two or three stage preparation from the following list. During preparation of organic compounds, the techniques such as crystallization, distillation, solvent extraction, TLC and column chromatography should be demonstrated.

1. Aniline → acetanilide →p-bromoacetanilide →p-bromoaniline
2. Aniline → Acetanilide →p-nitroacetanilide →p-nitroaniline
3. Benzaldehyde)thiamine hydrochloride→ (benzoin → benzil → benzilic acid
4. p-Nitrotoluene →p-nitrobenzoic acid→ PABA →p-iodobenzoic acid
5. p-Cresol → p-cresylacetate → 2-hydroxy-5-methyl acetophenone → 2-hydroxy chalcone
6. Benzophenone → Benzophenone oxime → Benzanilide → Benzoic acid +aniline
7. Aniline → aniline hydrogen sulphate → sulphanilic acid → Orange II
8. Aniline → N-arylglycine → indoxyl → indigo
9. Phthalimide → Anthranilic acid → Phenyl glycine-o-carboxylic acid → Indigo
10. Phalic anhydride → Phthalimide → Anthranilic acid → o-chlorobenzoic acid
11. Phalic anhydride → Phthalimide → Anthranilic acid →Diphenic acid
12. *Any other suitable three stage preparation as per the availability of chemicals*

B) Qualitative Analysis : Separation of the components of a mixture of three organic compounds)three solids, two solids and one liquid, two liquids and one solid, all three liquids and identification of any two components using chemical methods or physical techniques .Minimum 4-6 mixtures to be analyzed.

C) IR spectroscopy: The IR spectrum of minimum four synthesized compounds from the Section A should be interpreted.

D) Use of Computers- Chem Draw, Chem Sketch for drawing simple organic molecules, aliphatic and aromatic compounds should be demonstrated (2 hour activity).

References

1. Practical organic chemistry by FG Mann and BC Saunders
2. Text book of practical organic chemistry –by Vogel
3. The synthesis, identification of organic compounds –Ralph L. Shriner, Christine K.F. Hermann, Terence C. Morrill and David Y. Curtin

4. Compendious Practical Organic Chemistry: Preparations, Isolation, and Chromatography by Basavarajaiah S M, Nagesh G Y, Ramakrishna Reddy K
5. Advanced Practical organic chemistry by N.K. Vishnoi

SEMESTER III

Practical 6

MCH3P06: Elective (c) Physical Chemistry Special Practical

4 h per week *100 Marks*

Course Outcomes: *At the end of the course students will be able to*

1. *Inculcate the potential of establishing any new laboratory at UG or PG level.*
2. *Execute the theoretical principles in practical*
3. *Analyze and interpret the results of their performances*
4. *Inculcate the skills of preparing, maintaining and developing the chemicals and reagents*
5. *Understand the role of laboratory safety and preparedness*

Thermodynamics:

1. Determination of partial molar volume of solute and solvent **(**ethanol-water, methanol-water, KCl-water mixture**)**

Solutions:

2. Study the variation of solubility of potassium hydrogen tartarate with ionic strength using a salt having a common ion and hence determine the mean ionic activity coefficients**.**
3. Determination of temp**.** dependence of the solubility of a compound in two solvents having similar intermolecular interactions**(**benzoic acid in water and DMSO – water mixture**)** and calculation of the partial molar heat of solution**.**

Phase equilibrium:

1. To study the effect of addition of an electrolyte such as NaCl, KCl,Na_2SO_4,K_2SO_4 etc**.** on the solubility of an organic acid**(**benzoic acid or salicylic acid**).**
2. To determine the heat of crystallization of $CuSO_4$,$5H_2O$
3. To determine the heat of reaction involving precipitation of a salt $BaSO_4$
4. To determine transition temperature of $CaCl_2$ by thermometric method and to determine transition temperature of $CaCl_2$, sodium bromide by solubility method

Kinetics:

1. To determine the activation energy of hydrolysis of an ester by acid**.**
2. Kinetics of reaction between sodium thiosulphate and KI**.** Determination of rate constant; study of influence of ionic strength
3. Kinetics of decomposition of H_2O_2 catalysed by iodide ion**.** Also determination of activation energy of reaction**.**
4. Clock reaction**-** activation energy of bromide**-**bromate reaction**.**
5. Temp dependence of persulfate**-**iodide reaction by iodine clock method and calculation of thermodynamic and Arrhenius activation parameters**.** Study of ionic strength effect on persulfate-iodide reaction**.**
6. Kinetics of B**-**Z reaction; Kinetics of modified B-Z reaction
7. Investigate the Autocatalytic reaction between potassium permanganate and oxalic acid**.**
8. Determination of pKa value of a weak acid by chemical kinetic method **(**formate**-**iodine reaction**)**

Conductometry:

1. Estimate the concentration of H_2SO_4, CH_3COOH, $CuSO_4.5H_2O$ in a given solution by carrying out conductometric titration against NaOH solution.
2. Determine the eq. conductance of strong electrolyte (KCl, NaCl, HCl, KNO_3) at several concentration and hence verify Onsager's equation.
3. Carry out the following precipitation titration conductometrically. a. 50 ml.0.02N $AgNO_3$ with 1N HCl; b.50 ml.0.02N $AgNO_3$ with 1N KCl; c. 50 ml 0.004 N $MgSO_4$ with 0.1 N $Ba(OH)_2$; d. 50 ml 0.002 N $BaCl_2$ with 1 N Li_2SO_4; e. 50 ml.0.02 N $BaCl_2$ with 1N K_2SO_4
4. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by conductometric method.
5. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
6. Complexation between $Hg^{2+}$and I^- conductometrically.
7. To determine solubility product of lead chromate.
8. Kinetic study of saponification ethyl acetate by conductometry.

Potentiometry:

1. To prepare calomel electrode and to determine the potential of calomel electrode by potentiometry.
2. To determine stability constant of Fe^{3+} with potassium dichromate in presence of dilute sulphuric acid by redox titration.
3. To determine solubility product of Silver chloride by potentiometric method.
4. Determination of redox potential of the couples(Fe^{2+}/Fe^{3+},Co^{3+}/Co^{2+},Cr^{3+}/Cr^{2+},MnO_4^- /Mn2+(any two) and equilibrium constant.
5. Study of complex formation by potentiometry e.g.Ag^+-$S_2O_3^{-2}$, Fe^{3+}-SCN^-,Ag^+-NH_3(any two) and calculation of stability constant.
6. Transport number by potentiometry.
7. To determine degree of hydrolysis of aniline hydrochloride and hence to determine the hydrolysis constant of salt by potentiometry method.
8. To determine pK of weak acids, succinic acid, acetic acid, Malonic acids, (dibasic acids).
9. Complexation between $Hg^{2+}$and I^- conductometrically.

Spectrophotometry:

1. To verify Beers law for solution of potassium permanganate and to find molar extinction coefficient.
2. To determine the indicator constant (pK_{In}) of methyl orange/red spectrophotometrically.
3. To determine the stability constant of reaction between Ferric ion solution and SCN^- ion solution by Job's method.
4. To determine the stability constant between Fe^{3+} and SCN^- ion solution by Ostwald and Frank method.

Polarography:

1. Determination of the half-wave potential of the cadmium ion in 1M potassium chloride solution.
2. Investigation of the influence of dissolved oxygen.
3. Determination of cadmium in solution.
4. Determination of lead and copper in steel.

Adsorption:

1. To verify Freundlich adsorption isotherm.
2. To verify Langmuir adsorption isotherm.
3. To verify Gibbs adsorption isotherm and to find surface excess concentration of solute.
4. Study of variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule

Transport Number:

1. To determine transport number by Hittorff's method
2. To determine the transport number by moving boundary method

References

1. Vogel A: A Textbook Of Quantitative Inorganic Analysis, Longman
2. Das and Behra, Practical Physical Chemistry
3. Carl W. Garland, Joseph W. Nibler and David P. Shoemaker, Experiments in Physical Chemistry, Mc-Graw Hill, 8th Edition, 2009.
4. Farrington Daniels, Joseph Howard Mathews, John Warren Williams, Paul Bender, Robert A. Alberty, Experimental Physical Chemistry, Mc-Graw Hill, Fifth Edition, 1956.
5. John W. Shriver and Michael George, Experimental Physical Chemistry, Lab Manual and Data Analysis, The University of Alabama in Huntsville, Fall 2006
6. Day And Underwood: Quantitative Analysis
7. Merits And Thomas: Advanced Analytical Chemistry
8. Ewing, G. W.: Instrumental Methods of Chemical Analysis, Mcgraw-Hill
9. Drago, R.S: Physical Methods in Inorganic Chemistry
10. Christian G.D: Analytical Chemistry
11. Khopkar S.M.: Basic Concept of Analytical Chemistry
12. Koltath And Ligane: Polorography
13. Braun: Instrumental Methods of Chemical Analysis
14. Willard, Merritt and Dean: Instrumental Methods of Chemical Analysis ,Van Nostrand
15. Strouts,Crifi; Llan And Wisin: Analytical Chemistry
16. Skoog S.A. And West D. W.: Fundamental of Analytical Chemistry
17. Dilts R.V.: Analytical Chemistry
18. Jahgirdar D.V : Experiments in Chemistry
19. Chondhekar T.K: Systematic Experiments in Physical Chemistry, Rajbhoj S.W., Anjali Pubn.
20. Wlehov G. J: Standard Methods of Chemical analysis 6th Ed

SEMESTER III

Practical 6

MCH3P06: Elective (d) Analytical Chemistry Special Practical

4 h per week *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *Understand the fundamental principles forming basis for the instrumental methods of analysis.*
2. *Select most suitable technique for the desired analysis.*
3. *Identify experimental conditions necessary to carry out the analysis of different samples.*
4. *Compare results obtained through different techniques.*
5. *Formulate experiments based on optical and electroanalytical techniques.*
6. *Demonstrate working of each instrument used in analysis.*

pH-metry

1. Determination of percent Na_2CO_3 in soda ash by pH-metric titration.
2. Determination of isoelectric point of amino acid.
3. Determination of three dissociation constants of phosphoric acid.

Conductometry

1. Estimation of acids in mixtures.
2. Displacement titration of CH_3COONa with HCl.
3. Precipitation titration of $MgSO_4$ and $BaCl_2$.
4. Titration of mixture of CH_3COOH, H_2SO_4 and $CuSO_4$ with NaOH.
5. Determination of dissociation constants of weak acids.

Potentiometry

1. Estimation of Cl^-, Br^- and I^- in a mixture.
2. Determination of percent purity of phenol by potentiometric titration with NaOH.
3. Estimation of acids in mixtures.
4. Potentiometric titration of phosphoric acid with NaOH.

Electrogravimetry

1. Estimation of nickel and copper individually as well as in mixture.

Spectrophotometry

1. Simultaneous determination of chromium and manganese in given mixture.
2. Simultaneous determination of two dyes in a mixture.
3. Estimation of Mn in steel.
4. Estimation of Cu/Ni in alloys.
5. Estimation of iron in water sample using 1,10-phenanthroline.
6. Estimation of Fe(III) in given solution by photometric titration with EDTA (salicylic acid method).

Flame photometry

1. Estimation of Li, Na, K, Ca in vegetable/ soil / water samples.

Polarography

1. Determination of $E_{1/2}$ of Cd^{2+} and Zn^{2+} at DME.
2. Estimation of Cd^{2+} and Zn^{2+} in respective solutions by calibration curve and standard addition methods.

Cyclic voltammetry

1. Study of cyclic voltammograms of $K_3[Fe(CN)_6]$.

Turbidimetry and nephelometry

1. Estimation of sulphate in water sample by turbidimetry.
2. Estimation of phosphate by nephelometry.
3. Determination of molecular weight of polymer.

Polarimetry

1. Determination of specific and molar rotation of optically active compound.
2. Kinetics of inversion of cane sugar in the presence of HCl.
3. Determination of percentage of two optically active substances (d-glucose and d-tartaric acid) in mixture.

References

1. Quantitative analysis**:** Day and Underwood **(**Prentice**-**Hall of India**)**
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry**:** Gary D**.** Christian **(**Wiley India**).**
4. Experiments and calculations in Engineering Chemistry- S. S. Dara (S. Chand and Co.)
5. Experiments in Chemistry-D. V. Jahagirdar (Himalaya)
6. Advanced Practical Chemistry-J. B. Yadav (Goel Publishing House)
7. Advanced Practical Chemistry-Jagdamba Singh (Pragati Prakashan)

SEMESTER III

Practical 7

MCH3P07: Research Project (RP)

8 h per week *100 Marks*

The objective of research project is to train the student in identifying the problem of research, develop the hypothesis, design the experiments/surveys to test the hypothesis, collect and analyse the data and draw conclusions from it. In addition, the aim is also to prepare the student to present the data in various forms such as project report, presentation in conferences and seminars and research paper. Research project is also aimed to prepare the student for doctoral research after the completion of the programme.

The student will have to carry out a research-based project work in the third and fourth semester. The project work may be carried out in the parent department or any other institute in collaboration with the parent institute. For this, the student will be attached to any of the national/regional/private research institute/organization for the duration of the third semester. If the student is working in the organisation other than the parent department, then it will be the responsibility of the student to attend the classes and other departmental activities in order to be eligible to appear for the examination. The student will be allotted the supervisor in the third semester; after which the student will finalize the topic of the project work in consultation with the supervisor.

The research project of the student will be evaluated on the basis of the project report submitted by him/her and the power point presentation made by him/her in the presence of internal and external examiner during the examination.

SEMESTER IV

Paper 12

MCH 4T12: Spectroscopy-II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course, student will be able to*

1. *Interpret the structures of simple molecules using physical methods of analysis*
2. *Understand and interpret the NMR data*
3. *Analyze X ray diffraction data*
4. *Develop the skills of analytical ability*
5. *Execute out the combined application of spectral method*

Unit I:

A) Ultraviolet and visible spectroscopy: Natural line width, line broadening, transition probability, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. General nature of band spectra. Beer- Lambert Law, limitations, Frank-Condon principle, various electronic transitions, effect of solvent and conjugation on electronic transitions, Fieser Wooodward rules for dienes, aldehydes and ketones. Structure differentiation of organic molecules by UV Spectroscopy

B) Photoelectron spectroscopy: Basic principles, photoelectric effect, ionization process, Koopman theorem, PES and XPES, PES of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy.

Unit II:

Nuclear Magnetic Resonance Spectroscopy: Magnetic properties of nuclei, resonance condition, NMR instrumentation, chemical shift, spin spin interaction, shielding mechanism, factors affecting chemical shift, PMR spectra for different types of organic molecules, effect of deuteration, complex spin spin interaction (1^{st} order spectra), stereochemistry, variations of coupling constant with dihedral angle, electronegativity, Karplus equation etc., classification of molecules as AX, AX_2, AMX, A_2B_2, Shift reagents. NMR studies of ^{13}C, chemical shift in aliphatic, olefinic, alkyne, aromatic, heteroatomic and carbonyl compounds, ^{19}F, ^{31}P. Structure determination of organic molecules by NMR spectroscopy

Unit III:

A) Application of NMR spectroscopy: FT-NMR, advantages of FT-NMR, two-dimensional NMR spectroscopy-COSY, HETCOR, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques, Nuclear Overhauser effect, use of NMR in medical diagnosis

B) Problems based on structure determination of organic molecules by using NMR (^1H and ^{13}C nuclei) data, Structure elucidation using combined techniques including UV, IR, NMR and mass spectrometry (based on data and copies of the spectra)

Unit IV:

Diffraction techniques: X ray diffraction: Braggs condition, Miller indices, Laue method, Bragg method, Debye Scherrer method, identification of unit cells from systematic absences in diffraction pattern, structure of simple lattices and x-ray intensity, structure factor and its relation to intensity and electron density, absolute configuration of molecules.

Electron diffraction: scattering intensity vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces.

Neutron diffraction: Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

References

2. Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally
3. Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely
4. Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall
5. Organic Spectroscopy-William Kemp, ELBS with McMillan
6. Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi
7. Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin
8. Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming
9. Fundamentals of Molecular Spectroscopy-CN Banwell
10. Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro
11. Photoelectron Spectroscopy-Baber and Betteridge
12. Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten
13. NMR –Basic Principle and Application-H Guntur
14. Interpretation of NMR spectra-Roy H Bible
15. Interpretation of IR spectra-NB Coulthop
16. Electron Spin Resonance Theory and Applications-W gordy
17. Mass Spectrometry Organic Chemical Applications, JH Banyon

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Weblink to Equivalent MOOC on SWAYAM if relevant:

- Application of Spectroscopic Methods in Molecular Structure Determination https://nptel.ac.in/courses/101/104/104106075/

SEMESTER IV

Paper 13

MCH 4T13: Advanced Organic Chemistry II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course, student will be able to*

1. *Recognize the chemical reactions of carbonyl compounds and alkenes under photochemical conditions*
2. *Understand the stereochemistry of complex organic molecules*
3. *Apply the knowledge of enaolate chemistry in modern organic synthesis*
4. *Demonstrate the applications of stereochemistry of common organic reactions*
5. *Analyze the philosophy of synthesis of small molecules*

Unit I: Organic Photochemistry

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno–Buchi reaction, Photoreduction, Photochemistry of enones, Hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones

Photochemistry of *p*-benzoquinones, photochemistry of aromatic compounds with reference to isomerization, addition and substitution Photochemical isomerization of *cis* and *trans* alkenes, Photochemical cyclization of reaction, Photo-Fries rearrangement, di-pi methane rearrangement, Photo theory reaction of anilides, photochemistry of vision, DeMayo reaction

Unit II:

Advanced Stereochemistry

A) Recapitulation of Stereochemical concepts- enantiomers, diastereomers, homo topic and heterotopic ligands, racemization and resolution methods, Chemo-, regio-, diastereo- and enantio-controlled approaches; Chirality transfer, Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model, Cram's chelate model. Asymmetric synthesis, use of chiral auxiliaries, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation

B) Stereochemistry of fused and bridged ring systems: Nomenclature, synthesis; stereochemical aspects of Perhydrophenanthrene, Perhydroanthracene, hydrindane, Steroids; Bridged system (bi, tri and polycyclo system) including heteroatoms, Bredt's Rule. Conformations of following compounds with justification of each: *cis* and *trans*-1,3- and l,4-di-t-butyl-cyclohexanes; Cis-4-di-t-butylcis-2,5-dihydroxycyclohexane; Twistane; bicyclo-[2.2.2]octane; Trans-anti-trans-Perhydro-anthracene and the lactone; cyclohexane-l,4-dione; 1,2,2,6,6-penta-methyl-4- hydroxy-4-phenylpiperidine; ψ-tropine; 2-hydroxy-2-phenyl quinolizidine; 4-*t*-butyl-4-methyl-l,3-dioxane; *cis*-and *trans*-2,5-di-t-butyl-l,3-dithianes; *cis*-2,5-di-t-butyl-l,3,2- dioxaphosphorinan-2-one

Unit III:

Alkylation of enolates and other carbon nucleophiles: Generation and properties of enolates and other stabilized carbaions, regioselectivity and stereoselectivity in enolate formation from ketones and esters, alkylation of enolates of ketones, aldehydes, esters, carboxylic acids, amides, and nitriles, Generation and alkylation of dianions, intramolecular alkylation of enolates, control of enantioselectivity in alkylation reactions, The nitrogen analogs of enols and enolates: Enamine and imine anions

Reactions of carbon nucleophiles with carbonyl compounds: Aldol addition and condensation reaction, mechanism, Control of regioselectivity and stereoselectivity of aldol reacions of aldehydes and ketones, Aldol addition reactions of enolates of esters and other carbonyl derivatives, Reaction of (*E*) or (*Z*)-enolates with chiral aldehydes, The Mukaiyama aldol reaction, Control of facial selectivity in aldol and Mukaiyama aldol reaction, Intramolecular aldol reaction and the Robinson annulation, Evans aldol reaction, Mannich reaction, Conjugate addition of enolates, organomettalic reagents and cyanide ion, Conjugate addition with tandem alkylations, Control of facial selectivity in conjugate addition reaction

Unit IV: Designing the synthesis based on retrosynthetic analysis

A) Disconnection Approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis

B) One Group C-C Disconnections: Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

C) Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalisedcompounds, Michael addition and Robinson annelation, Methods of ring synthesis, Linear and convergent synthesis

References

1. N. J. Turro, "Modern Molecular Photochemistry" (MMP), University Press, Menlo Park, CA, 1978
2. A. Gilbert and J. Baggott, "Essentials of Molecular Photochemistry," CRC Press, London, UK, 1991
3. J. Mattay and A. Griesbeck, eds., "Photochemical Key Steps in Organic Synthesis", VCH, New York, 1994
4. J. D. Coyle, ed., "Photochemistry in Organic Synthesis", Royal society of Chemistry, London, 1986
5. Stereochemistry of Organic Compounds Principles and Applications by D. Nasipuri, 3rd Edition, New Age International (P) Ltd Publishers
6. Basic Stereochemistry of Organic Molecules, 2nd Edition, Book Syndicate Pvt. Ltd

7. Basic Organic Stereochemistry by Ernest L. Eliel, Samuel H. Wilen and Michael P. Doyle, 2001 edition, Wiley Interscience.
8. Advance Organic Chemistry Part-B-F .A .Caray and R .J .Sundberg Plenum Press (Useful for Unit III)
9. Organic Chemistry, J .Clayden, N .Greeves, S .Warren and P .Wothers, Oxford University Press
10. Some Modern Methods of Organic Synthesis-W .Carruthers
11. Principles of Organic Synthesis by R. O. C. Norman and James M. Coxon (Nelson Thornes Ltd)
12. Modern Organic Synthesis: An Introduction by G. S. Zweifel and M. H. Nantz (Wiley)
13. Organic Synthesis by Michael Smith , 4th Edition (Academic Press)
14. Organic Synthesis: The Disconnection Approach-S. Warren
15. Designing Organic Synthesis-S. Warren

Weblink to Equivalent MOOC on SWAYAM if relevant:

- Organic Photochemistry and Pericyclic Reactions: Dr. N.D. Pradeep Singh Department of Chemistry IIT Kharagpur, https://nptel.ac.in/courses/104105038
- Pericyclic Reactions and Organic Photochemistry: Prof. Sankararaman, IIT Madras https://nptel.ac.in/courses/104/106/104106077/
- A Study Guide in Organic RetrosynthesisL Problem Solving Approach: Prof. Samik Nanda, IIT Kharagpur https://nptel.ac.in/courses/104105087
- Stereochemistry: Prof. Amit Basak, IIT Kharagpur https://nptel.ac.in/courses/104105086
- Stereochemistry and Applications: Prof. A. R. Choudhury, IISER Mohali https://nptel.ac.in/courses/104106127
- Structure, Stereochemistry and Reactivity of Organic Compounds and Intermediates: A Problem-solving Approach: Prof. Amit Basak, IIT Kharagpur https://nptel.ac.in/courses/104105127

SEMESTER IV

Paper 14

MCH 4T14**: Advanced Physical Chemistry**

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course, student will be able to*

1. *Understand the types and behavior of solids based on their structure.*
2. *Estimate various dependent parameters of under different influences.*
3. *Understand solid state reactions and synthesis process.*
4. *Understanding nano chemistry.*
5. *Identification of crystals and their analysis.*

UNIT I: SOLID STATE AND THEIR MAGNETIC PROPERTIES

A**)** Solid State Chemistry**:** Metals, Insulators and Semiconductors, Electronic structure of solids-band theory**.** Band structure of metals, Insulators and Semiconductors, Intrinsic and Extrinsic Semiconductors, p-n junction, energy band formation, forward bias and reversed bias p-n junction, their applications, Superconductors— types, Meissner effect, BCS theory, Low Temperature Superconductor **(**LTSC**)** and High Temperature Superconductor **(**HTSC**)**, Conventional and organic Superconductors, their applications**.**

B**)** Magnetic Properties**:** Behaviour of substances in magnetic field, effect of temperature, Curie and Curie-weiss law, calculation of magnetic moments, magnetic materials, their structure and properties, Applications, structure/ property relations, numerical**.**

UNIT II: ELECTRICAL PROPERTIES OF MOLECULES

Dipole moments of molecules, basic ideas of electrostatic interactions, polarizability, orientation polarization, Debye equations, limitation of the Debye theory, Clausius-Mossotti equation**.** electrostatic of dielectric medium, molecular basis of dielectric behavior, structural information from dipole moment measurements, use of individual bond dipole moments, application to disubstituted benzene derivatives, dipole moment and ionic character of a molecule, determination of dipole moment from dielectric measurements in pure liquids and in solutions**.** The energies due to dipole-dipole, dipole induced dipole and induced dipole-induced dipole interaction**.** Dispersion, dielectric loss and refractive index**.** Lennard-Jones potential**.**

UNIT III: THIN FILMS AND LIQUID CRYSTALS

(A) Preparation techniques, evaporation/sputtering, chemical processes, MOCVD, sol-gel, etc. Langmuir Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films.

(B) Liquid crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases, smectic-nematic transition and clearing temperature- homeotropic, planar and schlieren textures, twisted nematics, chiral nematics, molecular rearrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.

UNIT-IV: CRYSTAL STRUCTURES

A) Introduction to crystals, Unit Cell and lattice parameters, Symmetry elements in crystals, Absence of fivefold axis, Space groups, The Bravais Lattices, Miller Indices, Bragg's Equation, seven crystal system, packing in crystals, Hexagonal Closest Packing (HCP) Cubic Closest Packing (CCP), Voids, packing fraction, Numerical.

B) **Lattice Defects:** Perfect and Imperfect crystals, point defects**,** Interstitial, Schottky defect, Frenkel defect, line defect and other entities, thermodynamics of Schottky and Frankel defects. Dissociation, theory of dislocation, plane defects- Lineage boundary, grain boundary, stacking fault, 3D defects, Defects and their concentrations, ionic conductivity in solids, Non stoichiometric compounds. Electronicproperties of Non-stoichiometric oxides.

References

1. S**.** O**.** Pillai, Solid State Physics, New Age International, New Delhi, 2102**.**
2. C**.**Kittel, **"** Introduction to solid state Physics**"**,Wiley
3. L**.**V**.**Azaroff, **"** Introduction to solids**"**, McGraw Hill

SEMESTER IV

Paper 15

MCH4T15: Elective (a) Inorganic Chemistry Special II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student would be able to

1. *Understand the types and behavior cerasmic and composite materials.*
2. *Elaborate various types of ceramics and cementataceous composites.*
3. *Discuss corrosion types, reasons and solutions to corrosion problem.*
4. *Comprehend industrial materials and water treatment techniques.*
5. *Prepare a subject platform for energy sources and renewable fuel sources.*

Unit-I

a. Ceramic Materials: Classification of ceramics, dielectric properties and polarization properties of ceramics, piezo-, pyro- and ferro-electric effect of ceramics, sol-gel processing of ceramics. Examples and application of ceramics: oxides, carbides, borides, nitrides.

b. Composite Materials: Definition, glass transition temperature,fibersfor reinforced plastic composite materials (i.e. glass fibers, carbon fibres, and aramid fibers); concrets and asphalt materials. Application ofcomposite material.

Unit-II

A) Cementitious Materials: Difference between Blended and Non-Portland cements; Non-portland cements; high alumina cements, calcium sulfoaluminate cements, phosphate cements.Chemicals in cement hydration; hydration process, set retardersandaccelerators, plasticizers, slip-casting processing. Application of cementitousmaterials.

B) Bio-materials: Definition of biomaterials and biocompatibility;, Type of bio-materials: Metallic materials, Biopolymeric materials, Bioceramic materials (dense hydroxyapatite ceramics, bioactive glasses,and bioactive composites); Basic requirement of bone implants; Coating of hydroxyapatite on porous ceramics; Biomaterials in tissue attachments; Application of Biomaterials

Unit-III

A) Inorganic Chemicals as metallic Corrosion Inhibitors: Introduction, Principles of corrosion inhibitors, corrosion as an electrochemical process, Practical aspects of corrosion inhibition, Anion inhibitor properties in neutral electrolytes, some application of corrosion inhibitors (cooling water circulation-once through and open systems, engine radiation & cooling systems, central heating system, refrigeration plants and high chloride systems, water for steam raising, corrosion inhibitors for paintcoating).

B) Industrial gases: Introduction, Separation of gases from air,Hydrogen, Carbon dioxide, Carbon monoxide, Oxygen, Acetylene, Sulphur dioxide, Nitrous oxides.

C) Chemical explosives and propellants: Introduction, Potential energy of explosives , Properties of explosives, Manufacture of explosives , Explosives made by nitration, Dynamite , Commercial

high explosives containing no nitroglycerine , Initiating devices, Sporting and military explosives, Disruptive explosives for military use, Handling and storage of explosives.

Unit-IV

A) Applications of Biotechnology for the treatment of waste water: Introduction, Role of microorganism for the treatment of waste water, Application of biotechnology for a. high strength waste. b. Primary and secondary sludge c. Phenol & cyanide removal d. Solid phase extraction

B) Energy sources for future:

a. Solar Energy-Solar heating for homes and other buildings, electricity from solar thermal power collectors, electricity from photovoltaic cells.

b. Energy from biomass- Production of biomass, biofuels, biodiesel.

c. Geothermal energy,

d. water power

e. Tidal power.

f. Fuel Cells-Polymer electrolyte membrane fuel cells, Phosphoric acid fuel cell, Direct methanol fuel cell, Alkaline fuel cell, Regenerative(reversible) fuel cell, Clean cars for the future, Energy sources for the twenty first century.

References

1. Handbook of Industrial Chemistry,Vol.1, by K.H.Davis,F.S.Berner,Edited by S.C. Bhatia (CBS Publishers, Bangalore,2004)
2. Industrial inorganic chemistry, Karl Heinz Buchel, Hans-Heinrich Moretto, Peterwoditsch
3. Modern Electroplating, By M. Schlesinger and M. Paunovic (John Wiley and sons, Hoboken , New Jersey, 5th Edition2010)
4. Insight into Specialty Inorganic Chemicals-David Thompson (The Royal Society of Chemistry,1995)- Chapter 15.
5. New Trends in Green Chemistry (2nd Edition)-V.K.Ahluwalia and M.Kidwai (AnamayaPublishers, 2007)
6. Environmental Chemistry by A. K. Bagio.
7. Principles of Environmental Chemistry by James Girard Bartlett Publishers.
8. Waste Water Engineering by Calf& Eddy.
9. Waste Water treatment for pollution control by Arceivala.
10. Principles of water quality Control by T. H. Y Tebbut.
11. Manual on Sewage &Sewage treatment, Ministry of Works, New Delhi.

SEMESTER IV

Paper 15

MCH4T15: Elective (b) Organic Chemistry Special-II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: *At the end of the course students would be able to*

1. *Understand the reactivity of organometallic compounds*
2. *Demonstrate the applications of organometallic reagents in C-C bond formation*
3. *Understands the reactivity of heterocyclic compounds in various reaction conditions*
4. *Understand the electrophilic, nucleophilic reactions and synthesis of various heterocycles*
5. *Justify the need of protecting groups in organic synthesis*

Unit I:

Organometallic compounds of Group I and II Metals: Synthesis and applications of organolithium and organomagnesium reagents, nucleophilic addition to aldehyde, ketones, ester, epoxide, CO_2, CS_2, isocyanates, ketenes, imines, amides, lactones, Stereochemistry of Grignard addition to carbonyl compounds, *o*-metallation of arenes using organolithium compounds, Organocopper reagents: Preparation and applications in C-C bond forming reaction, mixed oragnocuprates, Gilman's reagent. Organo Hg and Cd reagents in organic synthesis, Reformatsky reaction, Barbier reaction

Unit II: Heterocycles-I

a) Ring Synthesis: Introduction, Cyclization reactions: Reaction types, displacement at saturated carbon, intramolecular nucleophilic addition to carbonyl groups, intramolecular addition of nucleophiles to other double bonds, cyclizations on to triple bonds, radical cyclizations, cabene and nitrene cyclization, electrocyclic reactions, reactions and structural effects of heterocyclic rings, ,3 - dipolar cycloadditions producing five - membered heterocycles, Hetero Diels-Alder reaction, [2+2] cycloaddition, ene reactions, Palladium catalysis in the synthesis of Benzo - Fused heterocycles

b) Three and four membered heterocylces: Aziridines, Oxiranes, Thirienes, Azetidines, Oxetanes and Thietanes

C) Azoles: Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages, Carbonyldiimidazole as coupling agent

Unit III: Heterocycles-II

A) Benzofused heterocycles: Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology, Synthesis and reactions of coumarin

B) Diazines: Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

C) Synthesis of following bioactive compounds: Vitamin B6, Ondansetron, Serotonin, Indometacin, Cyanamid, fentiazac, trimethoprim, papaverine

Unit IV:

A) Protection and de-protection of functional group in organic synthesis: Hydroxyl group- alkyl ether, benzyl ether,acyl, PMB, Trityl, TMS, TBDMS, THP, MOM, MEM, MIP ether; Diol- Acetone, Cyclohexanone; Amines- Benzyl, Acyl, CBZ, BOC, FMOC, Carboxyl group-Ester, DCCI, DIPCDI; Ketone and aldehydes- Glycol, Thioglycol, Ketal, Acetal; Othroesters as protecting groups, Protection deprotection approach - In Solid phase synthesis of polypeptide

B) Total synthesis selected molecules: FR-900848, cubane, biotin, longifolene and taxol, Endiandric Acid A, B, C and D

References

1. Organometallics: A concise Introduction, Ch. Elshebroicn and A. Salzer, VCH, chapters, 12-16
2. Organotransition Metal Chemistry: Applications to Organic Synthesis, S.G. Davies, Permagaon 1982.
3. Organometallics in Organic Synthesis – Swan & Black
4. Organometallic Chemistry - E.J. Elias and Gupta
5. Aromatic Heterocyclic Chemistry (Oxford Chemistry Primers) by David T. Davies
6. Heterocyclic Chemistry (3rd Edition) by Thomas. L. Gilchrist (Useful for Unit II)
7. Heterocyclic Chemistry by John A. Joule and K. Mills
8. The Chemistry of Heterocycles: Structure, Reactions, Syntheses, and Applications by Theophil Eicher and Siegfried HauptmannPrincipal of Modern Heterocyclic Chemistry-L .A .Paquelte
9. Heterocyclic Chemistry-Morton
10. An Introduction to Chemistry of Heterocyclic Compound-J .B .Acheson
11. Heterocyclic Chemistry by Dr Thomas. L. Gilchrist 3rd edition (Prentice Hall) for Unit II
12. Protective Groups in Organic Synthesis-T. W. Greene
13. Organic Chemistry, J .Clayden, N .Greeves, S .Warren and P .Wothers, Oxford University Press
14. Modern Organic Synthesis: An Introduction by G. S. Zweifel and M. H. Nantz (Wiley)

Weblink to Equivalent MOOC on SWAYAM if relevant:

- Organometallic Chemistry: Prof. D. Maiti, IIT Bombay
  https://nptel.ac.in/courses/104/101/104101079/
- Metal Mediated Synthesis: Prof. D. Maiti, IIT Bombay
  https://nptel.ac.in/courses/101/104/104101092/
- Transition Metal Organometallics in Catalysis and Biology: Prof. P. Ghosh, IIT Bombay
  https://archive.nptel.ac.in/courses/104/101/104101123/
- Classics in total synthesis: Prof. Krishna P. Kaliappan, IIT Bombay
  https://archive.nptel.ac.in/courses/104/101/104101133/
- Heterocyclic Chemistry: Prof. D. R. Mal, IIT Kharagpur
  https://archive.nptel.ac.in/courses/104/105/104105034/

SEMESTER IV

Paper 15

MCH4T15: Elective (c) Physical Chemistry Special-II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course students will be able to

1. *Execute the chemical dynamical calculations and research applications*
2. *Understand the applications of electrochemistry in industrial as well as research applications*
3. *Analyze the applications of radiation chemistry*
4. *Gain the knowledge of battery technology and their operations so as to work in the concerned research field*
5. *Understand, analyze and execute the concepts of quantum mechanics in various fields*

UNIT-I CHEMICAL DYNAMICS - II

A) Overview of Arrhenius rate law, Non-conventional equilibrium between reactants and activated complexes. Potential energy surfaces and reaction coordinate. Derivation of transition state theory-based equation for rate constant of bimolecular reaction. Prediction of rate constant using partition function and comparison with that given by collision theory. Arrhenius equation and activated complex theory. Transmission coefficient, quantum mechanical tunneling,

B) Reactions in solution: Cage effect, diffusion-controlled reactions, volume of activation its determination and correspondence with entropy of activation, Ionic reactions: Primary (Ionic strength) and Secondary salt effect and their nature.

UNIT II CORROSION AND CORROSION ANALYSIS

A) Scope and economics of corrosion, causes (Change in Gibbs free energy), Electrochemical Series and Galvanic series, dry (atmospheric) and wet (electrochemical) corrosion, other types of corrosion-Pit, Soil, chemical and electrochemical, inter-granular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

B) Thermodynamics of corrosion, corrosion measurements (Weight loss, OCP measurements, polarization methods), passivity and its breakdown, corrosion prevention (electrochemical inhibitor and coating methods).

UNIT – III: RADIATION CHEMISTRY AND BATTERY TECHNOLOGY

A) Interaction of radiation with matter, radiation track spurs and γ-rays. Linear energy transfer, Bathe's equation for linear energy transfer, Bresstrahlung effect, Passage of neutron through matter, Interaction of γ -radiation with matter, photoelectric effect and Compton effect, pair production phenomena, units of measuring radiation absorption, Chemical Dosimeters, Fricke Dosimeter and Ceric Sulphate Dosimeter, Conversion of measured dose values, Radiolysis of water, Radiolysis of some aqueous solutions. Effect of radiation on biological substances, genetic effects, Radiation effects on organic compounds and Polymers.

B) Battery Technology: basic concept, classification of batteries, primary, secondary and reserve batteries, Construction, working and application of Acid Storage batteries, Lithium -MnO_2

batteries, Nickel- Metal hydride batteries, Fuel Cells, Construction and working of $H_2O_2$and methanol-O_2 Cell.

UNIT IV: THE LIQUID STATE AND SOLUTIONS

A] Introduction, The van der Waals Approximation, Cell theory, Hole Theory, Radial Distribution Function Methods, Radial Distribution Functions and the Thermodynamic Functions, Other Theories, Applications of these theories.

B] Introduction to solutions, Lattice Models, Ideal solutions, non-ideal or regular Solutions (Bragg-Williams Approximation), Incomplete Miscibility, Dilute Solutions, Polymer Solutions.

References

1. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
3. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations McMilllan IndianLtd., New Delhi (1993)
5. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, **Vol 1**., Elsevier Publications, New York, 1969.
6. Gholam-Abbas Nazri, Gianfranco Pistoia, Lithum Batteries-Science and Technology, Springer, 2003.
7. C. H. Bamford and C. F. H. Tipper, Comprehensive Chemical Kinetics, **Vol 2**., Elsevier Publications, New York, 1969.
8. S. Glasstone, K. J. Laidler and H. Eyring, The Theory of Rate Processes, Mc-Graw Hill, New York, 1941.
9. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
10. D. Mcquarie and J. Simon, Physical Chemistry – A Molecular Approach, University Press, 2000
11. G. M. Barrow, Physical Chemistry, Tata Mc-Graw Hill, V edition 2003.
12. H. K. Moudgil, Text Book of Physical Chemistry, Pretice Hall of India, New Delhi, 2010.
13. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2102.
14. C.Kittel, **"** Introduction to solid state Physics**"**,Wiley
15. L.V.Azaroff, **"** Introduction to solids**"**, McGraw Hill
16. Santosh Kumar Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer 2006.
17. N. B. Hanny, Treaties in Solid State Chemistry, 4th Edn,
18. N. B. Hanny, "Solid State Chemistry"
19. M. C. Day and J Selbin, Theoretical Inorganic Chemistry, Reinhold Pub. Corp., New York,
20. C.N.Rao. Nuclear Chemistry
21. B. G. Harvey, Introduction to Nuclear Physics and Chemistry, Prentice Hall, Inc. (1969).
22. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.

23. W. Loveland, D. Morrissey and G. Seaborg, Modern Nuclear Chemistry, Wiley-Interscience, 2006.
24. P. P. Milella, Fatigue and Corrosion in Metals, Springer, 2013.
25. Corrosion- Understanding the Basics, asminternational.org, 2000.
26. H. H. Uhlig, Corrosion and Corrsion Control – 3rd edn, John Wiley and sons, New York.
27. J. W. T. Spinks and R. J. Woods, An Introduction to Radiation Chemistry, John Wiley and sons., New Yoek, 1975.
28. K. L. Kapoor, Text Book of Physical Chemistry, Vol – I to Vol-VI, 2011.

SEMESTER IV

Paper 15

MCH4T15: Elective (d) Analytical Chemistry Special-II

60 h (4 h per week): 15 h per unit *100 Marks*

Course Outcomes: At the end of the course, student will be able to

1. *Understand the fundamental principles forming basis for the instrumental methods of analysis.*
2. *Select most suitable technique for the desired analysis.*
3. *Identify experimental conditions necessary to carry out the analysis of different samples.*
4. *Formulate experiments based on optical and electroanalytical techniques.*
5. *Demonstrate working of each instrument used in analysis.*

Unit-I: Optical methods of analysis-IV

Inductively coupled plasma-atomic emission spectroscopy: Principle, atomization and excitation**.** Plasma source and sample introduction**.** Instrumentation**.** Comparison of ICP**-**AES with AAS**.** Applications**.**

X-ray fluorescence spectroscopy: Principle**.** Instrumentation**:** wavelength and energy dispersive devices**.** Sources and detectors**.** Comparison between wavelength and energy dispersive techniques**.** Sample preparation for XRF**.** Matrix effects in XRF**.** Applications in qualitative and quantitative analysis**.**

Electron microscopy: Principle, instrumentation and applications of scanning electron microscopy **(**SEM**)** and transmission electron microscopy **(**TEM**)**

Unit-II: Electrochemical methods of analysis-IV

Ion selective electrodes: Theory of membrane potential**.** Types of ion**-**selective electrodes**.** Construction of solid state electrodes, liquid membrane electrodes, glass membrane electrodes and enzyme electrodes, Selectivity coefficients, Glass electrodes with special reference to H^+, Na^+ and K^+ ions**.** Applications of ISE in analysis of environmentally important anions like F^-, Cl^-, Br^-, I^-, NO_3^- and CN^-**.** Advantages of ISE**.**

Coulometry**:** Principle**.** Coulometry at constant potential and constant current**.** Instrumentation**.** Applications and advantages of coulometric titrations**.**

Electrochemical microscopy**:** Introduction to scanning probe microscopy **(**SPM**)**, scanning tunneling microscopy **(**STM**)**, atomic force microscopy **(**AFM**)** and scanning electrochemical microscopy **(**SECM**).**

Unit-III: Thermal methods of analysis

Introduction to different thermal methods, Thermogravimetry (TG and DTG), Static thermogravimetry, quasistatic thermogravimetry and dynamic thermogravimetry, Instrumentation-Balances, X-Y recorder, Stanton-Redcroft TG-750, Thermogram, Factors affecting thermogram, Applications of thermogravimetry, Differential Thermal Analysis (DTA)- Theories, DTA curves, Factors affecting DTA curve, Applications of DTA, simultaneous determination in thermal analysis, Differential Scanning Calorimetry (DSC)- Introduction, Instrumentation, DSC curves, factors affecting DSC curves, applications, Thermogravimetric titration-Theory, Instrumentation and applications.

Unit-IV: Air pollution and analysis

Air pollution and analysis-classification of air pollutants, sources of air pollution and methods of control, sampling of aerosols and gaseous pollutants and their effects, SO_2, NO_2, CO, CO_2, particulates-SPM, RSPM, High Volume Sampler, Fabric Filters, Cyclones (direct and Reverse), ESP, ozone layer, Green house effect, Heat Islands, Acid Rain.

References

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
4. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
5. Vogel's Text Book of Quantitative inorganic Analysis: Bassett, Denney, Jeffery,Mendham (ELBS)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
7. Atomic Absorption Spectroscopy: Robinson (Marcel Dekker)
8. Instrumental Methods of chemical Analysis: Braun (Tata McGraw-Hill)
9. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
10. Analysis of Water: Rodier
11. Ion selective electrodes: Koryta (Cambridge University Press)
12. Industrial Chemistry: Arora and Singh (Anmol Publications)
13. Diffraction Methods: John Wormald (Clarendon Press)
14. Electroanalytical Chemistry: Bard (Dekker)
15. Analytical Chemistry by Open Learning (Wiley)
16. An Introduction to Electron Diffraction: Beeston (North Holand Publishing Co.)
17. Material Science and Engineering: V. Raghavan (Printice-Hall of India)
18. Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)
19. Indian Pharmacoepia, Vol-I, II and III.

Web link for related NPTEL courses

Analytical Chemistry: https://nptel.ac.in/courses/104105084

SEMESTER IV

Practical 8

MCH4P08: Major Research Project

12 h per week *200 Marks*

The objective of research project is to train the student in identifying the problem of research, develop the hypothesis, design the experiments/surveys to test the hypothesis, collect and analyse the data and draw conclusions from it. In addition, the aim is also to prepare the student to present the data in various forms such as project report, presentation in conferences and seminars and research paper. Research project is also aimed to prepare the student for doctoral research after the completion of the programme.

The student will have to carry out a research-based project work in the third and fourth semester. The project work may be carried out in the parent department or any other institute in collaboration with the parent institute. For this, the student will be attached to any of the national/regional/private research institute/organization for the duration of the fourth semester. If the student is working in the organisation other than the parent department, then it will be the responsibility of the student to attend the classes and other departmental activities in order to be eligible to appear for the examination. The student will be allotted the supervisor in the third semester; after which the student will finalize the topic of the project work in consultation with the supervisor.

The research project of the student will be evaluated on the basis of the project report submitted by him/her and the power point presentation made by him/her in the presence of internal and external examiner during the examination.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Computer Science)
Choice Based Credit System (Semester Pattern)
wef. 2023-24 as per NEP 2020

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Computer Science)
Choice Based Credit System (Semester Pattern), wef. 2023-24 as per NEP 2020

Pre-requisites to enrol for the M. Sc. Computer Science Programme:

The student who has completed the B. Sc. Coursewith Computer Science as one of the optional subject or Bachelor of Computer Application (BCA)or B. Sc. (IT) or B. Sc. (Data Science) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol for M. Sc. (Computer Science)Part I (Semester I). However, the student who has completed four-year B. Sc. course [B. Sc. (Honours)/(Research) as per NEP- 2020] with Computer Science/Information Technology/Data Science as the major subject or Bachelor of Computer Application (BCA) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol directly to M. Sc. (Computer Science) Part II (Semester III).

Credit distribution structure for two years Post Graduate Programme in Computer Science*

Year (2 Yr PG)	Level	Sem. (2 Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem. I	12 (3 theory + 2 Practical)	4	4			20	OneYear PG Diploma
		Sem. II	12 (3 theory +2 Practical)	4		4		20	
Cum. Cr. For PG Diploma/ I year of PG			24	8	4	4	-	40	
Exit option: One Year PG Diploma 40 credits									
II	6.5	Sem. III	12 (3 theory +2 Practical)	4			4	20	PG Degree After 3 Yr UG or PG degree after 4-Ys UG
		Sem. IV	12 (3 theory +2 Practical)	4			6	22	
Cum. Cr. For II year of PG			24	8			10	42	
Cum. Cr. For 2 year of PG degree			48	16	4	4	10	82	

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Computer Science)
Choice Based Credit System (Semester Pattern), wef. 2023-24 as per NEP 2020

Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Artificial Intelligence	MCS1T01	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Compiler Construction	MCS1T02	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 1	MCS1T03	4	-	-	4	3	80	20	40	-	-	-	100
4	RM	Research Methodology	MCS1T04	4	-	-	4	3	80	20	40	-	-	-	100
5	DSC	Practical Based on Paper MCS1T01 and MCS1T02	MCS1P01	-	-	6	3	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MCS1T03 and MCS1T04	MCS1P02	-	-	6	3	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

CIE = Continuous Internal Evaluation and SEE = Semester End Examination

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Cloud Computing	MCS2T05	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Machine Learning	MCS2T06	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 2	MCS2T07	4	-	-	4	3	80	20	40	-	-	-	100
4	OJT	Apprenticeship/Mini Project (Related to DSC)	MOJ2P01	-	-	8	4	3	-	-	-	50	50	50	100
5	DSC	Practical Based on Paper MCS2T05and MCS2T06	MCS1P03	-	-	6	3	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MCS2T07	MCS1P04	-	-	6	3	-	-	-	-	50	50	50	100
Total				12	-	20	**22**		**240**	**60**		**150**	**150**		**600**

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Advanced Software Engineering	MCS3T08	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Network Security	MCS3T09	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Digital Image Processing	MCS3T10	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 3	MCS3T11	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP3P01	-	-	8	4	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MCS3T08 ,MCS3T09,MCS3T10 and MCS3T11	MCS1P05	-	-	4	2	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

Semester IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Big Data Analytics	MCS4T12	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Computer Vision	MCS4T13	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Deep Learning	MCS4T14	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 4	MCS4T15	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP4P02	-	-	12	6	-	-	-	-	100	100	100	200
Total				16	-	12	22		**320**	**80**		**100**	**100**		**600**

Total Credits for Four Semesters (Two Year Course): = 88

Total Marks for Four Semesters (Two Year Course):= 2400

Abbreviations:

DSC: Discipline Specific Course, **DSE**: Discipline Specific Elective **SEE:** Semester End Examination, **CIE:** Continuous Internal Evaluation, **OJT:** On the Job Training (Internship/Apprenticeship), **FP:** Field Project, **RM:** Research Methodology, **RP**: Research Project

Elective papers:

In addition to the mandatory papers, the student has to opt for ONE elective paper in each semester from the basket of elective papers mentioned in the following table.

Basket for Elective Courses (4 Credits each)

Semester	Course Category	Name of the course	Course Code
I	Elective 1	a) Computer Architecture & Organization b) Discrete Mathematics c) Equivalent MOOC course	MCS1T03
II	Elective 2	a) R Programming b) Neural Network c) Equivalent MOOC course	MCS2T07
III	Elective 3	a) Computer Graphics b) Internet of Things (IOT) c) Equivalent MOOC course	MCS3T11
IV	Elective 4	a) Design and Analysis of Algorithm b) Cyber Forensics a) Equivalent MOOC course	MCS4T15

The students can opt either the elective paper taught in the department in offline mode or any other equivalent online course of at least 4 credits offered by MOOC or any other such platform. The student should submit the passing certificate to the College in order to include the marks in the marksheet. **The MOOCs which is identical to courses offered in this scheme of M.Sc. Computer Science (in terms of contents) and are accessible to the student shall not be allowed for credit transfer.**

The objectives of the Program

1. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves.
2. To provide opportunity for the study of modern methods of information processing and its applications.
3. To develop among students the programming techniques and the problem solving skills through programming

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. The ability to apply theoretical foundations of Computer Science and problem-solving skills through programming techniques for complex real time problems using appropriate data structures and algorithms.
2. The ability to design/develop hardware and software interfaces along with database management to meet the needs of industry.
3. The ability to demonstrate personal, organizational and entrepreneurship skills through critical thinking, engage themselves in life-long learning by following innovations in business, science & technology
4. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

M. Sc. (Computer Science)
Semester I

MCSIT01
Paper I: ARTIFICIAL INTELLIGENCE

Hours/Week : 4
Credits : 4

Course Objectives:

1. To impart artificial intelligence principles, techniques and its history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes:

- Evaluate Artificial Intelligence (AI) methods and describe their foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
- Analyze and illustrate how search algorithms and planning play vital role in problem solving.

UNIT I

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs AI Search techniques :- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

UNIT II

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logic programming, Forward versus Backward Reasoning, Matching, Control knowledge, Expert System.

UNIT III

Games playing: Minimax search procedure , adding alpha-beta cutoffs, additional refinements, Planning :- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

UNIT IV

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Introduction to pattern recognition, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems.

Books:

1. Artificial Intelligence by Elaine Rich, Mcgrawhill Inc.
2. Artificial Intelligence and Expert Systems – Jankiraman, Sarukes (M)
3. Lisp Programming – RajeoSangal – (TMH)
4. Artificial Intelligence – Russell-Pearson- Ist Text book.
5. Principles of AI- Nils Nilson
6. A.I. by R.J.Winston - Pearson

M. Sc. (Computer Science)
Semester I

MCS1T02
Paper II: COMPILER CONSTRUCTION

Hours/Week : 4
Credits : 4

Course Objectives:

1. To gain knowledge on Language Processor.
2. Distinguish different computing models and classify their respective types
3. Show a competent understanding of the basic concepts of Syntax Analysis.

Course Outcomes:

- Demonstrate the knowledge of Lexical Analysis
- Derive an appropriate model of code generation.

UNIT I

Introduction: Language Processors, the structure of a compiler, Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table Management, The Grouping of Phases into Passes, Compiler-Construction Tools.Evolution of Programming Languages: The Move to High-Level languages, Impact on Compilers, Applications of Compiler Technology, Programming Language Basics

UNIT II

A Simple Syntax-Directed Translator: Introduction, Syntax Definition, Syntax-Directed Translation, Parsing:Top-Down Parsing, Predictive Parsing.
Lexical Analysis: The role of the lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens: Transition Diagrams, Recognition of Reserved Words and Identifiers, The Lexical-Analyzer Generator 'Lex'.

UNIT III

Syntax Analysis: Introduction, Context-free grammars: The Formal Definition, Notational Conventions, Derivations and parse trees, Ambiguity, Writing a Grammar, Top-Down Parsing: Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Nonrecursive Predictive Parsing, Bottom-Up Parsing: Reductions, Handle Pruning, Shift-Reduce Parsing.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations: Type Expressions, Type Equivalence, Declarations, Type Checking: Rules, Type Conversions, Control Flow: Boolean Expressions, Short-Circuit Code, Flow-of-Control Statements, Control-Flow Translation of Boolean Expressions, Backpatching.

UNIT IV

Run-Time Environments: Storage Organization, Stack Allocation of Space, Heap Management.
Code Generation: Issues in Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs: Basic Blocks, Flow Graphs, Representation of Flow Graphs, Optimization of Basic Blocks: The DAG Representation of Basic Blocks, Finding Local Common Subexpressions, Dade Code Elimination, The use of Algebraic Identities, Representation of Array References, Peephole Optimization: Eliminating Redundant Loads and Stores, Eliminating Unreachable Code, Flow-of-Control Optimization.

Books:

1. Principles of Compiler Design - A.V. Aho, M. S. Lam, Ravi Sethi, J. D. Ullman, Second Edition, Pearson Education Inc.
2. Principles of Compiler Design - A.V. Aho, J. D.Ullman ; Pearson Education.
3. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
4. Engineering a Compiler-Cooper & Linda, Elsevier.
5. Compiler Construction, Louden, Thomson.

M. Sc. (Computer Science)
Semester I

Elective 1: MCSIT03
Paper III: COMPUTER ARCHITECTURE AND ORGANIZATION

Hours/Week : 4
Credits : 4

Course Objectives:

1. To provide knowledge on overview of IAS computer function and addressing modes.
2. Hardware and software implementation of arithmetic unit to solve addition, subtraction, multiplication and division.
3. To provide knowledge of memory technologies, interfacing techniques and sub system devices.

Course Outcomes:

- Provide fundamentals on machine instructions and addressing modes.
- Comprehend the various algorithms for computer arithmetic.
- Analyse the performance of various memory modules in memory hierarchy.
- Compare and contrast the features of I/O devices and parallel processors.
- Outline the evaluation of memory organization.
- Analyse the performance of Arithmetic logic unit, memory and CPU.

UNIT I

Principle of computer design : Software, hardware interaction, layers in computer architecture, central processing and machine language instruction, addressing modes, instruction types, instruction set selection, instruction and execution cycle.

UNIT II

Control Unit: Data path and control path design, microprogramming v/s hardwired control, pipelining in CPU design, RISC v/s CISC, superscalar processors.

UNIT III

Memory subsystem: Storage technologies, memory array organization, memory hierarchy, interleaving, cache memory and virtual memory including architectural aids to implement these.

UNIT IV

Input/ Output Processing: Bus Interface, Data transfer techniques, I/O interrupts and channels, Performance evaluation: SPEC marks, Transaction Processing Benchmarks.

Books:

1. Computer Architecture and Organization by Tenenbaum
2. Computer Architecture and Organization by J. P. Hayes.
3. Parallel Processing by Hwang
4. Computer Organization by Hamacher, Vranesic, Zaky (TMH)

M. Sc. (Computer Science)
Semester I

Elective 1: MCSIT03
Paper III: DISCRETE MATHEMATICAL STRUCTURE

Hours/Week : 4
Credits : 4

Course Objectives:

1 To cover certain sets, functions, relations and groups concepts for analyzing problems that arise in engineering and physical sciences.
2 To imparting to analyze the problems connected with combinatorics and Boolean algebra.
3 To solve calculus and integral calculus problems.

Course Outcomes:

- Observe the various types of sets, functions and relations.
- Understand the concepts of group theory.
- Understand the concepts of combinatorics.
- Understand the concepts of graph theory and its applications.
- Learning logic and Boolean algebra. Using these concepts to solve the problems.

UNIT I

Mathematical Logic: Propositional Calculus: Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, duality law, Tautological Implications, functionally complete set of connectives, other connectives. **Normal Forms**: CNF, DNF, PCNF, PDNF.

UNIT II

Fundamentals: Sets and Subsets, operations on sets, sequences, Division of the integer, Matrices, Methods of Proof, Mathematical Induction.
Counting: Permutations, Combinations, The pigeonhole Principle, Recurrence Relations.

UNIT III

Relations and Digraphs: Product sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Operations of Relations, Transitive Closure and Warshall's Algorithms.
Functions: Definition and Introduction, Permutation Functions, Growth of Functions.

UNIT IV

Order Relations and Structures: Partially Ordered Sets, Lattices.
Graph Theory: Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits.
Tree: Introduction, Undirected Tree, Minimal Spanning Trees.
Semigroups and Groups: Binary Operations Revisited, Semigroups, Products and Quotients of Groups.

Books:

1. Discrete Mathematical Structures By Bernard Kolman, Busby & Sharon Ross [PHI].
2. Discrete Mathematical Structures with Application to computer science By J. P. Tremblay & R. Manohar [Tata McGraw –Hill]
3. Discrete Mathematics with Graph Theory by Goodaire[PHI]
4. Discrete Mathematics by J.K.Sharma(McMillan)
5. Discrete Mathematics and its Applications by Kenneth Rosen (TMH)

M. Sc. (Computer Science)
Semester I

MCSIT04

Paper IV: RESEARCH METHODOLOGY

Hours/Week : 4
Credits : 4

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study processing and analysis of data, Quantitative and Qualitative data analysis.
3. Reviewing Literature and research papers, writing research papers, Thesis reports.

Course Outcomes:

- The basic concept of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters.
- Prepare a project (to undertake a project)
- Organize and conduct research in a more appropriate manner, writing research report and thesis.

UNIT I

Introduction: meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research processes, criteria of good research, **Defining Research Problem:** necessity of defining the problem, techniques involved in defining a problem, **Research Design**: meaning of research design, need for research design, features of good design, different research designs, basic principles of experimental design.

UNIT II

Methods of Data Collection: Collection of primary data, Observation method, Methods of Data collection, Interview Method, Collection of data through questionnaire, Collection of data through schedules, Difference between questionnaire and schedules, **Processing and Analysis of Data:** Processing operations, Problems in processing, Types of Analysis, Statistics in Research, Simple Regression analysis, multiple correlation and regressions, Partial correlation. **Quantitative Data analysis:** Types of quantitative data, data coding, visual aids for quantitative data analysis using statistics for quantitative data analysis, Interpretation data analysis result, evaluating quantitative data analysis, **Qualitative Data analysis:** Analyzing textual data, analyzing non-textual qualitative data, Grounded theory, computer aided qualitative analysis, evaluating qualitative data analysis.

UNIT III

Interpretation and Report Writing: Techniques of Interpretation, Significance of Report Writing, Different steps in Writing report, Layout of research report, type of report, oral presentation, mechanics of writing a research report **Python Tools:** File Handling, Introduction, Handling Binary data and CSV files, Zipping and Unzipping files, Directory **Regular Expression and Web scraping:** Introduction, Function of Re Module, web scraping.

UNIT IV

LaTeX: Writing scientific report, structure and components of research report, revision and Refining, writing project proposal, paper writing for international journals, submitting to editors conference presentation, preparation of effective slides, pictures, graphs and citation styles.

Books:

1. C. R. Kothari, Research Methodology Methods and Techniques, 2nd. ed. New Delhi: New Age International Publishers, 2009.
2. Briony J. Oastes, Researching Information Systems and Computing, SAG Publication India Pvt. Ltd., New Delhi.
3. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, Python Programming: A Practical Approach, First edition published 2022 by CRC Press.
4. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004.

M. Sc. (Computer Science)
Semester II

MCS2T05
Paper I: CLOUD COMPUTING

Hours/Week : 4
Credits : 4

Course Objectives:

1. To Understand fundamentals of cloud computing
2. To acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications

Course Outcomes:

- Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Program data intensive parallel applications in the cloud.
- Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
- Identify security and privacy issues in cloud computing.

UNIT I

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds, Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology. Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT II

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

UNIT III

Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations. Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images. Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability. Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

UNIT IV

Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking, How the Cloud Will Change Operating Systems,

Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Books:

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
5. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
6. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

M. Sc. (Computer Science)
Semester II

MCS2T06
Paper II: MACHINE LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:

1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:

- Understand the concepts of various machine learning strategies.
- Handle computational data and learn ANN learning models.
- Solve real world applications by selecting suitable learning model.
- Boost the performance of the model by combining results from different approaches.

UNIT I

Learning: Types of Machine Learning, Supervised Learning, The Brain and the Neuron, Design a Learning System, Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search, Finding a Maximally Specifie Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability, Linear Regression.

UNIT II

Multi-layer Perceptron: Going Forwards, Going Backwards: Back Propagation Error, Multilayer Perceptron in Practice, Examples of using the MLP, Overview, Deriving Back Propagation, Radial Basis Functions and Splines, Concepts, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machines.

UNIT III

Learning with Trees: Decision Trees, Constructing Decision Trees, Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Probability and Learning, Data into Probabilities, Basic Statistics, Gaussian Mixture Models, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms, Vector Quantization, Self-Organizing, Feature Map

UNIT IV

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Isomap, Least Squares Optimization, Evolutionary Learning, Genetic algorithms, Genetic Offspring: Genetic Operators, Using Genetic Algorithms, Reinforcement Learning, Overview, Getting Lost Example, Markov Decision Process, Graphical Models: Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Method

Books:

1.Introduction to Machine Learning (Adaptive Computation and Machine Learning Series),EthemAlpaydin,Third Edition, MIT Press

2.Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, Wiley

3.Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach,Cambridge University Press.

4.Deep Learning , Rajiv Chopra, Khanna Publi.

5.Machine Learning, V. K. Jain, Khanna Publi

M. Sc. (Computer Science)
Semester II

Elective 2: MCS2T07
Paper III: R PROGRAMMING

Hours/Week : 4
Credits : 4

Course Objectives:

1. This course introduces R, which is a popular statistical programming language.
2. The course covers data reading and its manipulation using R, which is widely used for data analysis. It also covers different control structures and design of user-defined functions. Loading, installing and building packages .

Course Outcomes:

- Develop an R script and execute it
- Install, load and deploy the required packages, and build new packages for sharing and reusability 3. Extract data from different sources using API and use it for data analysis
- Visualize and summarize the data
- Design application with database connectivity for data analysis

UNIT I

Introduction, How to run R, R Sessions, Introduction to Functions, Important R Data - Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II

R Programming Structures, Control Statements, Loops, Looping Over Non, vector Sets, If Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return Returning Complex Objects, Functions are Objective, No Pointers in R Recursion, A Quicksort Implementation Extended, Example: A Binary Search Tree.

UNIT III

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability Cumulative Sums and Products Minima and Maxima Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /Output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot () Function – Customizing Graphs, Saving Graphs to Files. Probability Distributions, Normal Distribution Binomial Distribution Poisson Distributions other Distribution, Basic Statistics, Correlation and Covariance.

Books:

1. The Art of R Programming, Norman Matloff, Cengage Learning
2. Cotton, R., Learning R: a step by step function guide to data analysis. 1st edition.O'reilly Media Inc.
3. R for Everyone, Lander, Pearson Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGrawHill International, Auckland.

M. Sc. (Computer Science)
Semester II

Elective 2: MCS2T07
Paper III: NEURAL NETWORK

Hours/Week : 4
Credits : 4

Course Objectives:

1. To introduce the foundations of Artificial Neural Networks
2. To learn various types of Artificial Neural Networks

Course Outcomes:

- Ability to understand the concepts of Neural Networks.
- Ability to select the Learning Networks in modeling real world systems

UNIT I

Introduction: Feedforward Neural Networks: Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Network Geometry of Binary Threshold Neurons and Their Network: Patterns Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are pattern Dichotomizes, Non-linearly separable Problems, Capacity of a simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks.

UNIT II

Supervised Learning I: Perceptrons and LMS: Learning and Memory, From Synapses to Behaviour: The Case of Aplysia, Learning Algorithms, Error Correction and Gradient Descent Rules, The Learning Objective for TLNs, Pattern space and Weight Space, Perceptron Learning Algorithm, Perceptron Convergence Theorem, Perceptron learning and Non-separable Sets, Handling Linearly Non-Separable sets, α-Least Mean Square Learning, MSE Error Surface and its Geometry, Steepest Descent Search with Exact Gradient Information, μ-LMS: Approximate Gradient Descent, Application of LMS to Noise Cancellation

UNIT III

Supervised Learning II: Backpropagation and Beyond: Multilayered Network Architectures, Backpropagation Learning Algorithm, Structure Growing Algorithms, Fast Relatives of Backpropagation, Universal Function Approximation and Neural Networks, Applications of Feedforward Neural Networks, Reinforcement Learning

UNIT IV

Neural Networks: A Statistical Pattern Recognition Perspective: Introduction, Bayes Theorem, Classification Decisions With Bayes Theorem, Probabilistic Interpretation Of A Neuron Discriminant Function, Interpreting Neuron Signals As Probabilities, Multilayered Networks, Error Functions And Posterior Probabilities, Error Functions For Classification Problems

Generalization: Support Vector Machines and Radial Basis Function Networks: Learning from Examples and Generalization, Statistical Learning Theory Briefer, Support Vector Machines, Radial Basis Function Networks, Regularization Theory Route to RRBFNs, Generalized Radial Basis Function Network, Learning In RRBFNs, Image Classification Application, Other Models for Valid Generalization

Books:

1. Neural Network- A Classroom Approach, Satish Kumar, Tata McGraw Hill
2. Introduction to neural networks using MATLAB 6.0 by Sivanandam, S Sumathi, S N Deepa, Tata Mcgraw Hill
3. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
4. Artificial neural networks - B.Yegnanarayana, Prentice Hall of India P Ltd 2005.
5. Neural networks in Computer intelligence, Li Min Fu, TMH 2003.
6. Neural networks James A Freeman David M S kapura, Pearson education 2004.

M. Sc. (Computer Science)
Semester III

MCS3T08
Paper I: ADVANCED SOFTWARE ENGINEERING

Hours/Week : 4
Credits : 4

Course Objective:
The course offers students to develop the ability to design software systems and analyse and test their performance.

Course Outcomes:
On successful completion of this subject students should be able to:

- To demonstrate an understanding of advanced knowledge of the practice of software engineering, design, validation, test and deployment.
- Use modern engineering principles, processes, and technologies to solve difficult engineering issues and tasks.
- Demonstrate leadership and the ability to participate in teamwork in an environment with different disciplines of engineering, science and business.
- Identify the proper ethical, financial, and environmental effects of their work.

Unit I
Introduction to Software Engineering, Software Engineering as a Layered Technology, Software Development Life Cycle, Generic View of process, A process framework, Process Model – Waterfall, Incremental, Evolutionary, Unified Process Model, Agile Process Model, Scrum, Dynamic System development model, CMMI.

Unit II
System Models: Context Model, Behavioural Model, Data Model, Object Model, Modelling with UML, Design Engineering: Design Process, Design Quality, Design Concepts: Abstraction, Architecture, Patterns, Information Hiding, Functional Independence, Modularity, Design Model: OO Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Unit III
Testing Strategies, Strategic Approach to software testing: Verification, Validation, Error, Fault, Bug, Failure. Types of software testing: Unit Testing, White Box Testing, Black Box Testing, Software Quality Assurance: Software Reliability, Risk Management: Reactive, Proactive risk, Risk Identification, Risk Projection, Risk Refinement, RMMM plan.

Unit IV
Software Metrics: Software Sizing, LOC, FP Based estimations, estimation model, COCOMO Model, Project Scheduling, Time Line Chart, Software Configuration Management: Change Control and version control, software Reuse, Software Re-engineering, Reverse Engineering.

Books:
1. Software Engineering: A Practitioner's Approach, Roger Pressman, Macgraw Hill International Edition.
2. Fundamentals of Software Engineering, Carlo Gheezzi, Mehdi Jazayeri, Dino Mandrioli, PHI Publication.

M. Sc. (Computer Science)
Semester III

MCS3T09
Paper II: NETWOR SECURITY

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on Network security, various encryption techniques, and intrusion detection and the solutions to overcome the attacks.

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify the symmetric encryption techniques
- Illustrate various Public key cryptographic techniques
- Evaluate the authentication and hash algorithms.
- Basic concepts of system level security

Unit I

Introduction to Security Security Goals, Different Types of Attacks on Networks, Threats, Vulnerabilities, Attacks, Data Integrity, Confidentiality, Anonymity Message and Entity Authentication Authorization, Nonrepudiation, Cryptographic Techniques.

Unit II

Principles of Cryptography Symmetric Key Cryptography: DES, Block Cipher Modes of operation, Advanced Encryption Standard. Key distribution, Attacks. Public key Cryptography RSA, Cryptographic Hash functions, Authentication, Message Authentication Code (MAC), Digital Signatures, DSA Signatures.

Unit III

PKI and Security Practices Digital Certificates, MD5, SHA, Challenge Response protocols-Authentication applications, Kerberos, X.509, Securing Email, Web Security.

Unit IV

Software Vulnerabilities Buffer Overflow, Cross Site Scripting, SQL Injection, Case Studies on worms and viruses, Virtual Private Networks, Firewalls **Wireless Security** Security in Wireless Local Area Networks, Security in Wireless Ad Hoc and Sensor Networks, Security of the Internet of Things

Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 7th edition, 2016.
2. Behrouz A. Forouzan, Cryptography and networksecurityMCGrawHill3rdEdition
3. C. Kaufman, R. Perlman, M. Speciner, "Network Security: Private Communication in a Public World", Pearson Education, 2nd edition, 2002.

Reference Books:

1. Applied Cryptography - Schnier
2. J. Edney, W.A. Arbaugh, "Real 802.11 Security: Wi-Fi Protected Access and 802.11i", Pearson Education, 2004.
3. E. Rescorla, "SSL and TLS: Designing and Building Secure Systems", Addison-Wesley, 2001.
4. B.L. Menezes, "Network Security and Cryptography", Wadsworth Publishing Company Incorporated, 2012.
5. Handbook of Applied Cryptography - Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone: Online Version

M. Sc. (Computer Science)
Semester III

MCS3T10
Paper III: DIGITAL IMAGE PROCESSING

Hours/Week : 4
Credits : 4

Course Objective: The course offers the students to develop the ability to understand image analysis algorithms and current applications in the field of digital image processing.

Course Outcomes:

On successful completion of this subject students should be able to:

• Know and understand the basics and fundamentals of digital image processing, digitization, sampling, quantization, and 2D-transforms.

• Operate on images using the techniques of smoothing, sharpening and enhancement. Understand the restoration concepts and filtering techniques.

Unit I

Fundamentals of Digital Image Processing:

Steps in Digital Image Processing, Components, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Color image fundamentals, RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit II

Image Enhancement: Spatial Domain: Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

Unit III

Image Restoration: Image Restoration, degradation model, Properties, Noise models, Mean Filters, Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener filtering

Unit IV

Image Segmentation: Edge detection, Edge linking via Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and merging, Morphological processing- erosion and dilation, Segmentation by morphological watersheds, basic concepts, Dam construction, Watershed segmentation algorithm.

Books:

1. Rafael C. Gonzalez, Richard E. Woods,'_Digital Image Processing', Pearson, Third Edition, 2010.
Anil K. Jain, _Fundamentals of Digital Image Processing', Pearson, 2002.
2. Kenneth R. Castleman, _Digital Image Processing', Pearson, 2006.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
4. D.E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, _Digital Image Processing', John Wiley, New York, 2002.
6. Milan Sonka et al _Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

M. Sc. (Computer Science)
Semester III

Elective 3: MCS3T11
Paper IV: COMPUTER GRAPHICS

Hours/Week : 4
Credits : 4

Course Objective:

1. To make students understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
2. To make the student present the content graphically.

Course Outcomes:

On successful completion of this subject students should be able to:

- Students can animate scenes entertainment.
- Will be able to work in computer aided design for content presentation..
- Better analogy data with pictorial representation.

Unit I

Introduction of computer Graphics and its applications. Overview of Graphics systems. Video display devices, Raster scan display, Raster scan systems, video controller, Raster scan display processor, Random scan display, random scan systems, color CRT monitor, Flat panel display, Interactive input devices, Logical classification of input devices, Keyboard, mouse, Trackball and spaceball, Joysticks, Image scanner, Light pens, Graphics software, Coordinates representations, Graphics functions.

Unit II

Line drawing algorithms, DDA, Bresenham's, Circle generating, Mid-point circle algorithm, Ellipse generating, Polygon , Scan-line polygon fill, Boundary fill.

Unit-3 : Basic transformation's, Translation, Rotation, Scaling, Matrix representation's & homogeneous coordinates, Composite transformation's, Reflection, Two dimensional viewing, Two dimensional clipping, Line, Polygon, Curve, Text. 3D-transformation, Projection, Viewing, Clipping. Spline representation, Cubic spline, Bezier curve, Bezier surfaces, Beta spline, B-spline surfaces, Bspline curve, Hidden surfaces, Hidden lines, Z-buffer.

Unit IV

Fractal's geometry Fractal generation procedure, Classification of Fractal, Fractal dimension, Fractal construction methods. Color models, XYZ, RGB, YIQ, CMY & HSV, Shading algorithms, Shading model, Illumination model, Gouraud shading, Phong shading.

Books:

1. Computer Graphics by M. Pauline Baker, Donald Hearn, 2 Edition PHI.
2. Mathematical Element for Computer Graphics By. David F. Roger., J. Alan Adams, 2nd Edition, Tata McGHill.

Reference Books:

1. Principles of Interactive Computer Graphics By. William. M. Newmann. 2nd Edition Mc. Graw Hill.
2. Procedural Element for Computer Graphics By. David F. Roger. Mc. Graw Hill.
3. Computer Graphics By A.P. Godse, 2nd Editio TPPublication,
4. Computer Graphics By V.K. Pachghare, 2nd Edition, Laxmi Publication 5. Computer Graphics By Apurva Desai (PHI)

M. Sc. (Computer Science)
Semester III

Elective 3: MCS3T11
Paper IV: INTERNET OF THINGS (IOT)

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on IoT and protocols, it expose the student to some of the electrical application areas where Internet of Things can be applied..

Course Outcomes:
On successful completion of this subject students should be able to:

- Able to understand the application areas of IoT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics,

UNIT I
Introduction to IoT: Overview of IoT, Types of Iot frameworks, IoT Ecosystem, Design patterns for IoT, Iol architectures such as four-layer architecture, seven-layer architecture. IoT sensors and actuators: Understanding the types of sensors: Temperature, humidity, proximity, light and actuators used in IoT devices: pump, servo motor and LED and their applications.

UNIT II
IoT communication protocols: Learning about various communication protocols such as MQTT, CoAP, HTTP, and their usage in IoT devices.
IoT platforms and cloud computing: Understanding IoT platforms: Cloud based IoT platform, Edge Based IoT Platform, On-Premises Cloud Platform. Cloud computing. IoT devices communication with cloud using Messaging, PUB/SUB, API, and their role in the deployment of IoT applications.

UNIT III
Data Analytics and Machine Learning for IoT: Data collection and Storage in IoT. Techniques and tools used for analyzing and processing data generated by IoT devices, including machine learning algorithms.
Security and Privacy in IoT: Understanding the security and privacy challenges in IoT and techniques for securing IoT systems.

UNIT IV
Overview of Arduino, Introduction to programming languages and IDEs, Basic electronics concepts (resistors, capacitors, LEDs, etc.), Introduction to breadboards and circuit design, Variables, data types, and control structures, Functions and libraries, Sensors and Actuators, Introduction to sensors (e.g., temperature, humidity, light), Introduction to actuators (e.g., motors, LEDs, relays), Connecting and controlling sensors and actuators with Arduino
Case Studies on IoT Applications For Smart Homes, Cities, Environment-Monitoring And Agriculture

Books:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Robert Barton, Jerome Henry
2. INTERNET OF THINGS Architecture and Design Principles, Raj Kamal, McGraw Hill Education (India) Private Limited
3. THE INTERNET OF THINGS KEY APPLICATIONS AND PROTOCOLS Olivier Hersent Actility, France David Boswarthick ETSI, France Omar Elloumi Alcatel-Lucent, France
4. Internet of Things -Architecture, Implementation and Security by Mayur Ramgir
5. Programming Arduino ™ Getting Started with Sketches Simon Monk

M. Sc. (Computer Science)
Semester IV

MCS4T12
Paper I: BIG DATA ANALYTICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers students to develop understanding towards the basic concepts of Big Data, adaptation and planning of Big Data and Business Intelligence

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify and categorize different types of Data Analytics
- frame Business Architecture
- Understand the use of Information and Communication Technology
- Differentiate Between Traditional data Analysis and Big Data Analytics
- Evaluate different Enterprise Technologies and Big Data Business Intelligence

Unit I

Concepts and terminology: Data Sets, Data Analysis, Data Analytics, Descriptive, Diagnostic, Predictive, Prescriptive Analytics, Business Intelligence, Big Data Characteristics, Volume, Velocity, Variety, Veracity and Value. Different types of Data, Structured, Unstructured, Semi-Structured, Meta Data Business Motivations and Drivers for Big Data Adoption.

Unit II

Big Data Analytics Life cycle - Business Case Evaluation, Data Identification, Data Acquisition and Filtering, Data Extraction, Data Validation and Cleansing, Data Aggregation and Representation, Data Analysis, Visualization, Utilization of Analysis Results.

Unit III

Enterprise Technologies - OLTP, OLAP, ETL Big Data BI, Clusters, Big Data Storage Concepts, Big Data Processing Concepts, Big Data Storage Technology - On Disk Storage Devices, NOSQL Databases, In-Memory Storage Devices.

Unit IV

Big Data Analysis Techniques - Quantitative, Qualitative, Statistical Analysis, Semantic Analysis, Visual Analysis, Introduction to Hadoop, Map Reduce, Hive, Pig, Spark and Big Data Analytics.

Books:

1. Big Data Fundamentals Concepts, Drivers & Techniques Thomas ErL, Wajid Khattak and Paul Buhler, Pearson Publication 2022.
2. Big Data Analytics Introduction to Hadoop, Spark and Machine-Learning, RajKamal, Preeti Saxena, McGraw Hill Publication, 2019.

M. Sc. (Computer Science)
Semester IV

MCS4T13
Paper II: COMPUTER VISION

Hours/Week : 4
Credits : 4

Course Objective: The course offers to introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving.

Course Outcomes:

On successful completion of this subject students should be able to:

- Implement fundamental image processing techniques required for computer vision.
- Develop computer vision applications.

Unit I

Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, Matching, Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.

Unit II

Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.

Unit III

Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting). **Region Analysis**: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

Unit IV

Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry - from 2D to 3D, Image matching: Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching.

Books:

1. David A. Forsyth, Jean Ponce,"Computer Vision: A Modern Approach"
2. R. Jain, R. Kasturi, and B. G. Schunk, "Machine Vision", McGraw-Hill.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision" Thomson Learning.
4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison- Wesley, 1993.

M. Sc. (Computer Science)
Semester IV

MCS4T14
Paper III: DEEP LEARNING

Hours/Week : 4
Credits : 4

Course Objectives: The course offers to understand major deep learning algorithms and to identify deep learning techniques suitable for a given problem.

Course Outcomes:

On successful completion of the course students will be able to:

- Solve various deep learning problems
- Apply autoencoders for unsupervised learning problems
- Implement Convolutional Neural Networks to image classification problems
- Apply recurrent neural network to sequence Learning Problem.

Unit I

Introduction to Neural Networks: Feed Forward Neural Networks, Backpropagation , Gradient Descent (GD) Principal Component Analysis: Eigenvalues and eigenvectors, Eigenvalue Decomposition Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition.

Unit II

Autoencoders: Undercomplete Autoencoders, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Noise Robustness

Unit III

Convolutional Neural Networks: The Convolution Operation, Motivation, Pooling, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.

Unit IV

Recurrent Neural Networks: Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, LSTMs, GRUs, The Challenge of Long-Term Dependencies, Attention Mechanism.

Books:

1. Neural Networks and Deep Learning A Textbook, Charu C. Aggarwal, Springer
2. Deep Learning from Scratch, Building with Python from First Principles, Seth Weidman, O'Reilly

Reference Books:

1. Deep Learning by Ian Good fellow, Yoshua Bengio and Aaron Courville MIT press

M. Sc. (Computer Science)
Semester IV

Elective 4: MCS4T15
Paper IV: DESIGN AND ANALYSIS OF ALGORITHM

Hours/Week : 4
Credits : 4

Course Objective: The course offers students to develop the ability to design, analyse and synthesize the important algorithmic design paradigms.

Course Outcomes:

On successful completion of this subject students should be able to:

- Produce thorough proofs of an algorithm's soundness.
- Demonstrate about important algorithms and data structures.
- Use key analytical techniques and concepts for algorithmic design.
- Combine effective algorithms in typical engineering design scenarios.

Unit I

Definition of Algorithm & its characteristics, Recursive and Non-recursive Algorithms, Time & Space Complexity, Definitions of Asymptotic Notations, Insertion Sort (examples and time complexity), Heaps & Heap Sort (examples and time complexity). **Divide & Conquer:** Concept of divide and Conquer, Binary Search (recursive), Quick Sort, Merge sort.

Unit II

Greedy Algorithm: Fractional Knapsack problem, Optimal Storage on Tapes, Huffman codes, Concept of Minimum Cost Spanning Tree, Prim's and Kruskal's Algorithm.

Unit III

Dynamic Programming: The General Method, Principle of Optimality, Matrix Chain Multiplication, 0/1 Knapsack Problem, Concept of Shortest Path, Single Source shortest path, Dijkstra's Algorithm, Bellman Ford Algorithm, Floyd- Warshall Algorithm, Travelling Salesperson Problem.

Unit IV

Branch & Bound: Introduction, Definitions of LCBB Search, Bounding Function, Ranking Function, FIFO BB Search, Traveling Salesman problem Using Variable tuple. Decrease and Conquer: Definition of Graph Representation, BFS, DFS, Topological Sort/Order, Strongly Connected Components, Biconnected Component.

Books:

1. Fundamentals of Computer Algorithms, Authors - Ellis Horowitz, Sartaz Sahani, Sanguthevar Rajsekaran Publication: - Galgotia Publications
2. Introduction to Algorithms (second edition) Authors: - Thomas Cormen, Charles E Leiserson, Ronald L.Rivest , Clifford Stein ,Publication: - PHI Publication

M. Sc. (Computer Science)
Semester IV

Elective 4: MCS4T15
Paper IV: CYBER FORENSICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers to Identify, gather, and preserve the proof of a law-breaking and to track and prosecute the perpetrators in an exceedingly court of law.

Course Outcomes:

On successful completion of this subject students should be able to:

- To learn investigation tools and techniques, analysis of data to identify evidence.
- To analyze the technical Aspects & Legal Aspects related to cyber crime.

Unit I

Recent amendments in IT Act, internet & web technologies, web hosting and development, attributes in cyberspace and legal framework of cyberspace, hacking, virus, obscenity, pornography, programme manipulation, Copyright, Patent, software piracy, intellectual property rights, trademark, domain disputes, and computer security, etc., Encryption and Decryption methods, Search and seizures of evidence, Investigation of cyber crimes and tools for analysis.

Unit II

Information security: Domains, Common Attacks, Impact of Security Breaches, Protecting Critical Systems (Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security) Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats File protection mechanism, Authentication: Authentication basics, Password, Challenge response, Biometrics. Network Security: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec. Principles of network forensics, Attack Trace-back and attributes, Critical Needs Analysis. IDS: Network based Intrusion Detection and Prevention Systems, Host based Intrusion Prevention System, Cloud Computing-Its Forensic and Security Aspects.

Unit III

Cyber Crime Investigations: Where Evidence Resides on Windows systems, Conducting a Windows investigation, File Auditing and Theft of information, Handling the Departing Employee, Steps in a Unix Investigation, Reviewing Pertinent Logs, Performing Keywords Searches, Reviewing Relevant Files, Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships, Detecting Trojan Loadable Kernel Models, Finding Network based Evidence, Generating Session data with TCP Trace, Reassembling sessions using TCP flow and Ethereal.

Unit IV

Open source tools for digital forensics and Registry Forensic- Open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host, Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools) Registry Analysis, Understanding Windows Registry and Registry Structure.

Books:

1. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.

2. Computer Forensic Investigating Data and Image Files, EC Council Press
3. Robert Jones, Internet Forensics Using Digital Evidence to Solve Computer Crimes, O'Reilly Media Publication
4. Forouzan Data Communication and Networking McGraw Hill
5. Stallings, "Cryptography And Network Security: Principles and practice"
6. Kevin Mandia, Chris Prosise and Matt Pepe, Incident response and computer forensics, McGraw Hill Publication
7. Cory Altheide, Harlan Carvey, Digital Forensics with Open source Tools, Syngress Publication
8. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003
9. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC 28 Press LLC, 2004.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Information Technology)
Choice Based Credit System (Semester Pattern)
wef. 2023-24 as per NEP 2020

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Information Technology)
Choice Based Credit System (Semester Pattern), wef. 2023-24 as per NEP 2020

Pre-requisites to enrol for the M. Sc. (Information Technology) Programme:

The student who has completed the B. Sc. Course with Computer Science as one of the optional subject or Bachelor of Computer Application (BCA)or B. Sc. (IT) or B. Sc. (Data Science) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enroll for M. Sc. (Information Technology)Part I (Semester I). However, the student who has completed four-year B. Sc. course [B. Sc. (Honours)/ (Research) as per NEP- 2020] with Computer Science/Information Technology/Data Science as the major subject or Bachelor of Computer Application (BCA) with not less than 45% of aggregate marks (40% in case of student from reserved category) or equivalent CGPA from any of the recognised university is eligible to enrol directly to M. Sc. (Information Technology) Part II (Semester III).

Credit distribution structure for two years Post Graduate Programme in Information Technology*

Year (2 Yr PG)	Level	Sem. (2 Yr)	Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem. I	12 (3 theory + 2 Practical)	4	4			20	One Year PG Diploma
		Sem. II	12 (3 theory + 2 Practical)	4		4		20	
Cum. Cr. For PG Diploma/ I year of PG			24	8	4	4	-	40	
Exit option: One Year PG Diploma 40 credits									
II	6.5	Sem. III	12 (3 theory + 2 Practical)	4			4	20	PG Degree After 3 Yr UG or PG degree after 4-Yrs UG
		Sem. IV	12 (3 theory +2 Practical)	4			6	22	
Cum. Cr. For II year of PG			24	8			10	42	
Cum. Cr. For 2 year of PG degree			48	16	4	4	10	82	

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Board of Studies (Computer Science)
Syllabus
of
M. Sc. (Information Technology)
Choice Based Credit System (Semester Pattern), wef. 2023-24 as per NEP 2020

Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Artificial Intelligence	MIT1T01	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Cyber Security	MIT1T02	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 1	MIT1T03	4	-	-	4	3	80	20	40	-	-	-	100
4	RM	Research Methodology	MIT1T04	4	-	-	4	3	80	20	40	-	-	-	100
5	DSC	Practical Based on Paper MIT1T01 and MIT1T02	MIT1P01	-	-	6	3	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MIT1T03 and MIT1T04	MIT1P02	-	-	6	3	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

CIE = Continuous Internal Evaluation and SEE = Semester End Examination

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Cloud Computing	MIT2T05	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Machine Learning	MIT2T06	4	-	-	4	3	80	20	40	-	-	-	100
3	DSE	Elective 2	MIT2T07	4	-	-	4	3	80	20	40	-	-	-	100
4	OJT	Apprenticeship/Mini Project (Related to DSC)	MOJ2P01	-	-	8	4	3	-	-	-	50	50	50	100
5	DSC	Practical Based on Paper MIT2T05 and MIT2T06	MIT1P03	-	-	6	3	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MIT2T07	MIT1P04	-	-	6	3	-	-	-	-	50	50	50	100
Total				12	-	20	**22**		**240**	**60**		**150**	**150**		**600**

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Advanced Software Engineering	MIT3T08	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Network Security	MIT3T09	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Internet of Things (IoT)	MIT3T10	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 3	MIT3T11	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP3P01	-	-	8	4	-	-	-	-	50	50	50	100
6	DSC	Practical Based on Paper MIT3T08 ,MIT3T09,MIT3T 10 and MIT3T11	MIT1P05	-	-	4	2	-	-	-	-	50	50	50	100
Total				16	-	12	**22**		**320**	**80**		**100**	**100**		**600**

Semester IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	Total
1	DSC	Big Data Analytics	MIT4T12	4	-	-	4	3	80	20	40	-	-	-	100
2	DSC	Block Chain Technology	MIT4T13	4	-	-	4	3	80	20	40	-	-	-	100
3	DSC	Deep Learning	MIT4T14	4	-	-	4	3	80	20	40	-	-	-	100
4	DSE	Elective 4	MIT4T15	4	-	-	4	3	80	20	40	-	-	-	100
5	RP	Research Project/ Dissertation (Core)	MRP4P02	-	-	12	6	-	-	-	-	100	100	100	200
Total				16	-	12	22		**320**	**80**		**100**	**100**		**600**

Total Credits for Four Semesters (Two-Year Course): = 88

Total Marks for Four Semesters (Two Year Course): = 2400

Abbreviations:

DSC: Discipline Specific Course, **DSE**: Discipline Specific Elective **SEE:** Semester End Examination, **CIE:** Continuous Internal Evaluation, **OJT:** On the Job Training (Internship/Apprenticeship), **FP:** Field Project, **RM:** Research Methodology, **RP**: Research Project

Elective papers:

In addition to the mandatory papers, the student has to opt for ONE elective paper in each semester from the basket of elective papers mentioned in the following table.

Basket for Elective Courses (4 Credits each)

Semester	Course Category	Name of the course	Course Code
I	Elective 1	a) PHP b) Discrete Mathematics c) Equivalent MOOC course	MIT1T03
II	Elective 2	a) ASP.NET b) Data Mining c) Equivalent MOOC course	MIT2T07
III	Elective 3	a) Neural Network b) Computer Vision c) Equivalent MOOC course	MIT3T11
IV	Elective 4	a) Reinforcement Learning b) Cyber Forensics c) Equivalent MOOC course	MIT4T15

The students can opt either the elective paper taught in the department in offline mode or any other equivalent online course of at least 4 credits offered by MOOC or any other such platform. The student should submit the passing certificate to the College in order to include the marks in the mark sheet. **The MOOCs which is identical to courses offered in this scheme of M.Sc. Information Technology (in terms of contents) and are accessible to the student shall not be allowed for credit transfer.**

M. Sc. (Information Technology)
Semester I

MIT1T01
Paper I: ARTIFICIAL INTELLIGENCE

Hours/Week : 4
Credits : 4

Course Objectives:

1. To impart artificial intelligence principles, techniques and its history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes:

- Evaluate Artificial Intelligence (AI) methods and describe their foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
- Analyze and illustrate how search algorithms and planning play vital role in problem solving.

UNIT I

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs AI Search techniques :- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

UNIT II

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logic programming, Forward versus Backward Reasoning, Matching, Control knowledge, Expert System.

UNIT III

Games playing: Minimax search procedure , adding alpha-beta cutoffs, additional refinements, Planning :- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

UNIT IV

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Introduction to pattern recognition, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems,

Books:

1. Artificial Intelligence by Elaine Rich, Mcgrawhill Inc.
2. Artificial Intelligence and Expert Systems – Jankiraman, Sarukes (M)
3. Lisp Programming – RajeoSangal – (TMH)
4. Artificial Intelligence – Russell-Pearson- Ist Text book.
5. Principles of AI- Nils Nilson
6. A.I. by R.J.Winston - Pearson

M. Sc. (Information Technology)
Semester I

MIT1T02
Paper II: CYBER SECURITY

Hours/Week : 4
Credits : 4

Course Objectives:

1. To Understand the different types of vulnerability scanning
2. To know the different network defense tools and web application tools
3. To understand the different types of cyber crimes and laws
4. To understand the different tools for cyber crime investigation

Course Outcomes:

- Apply regulation of cyberspace and know the issue and challenges of cyber security.
- Legal perspectives of cyber crime, IT act 2000 and its amendments.
- Social media monitoring : Challenges, opportunities and pitfalls in online social network, Security issues related to social media

UNIT I

Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

UNIT II

Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes-cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India, Case studies.

UNIT III

Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

UNIT IV

Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Books

1. Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press, Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd..
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

M. Sc. (Information Technology)
Semester I

Elective 1: MIT1T03
Paper III: PHP

Hours/Week : 4
Credits : 4

Course Objectives:

1. To become familiar with client server architecture and able to develop a web application using various technologies.
2. To understand and develop a web-based application using a framework concept.
3. To gain the skills and project-based experience needed for entry into web application and development careers

Course Outcomes:

- Able to Installing and Configuring PHP on Windows and Linux Platforms
- Web page development using PHP

UNIT I

Introduction to PHP: What Does PHP Do, A Brief History of PHP, Installing PHP, A Walk Through PHP Language Basics: Lexical Structure, Data Types, Variables, Expressions and Operators, Flow-Control Statements, Including Code, Embedding PHP in Web Pages, Installing and Configuring PHP on Windows and Linux Platforms

UNIT II

Functions: Calling a Function, Defining a Function, Variable Scope, Function Parameters, Return Values, Variable Functions, Anonymous Functions, Strings: Quoting String Constants, Printing Strings, Accessing Individual Characters, Cleaning Strings, Encoding and Escaping, Comparing Strings, Manipulating and Searching Strings, Regular Expressions, POSIX-Style Regular Expressions, Perl-Compatible Regular Expressions, **Arrays:** Indexed Versus Associative Arrays, Identifying Elements of an Array, Storing Data in Arrays, Multidimensional Arrays, Extracting Multiple Values, Converting Between Arrays and Variables, Traversing Arrays, Sorting, Acting on Entire Arrays, Using Arrays

UNIT III

Classes and Objects: Terminology, Creating an Object, Accessing Properties and Methods, Declaring a Class, Introspection, Serialization, Web Techniques: HTTP Basics, Variables, Server Variables, Server Information, Processing Forms, Setting Response Headers, Session, cookies, files, Maintaining State, SSL, Using PHP to Access a Database: Relational Databases and SQL, Mysql database Basics, Advanced Database Techniques

UNIT IV

Graphics: Embedding an Image in a Page, The GD Extension, Basic Graphics Concepts, Creating and Drawing Images, Images with Text, Dynamically Generated Buttons, Scaling Images, Color Handling, **PDF:** PDF Extensions, Documents and Pages, Text, Images and Graphics, Navigation, Other PDF Features

XML : Lightning Guide to XML, Generating XML, Parsing XML, Transforming XML with XSLT, Web Services, **Security:** Global Variables and Form Data, Filenames, File Uploads, File Permissions, Concealing PHP Libraries, PHP Code, Shell Commands, Security Redux, Application Techniques, Code Libraries, Tinplating Systems, Handling Output, Error Handling, Performance Tuning.

Books:

1. PHP 5.1 for beginners by Evan Bayross and Sharman Shah, SPD publications
2. Programming PHP by Rasmus Lerdorf and Kevin Tatroe, Orilly Publications.

M. Sc. (Information Technology)
Semester I

Elective 1: MIT1T03
Paper III: DISCRETE MATHEMATICS

Hours/Week : 4
Credits : 4

Course Objectives:

1 To cover certain sets, functions, relations and groups concepts for analyzing problems that arise in engineering and physical sciences.
2 To imparting to analyze the problems connected with combinatories and Boolean algebra.
3 To solve calculus and integral calculus problems.

Course Outcomes:

- Observe the various types of sets, functions and relations.
- Understand the concepts of group theory.
- Understand the concepts of combinatorics.
- Understand the concepts of graph theory and its applications.
- Learning logic and Boolean algebra. Using these concepts to solve the problems

UNIT I

Mathematical Logic: Propositional Calculus: Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, duality law, Tautological Implications, functionally complete set of connectives, other connectives. **Normal Forms**: CNF, DNF, PCNF, PDNF.

UNIT II

Fundamentals: Sets and Subsets, operations on sets, sequences, Division of the integer, Matrices, Methods of Proof, Mathematical Induction.
Counting: Permutations, Combinations, The pigeonhole Principle, Recurrence Relations.

UNIT III

Relations and Digraphs: Product sets and Partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Operations of Relations, Transitive Closure and Warshall's Algorithms.
Functions: Definition and Introduction, Permutation Functions, Growth of Functions.

UNIT IV

Order Relations and Structures: Partially Ordered Sets, Lattices.
Graph Theory: Basic Concept of Graph Theory, Euler Paths and Circuits, Hamiltonian Paths and Circuits.
Tree: Introduction, Undirected Tree, Minimal Spanning Trees.
Semigroups and Groups: Binary Operations Revisited, Semigroups, Products and Quotients of Groups.

Books:

1. Discrete Mathematical Structures By Bernard Kolman, Busby & Sharon Ross [PHI].
2. Discrete Mathematical Structures with Application to computer science By J. P. Tremblay & R. Manohar [Tata McGraw –Hill]
3. Discrete Mathematics with Graph Theory by Goodaire[PHI]
4. Discrete Mathematics by J.K.Sharma(McMillan)
5. Discrete Mathematics and its Applications by Kenneth Rosen (TMH)

M. Sc. (Information Technology)
Semester I

MIT1T04
Paper IV: RESEARCH METHODOLOGY

Hours/Week : 4
Credits : 4

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study processing and analysis of data, Quantitative and Qualitative data analysis.
3. Reviewing Literature and research papers, writing research papers, Thesis reports.

Course Outcomes:

- The basic concept of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters.
- Prepare a project (to undertake a project)
- Organize and conduct research in a more appropriate manner, writing research report and thesis.

UNIT I

Introduction: Meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research processes, criteria of good research, **Defining Research Problem:** necessity of defining the problem, techniques involved in defining a problem, **Research Design**: meaning of research design, need for research design, features of good design, different research designs, basic principles of experimental design.

UNIT II

Methods of Data Collection: Collection of primary data, Observation method, Methods of Data collection, Interview Method, Collection of data through questionnaire, Collection of data through schedules, Difference between questionnaire and schedules, **Processing and Analysis of Data:** Processing operations, Problems in processing, Types of Analysis, Statistics in Research, Simple Regression analysis, multiple correlation and regressions, Partial correlation. **Quantitative Data analysis:** Types of quantitative data, data coding, visual aids for quantitative data analysis using statistics for quantitative data analysis, Interpretation data analysis result, evaluating quantitative data analysis, **Qualitative Data analysis:** Analyzing textual data, analyzing non-textual qualitative data, Grounded theory, computer aided qualitative analysis, evaluating qualitative data analysis.

UNIT III

Interpretation and Report Writing: Techniques of Interpretation, Significance of Report Writing, Different steps in Writing report, Layout of research report, type of report, oral presentation, mechanics of writing a research report **Python Tools:** File Handling, Introduction, Handling Binary data and CSV files, Zipping and Unzipping files, Directory **Regular Expression and Web scraping:** Introduction, Function of Re Module, web scraping.

UNIT IV

LaTeX: Writing scientific report, structure and components of research report, revision and Refining, writing project proposal, paper writing for international journals, submitting to editors conference presentation, preparation of effective slides, pictures, graphs and citation styles.

Books:

1. C. R. Kothari, Research Methodology Methods and Techniques, 2nd. ed. New Delhi: New Age International Publishers, 2009.
2. Briony J. Oastes, Researching Information Systems and Computing, SAG Publication India Pvt. Ltd., New Delhi,
3. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, Python Programming: A Practical Approach, First edition published 2022 by CRC Press.
4. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004.

M. Sc. (Information Technology)
Semester II

MIT2T05
Paper I: CLOUD COMPUTING

Hours/Week : 4
Credits : 4

Course Objectives:
1. To Understand fundamentals of cloud computing
2. To acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications

Course Outcomes:
- Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Program data intensive parallel applications in the cloud.
- Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
- Identify security and privacy issues in cloud computing.

UNIT I
Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology. Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT II
Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security Features of Cloud and Grid Platforms. Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure. Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

UNIT III
Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations. Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images. Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability. Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

UNIT IV
Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking. How the Cloud Will Change Operating Systems.

Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Books:

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
5. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
6. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

M. Sc. (Information Technology)
Semester II

MIT2T06
Paper II: MACHINE LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:

1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:

- Understand the concepts of various machine learning strategies.
- Handle computational data and learn ANN learning models.
- Solve real world applications by selecting suitable learning model.
- Boost the performance of the model by combining results from different approaches.

UNIT I

Learning: Types of Machine Learning, Supervised Learning, The Brain and the Neuron, Design a Learning System, Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search, Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability, Linear Regression.

UNIT II

Multi-layer Perceptron: Going Forwards, Going Backwards: Back Propagation Error, Multilayer Perceptron in Practice, Examples of using the MLP, Overview, Deriving BackPropagation, Radial Basis Functions and Splines, Concepts, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machines.

UNIT III

Learning with Trees: Decision Trees, Constructing Decision Trees, Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Probability and Learning, Data into Probabilities, Basic Statistics, Gaussian Mixture Models, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms, Vector Quantization, Self Organizing, Feature Map

UNIT IV

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Isomap, Least Squares Optimization, Evolutionary Learning, Genetic algorithms, Genetic Offspring: Genetic Operators, Using Genetic Algorithms, Reinforcement Learning, Overview, Getting Lost Example, Markov Decision Process, Graphical Models: Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Method.

Books:

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), EthemAlpaydin,Third Edition, MIT Press
2. Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, Wiley
3. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach,Cambridge University Press.
4. Deep Learning , Rajiv Chopra, Khanna Publi.
5. Machine Learning, V. K. Jain, Khanna Publi

M. Sc. (Information Technology)
Semester II

Elective 2: MIT2T07
Paper III: ASP.NET

Hours/Week : 4
Credits : 4

Course Objectives:
1. To understand ASP.NET structure
2. To understand Error handling, Component based programming.

Course Outcomes:
- Able to Installing and Configuring .NET framework
- Web development using ASP.NET

UNIT I

Introduction to ASP .NET – The .NET Framework, The .NET Programming Framework, .NET Languages, The .NET Class Library, About ASP .NET, Basic difference between C# and VB .NET, Data Types, Declaring Variables – Initializers, Arrays, Enumerations, Variable Operations –Advanced Math Operations, Type Conversions, Delegates.

UNIT II

The Basics about Classes - Shared Members, A Simple Class, Adding properties, Basic Method, Basic Event, Constructors, Value Types & Reference Types – Assignment Operations, Equality Testing, Advanced Class Programming – Inheritance, Shared Members, Casting, Understanding Namespaces and Assemblies – Importing Namespaces, Assemblies.

UNIT III

Web Server and user - Installing US, US Manager - Creating a virtual Director, Virtual Directories and Applications, Folder Settings, Adding virtual directory to your Neighborhood.Installing ASP.NET, ASP.NET Applications - ASP .NET file Types, The bin directory, Code- Behind, The Global .asax Code-Behind, Understanding ASP. Net Classes, ASP .NET Configuration,**Web Controls** - Basic Web Control classes, Auto PostBack and Web Control Events, A Web page Applets, Validation and Rich Controls.

UNIT IV

State Management Tracing, Logging and Error Handling - Common errors, .NET Exception Object, Handling Exceptions, Throwing your own Exceptions, Logging Exceptions, Error pages, Page tracing. **Advanced ASP.NET -Component-Based Programming** - Creating Simple Component, Properties and State, Database Components, Using COM Components, Custom Controls-User Controls, Deriving Custom controls.

Books:

1. The Complete Reference - ASP .NET by Matthew MacDonald - Tata McGraw- Hill
2. Introducing MicrosoftDot Net, DavidPlatt,PHIPublication.
3. ASP .NET 4.5(Covers C# and VB codes),Black Book, Dreamtech Publication

M. Sc. (Information Technology)
Semester II

Elective 2: MIT2T07
Paper III: DATA MINING

Hours/Week : 4
Credits : 4

Course Objectives:

1. To introduce the fundamental processes data warehousing and major issues in data mining
2. To impart the knowledge on various data mining concepts and techniques that can be applied to text mining, web mining etc.
3. To develop the knowledge for application of data mining and social impacts of data mining.

Course Outcomes:

- Interpret the contribution of data mining to the decision-support systems.
- Prepare the data needed for data mining using preprocessing techniques and apply the various visualization techniques.
- Discover interesting patterns from large amounts of data using Association Rule Mining
- Extract useful information from the labeled data using various classifiers and Predictors

UNIT I

Introduction to Data Mining: What is Data Mining? Motivating Challenges, Definitions, Origins of Data Mining, Data Mining Tasks, Data: Types of Data- Attributes and Measurement and Types of data sets, Data Quality-Measurement and Data Collection Issues, Issues Related to Applications, Data Preprocessing- Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Variable Transformation.

UNIT II

Exploring Data: The Iris Data Set, Summary Statistics- Frequencies and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Multivariate Summary Statistics, Visualization: Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Visualizing Higher-Dimensional data, OLAP and Multidimensional data Analysis, Classification: Basic Concepts, Decision Trees, and Model Evaluation: Preliminaries, General Approach to Solving Classification Problem, Decision Tree Induction, Evaluating the Performance of a Classifier, Methods for Comparing Classifiers.

UNIT III

Classification: Alternative Techniques: Rule-Based Classifier, Rule Ordering Schemes, Building Rules-Based Classifier, Nearest Neighbor Classifiers, Bayesian Classifiers, Naive Bayes Classifier, Artificial Neural Networks (ANN), Support Vector Machines. Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Itemset Generation- Apriori Principle, Candidate Generation and Pruning, Support Counting, Computational Complexity, Rule Generation, Compact Representation of Frequent Itemsets, Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm, FP-Tree Representation.

UNIT IV

Cluster Analysis: Basic Concepts and Algorithms: What is Cluster Analysis? Different Types of Clustering, Types of Clusters, Clustering Algorithms: K-means and its variants, Hierarchical clustering, Density based clustering, Graph-Based Clustering, Shared Nearest Neighbor

Approach, Jarvis Patrick Clustering, SNN Density-Based Clustering, Anomaly Detection: Causes of Anomaly Detection, Approaches to Anomaly Detection, Statistical Approaches, Proximity-Based Outlier Detection, Density-based Outlier Detection, Clustering-Based Techniques.

Books:

1. Introduction to Data Mining, Tan, Steinbach, Kumar.
2. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann
3. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann
4. Principles of Data Mining: David Hand, HeikkiMannila and Padhraic Smyth, PHP

M. Sc. (Information Technology)
Semester III

MIT3T08
Paper I: ADVANCED SOFTWARE ENGINEERING

Hours/Week : 4
Credits : 4

Course Objective:
The course offers students to develop the ability to design software systems and analyse and test their performance.

Course Outcomes:
On successful completion of this subject students should be able to:

- To demonstrate an understanding of advanced knowledge of the practice of software engineering, design, validation, test and deployment.
- Use modern engineering principles, processes, and technologies to solve difficult engineering issues and tasks.
- Demonstrate leadership and the ability to participate in teamwork in an environment with different disciplines of engineering, science and business.
- Identify the proper ethical, financial, and environmental effects of their work.

Unit I
Introduction to Software Engineering, Software Engineering as a Layered Technology, Software Development Life Cycle, Generic View of process, A process framework, Process Model – Waterfall, Incremental, Evolutionary, Unified Process Model, Agile Process Model, Scrum, Dynamic System development model, CMMI.

Unit II
System Models: Context Model, Behavioural Model, Data Model, Object Model, Modelling with UML, Design Engineering: Design Process, Design Quality, Design Concepts: Abstraction, Architecture, Patterns, Information Hiding, Functional Independence, Modularity, Design Model: OO Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Unit III
Testing Strategies, Strategic Approach to software testing: Verification, Validation, Error, Fault, Bug, Failure. Types of software testing: Unit Testing, White Box Testing, Black Box Testing, Software Quality Assurance: Software Reliability, Risk Management: Reactive, Proactive risk, Risk Identification, Risk Projection, Risk Refinement, RMMM plan.

Unit IV
Software Metrics: Software Sizing, LOC, FP Based estimations, estimation model, COCOMO Model, Project Scheduling, Time Line Chart, Software Configuration Management: Change Control and version control, software Reuse, Software Re-engineering, Reverse Engineering.

Books:
1. Software Engineering: A Practitioner's Approach, Roger Pressman, Macgraw Hill International Edition.
2. Fundamentals of Software Engineering, Carlo Gheezzi, Mehdi Jazayeri, Dino Mandrioli, PHI Publication.

M. Sc. (Information Technology)
Semester III

MIT3T09
Paper II: NETWORK SECURITY

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on Network security, various encryption techniques, and intrusion detection and the solutions to overcome the attacks.

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify the symmetric encryption techniques
- Illustrate various Public key cryptographic techniques
- Evaluate the authentication and hash algorithms.
- Basic concepts of system level security

Unit - I

Introduction to Security Security Goals, Different Types of Attacks on Networks, Threats, Vulnerabilities, Attacks, Data Integrity, Confidentiality, Anonymity Message and Entity Authentication Authorization, Nonrepudiation, Cryptographic Techniques.

Unit – II

Principles of Cryptography Symmetric Key Cryptography: DES, Block Cipher Modes of operation, Advanced Encryption Standard, Key distribution, Attacks. Public key Cryptography RSA, Cryptographic Hash functions, Authentication, Message Authentication Code (MAC), Digital Signatures, DSA Signatures.

Unit - III

PKI and Security Practices Digital Certificates, MD5, SHA, Challenge Response protocols-Authentication applications, Kerberos, X.509, Securing Email, Web Security.

Unit - IV

Software Vulnerabilities Buffer Overflow, Cross Site Scripting, SQL Injection, Case Studies on worms and viruses, Virtual Private Networks, Firewalls **Wireless Security** Security in Wireless Local Area Networks, Security in Wireless Ad Hoc and Sensor Networks, Security of the Internet of Things

Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 7th edition, 2016.
2. Behrouz A. Forouzan, Cryptography and networksecurityMCGrawHill3rdEdition
3. C. Kaufman, R. Perlman, M. Speciner, "Network Security: Private Communication in a Public World", Pearson Education, 2nd edition, 2002.

Reference Books:

1. Applied Cryptography - Schnier
2. J. Edney, W.A. Arbaugh, "Real 802.11 Security: Wi-Fi Protected Access and 802.11i", Pearson Education, 2004.
3. E. Rescorla, "SSL and TLS: Designing and Building Secure Systems", Addison-Wesley, 2001.
4. B.L. Menezes, "Network Security and Cryptography", Wadsworth Publishing Company Incorporated, 2012.
5. Handbook of Applied Cryptography - Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone: Online Version

M. Sc. (Information Technology)
Semester III

MIT3T10
Paper III: INTERNET OF THINGS (IoT)

Hours/Week : 4
Credits : 4

Course Objective: The course offers to impart knowledge on IoT and protocols, it expose the student to some of the electrical application areas where Internet of Things can be applied..

Course Outcomes:

On successful completion of this subject students should be able to:

- Able to understand the application areas of IoT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

UNIT I

Introduction to IOT , Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT, Communication Technologies, Challenges in IOT.

UNIT II

Arduino Simulation Environment, Arduino Uno Architecture, Setup the IDE, Writing Arduino Software , Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD

UNIT III

Sensor & Actuators with Arduino , Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino

UNIT IV

Basic Networking with ESP8266 WiFi module, Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration

Posting sensor(s) data to web server

Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

Referenced Book:

1.Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition
2. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", Pearson Education 2015
3. Cuno Pfister, "Getting Started with the Internet of Things", O'Reilly Media 2011

M. Sc. (Information Technology)
Semester III

Elective 3: MIT3T11
Paper IV: NEURAL NETWORK

Hours/Week : 4
Credits : 4

Course Objectives:
1. To introduce the foundations of Artificial Neural Networks
2. To learn various types of Artificial Neural Networks

Course Outcomes:
- Ability to understand the concepts of Neural Networks.
- Ability to select the Learning Networks in modeling real world systems

UNIT I

Introduction: Feedforward Neural Networks: Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Network Geometry of Binary Threshold Neurons and Their Network: Patterns Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are pattern Dichotomizes, Non-linearly separable Problems, Capacity of a simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks.

UNIT II

Supervised Learning I: Perceptrons and LMS: Learning and Memory, From Synapses to Behaviour: The Case of Aplysia, Learning Algorithms, Error Correction and Gradient Descent Rules, The Learning Objective for TLNs, Pattern space and Weight Space, Perceptron Learning Algorithm, Perceptron Convergence Theorem, Perceptron learning and Non-separable Sets, Handling Linearly Non-Separable sets, α-Least Mean Square Learning, MSE Error Surface and its Geometry, Steepest Descent Search with Exact Gradient Information, μ-LMS: Approximate Gradient Descent, Application of LMS to Noise Cancellation

UNIT III

Supervised Learning II: Backpropagation and Beyond: Multilayered Network Architectures, Backpropagation Learning Algorithm, Structure Growing Algorithms, Fast Relatives of Backpropagation, Universal Function Approximation and Neural Networks, Applications of Feedforward Neural Networks, Reinforcement Learning

UNIT IV

Neural Networks: A Statistical Pattern Recognition Perspective: Introduction, Bayes Theorem, Classification Decisions With Bayes Theorem, Probabilistic Interpretation Of A Neuron Discriminant Function, Interpreting Neuron Signals As Probabilities, Multilayered Networks, Error Functions And Posterior Probabilities, Error Functions For Classification Problems

Generalization: Support Vector Machines and Radial Basis Function Networks: Learning from Examples and Generalization, Statistical Learning Theory Briefer, Support Vector Machines, Radial Basis Function Networks, Regularization Theory Route to RRBFNs, Generalized Radial Basis Function Network, Learning In RRBFNs, Image Classification Application, Other Models for Valid Generalization.

Books:

1. Neural Network- A Classroom Approach, Satish Kumar, Tata McGraw Hill
2. Introduction to neural networks using MATLAB 6.0 by Sivanandam, S Sumathi, S N Deepa, Tata

Mcgraw Hill
3. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
4. Artificial neural networks - B.Yegnanarayana, Prentice Hall of India P Ltd 2005.
5. Neural networks in Computer intelligence, Li Min Fu, TMH 2003.
6. Neural networks James A Freeman David M S kapura, Pearson education 2004.

M. Sc. (Information Technology)
Semester III

Elective 3: MIT3T11
Paper IV: COMPUTER VISION

Hours/Week : 4
Credits : 4

Course Objective: The course offers to introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving.

Course Outcomes:

On successful completion of this subject students should be able to:

- Implement fundamental image processing techniques required for computer vision.
- Develop computer vision applications.

Unit - I

Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, Matching, Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection, Thinning, Region growing, region shrinking, Labeling of connected components.

Unit - II

Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.

Unit - III

Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting,Curve fitting (Least-square fitting). **Region Analysis**: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

Unit - IV

Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry - from 2D to 3D, Image matching: Intensity matching of 1D signals, Matching of 2D image, Hierarchical image matching.

Books:

1. David A. Forsyth, Jean Ponce,"Computer Vision: A Modern Approach"
2. R. Jain, R. Kasturi, and B. G. Schunk, "Machine Vision", McGraw-Hill.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision" Thomson Learning.
4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison- Wesley, 1993.

M. Sc. (Information Technology)
Semester IV

MIT4T12
Paper I: BIG DATA ANALYTICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers students to develop understanding towards the basic concepts of Big Data, adaptation and planning of Big Data and Business Intelligence

Course Outcomes:

On successful completion of this subject students should be able to:

- Classify and categorize different types of Data Analytics
- frame Business Architecture
- Understand the use of Information and Communication Technology
- Differentiate Between Traditional data Analysis and Big Data Analytics
- Evaluate different Enterprise Technologies and Big Data Business Intelligence

Unit – I

Concepts and terminology: Data Sets, Data Analysis, Data Analytics - Descriptive, Diagnostic, Predictive, Prescriptive Analytics, Business Intelligence, Big Data Characteristics - Volume, Velocity, Variety, Veracity and Value. Different types of Data - Structured, Unstructured, Semi-Structured, Meta Data Business Motivations and Drivers for Big Data Adoption.

Unit - II

Big Data Analytics Life cycle - Business Case Evaluation, Data Identification, Data Acquisition and Filtering, Data Extraction, Data Validation and Cleansing, Data Aggregation and Representation, Data Analysis, Visualization, Utilization of Analysis Results.

Unit - III

Enterprise Technologies - OLTP, OLAP, ETL Big Data BI, Clusters, Big Data Storage Concepts, Big Data Processing Concepts, Big Data Storage Technology - On Disk Storage Devices, NOSQL Databases, In-Memory Storage Devices.

Unit - IV

Big Data Analysis Techniques - Quantitative, Qualitative, Statistical Analysis, Semantic Analysis, Visual Analysis, Introduction to Hadoop, Map Reduce, Hive, Pig, Spark and Big Data Analytics.

Books:

1. Big Data Fundamentals Concepts, Drivers & Techniques Thomas ErL, Wajid Khattak and Paul Buhler, Pearson Publication 2022.
2. Big Data Analytics Introduction to Hadoop, Spark and Machine- Learning, RajKamal, Preeti Saxena, McGraw Hill Publication, 2019.

M. Sc. (Information Technology)
Semester IV

MIT4T13
Paper II: BLOCK CHAIN TECHNOLOGY

Hours/Week : 4
Credits : 4

Course Objective: To understand the technology behind blockchain, comprehend the issues related to blockchain and study the real-world applications of blockchain

Course Outcomes:
On successful completion of this subject students should be able to:

- Understand the requirements of the basic design of blockchain
- Identify the need of blockchains to find the solution to the real-world problems
- Summarize the working of blockchain
- Recognize the underlying technology of transactions, blocks, proof-of-work,
- and consensus building
- Design and implement new ways of using blockchain for applications other than cryptocurrency
- Categorize and implement the various platforms

Unit I
Blockchain concepts, evolution, structure, characteristics, a sample blockchain application, the blockchain stack, benefits and challenges, What is a Blockchain? Public Ledgers, Blocks in a Blockchain, Blockchain as public ledgers, Transactions, Distributed consensus.

Unit II
Building a block: Elements of Cryptography-Cryptographic Hash functions, Merkle Tree, Elements of Game Theory, Building a block: Elements of Cryptography-Cryptographic Hash functions, Merkle Tree, Elements of Game Theory, Design methodology for Blockchain applications, Blockchain application templates, Blockchain application development, Ethereum, Solidity, Sample use cases from Industries, Business problems.

Unit III
Smart contract, structure of a contract, interacting with smart contracts using Geth client and Mist wallet, smart contract examples, smart contract patterns, Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps

Unit IV
Byzantine fault tolerance, proof-of-work vs proof-of-stake, Security and Privacy of Blockchain, smart contract vulnerabilities, Scalability of Blockchain

Books:
1. Blockchain applications: a hands-on approach, Bahga A., Madisetti V., VPT, 2017.

Reference Book:

1. Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress, 2018.
2. Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara and Paul R. Allen, McGraw Hill, 2018.
3. Blockchain enabled Applications Vikram Dhillon, David Metcalf and Max Hooper, Apress, 2017.
4. The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology, William Mougayar, Wiley, 2016.
5. Blockchain Science: Distributed Ledger Technology, Roger Wattenhofer, Inverted Forest Publishing; 3rd edition, 2019.

M. Sc. (Information Technology)
Semester IV

MIT4T14
Paper III: DEEP LEARNING

Hours/Week : 4
Credits : 4

Course Objectives: The course offers to understand major deep learning algorithms and to identify deep learning techniques suitable for a given problem.

Course Outcomes:

On successful completion of the course students will be able to:

- Solve various deep learning problems
- Apply autoencoders for unsupervised learning problems
- Implement Convolutional Neural Networks to image classification problems
- Apply recurrent neural network to sequence Learning Problem.

Unit - I

Introduction to Neural Networks: Feed Forward Neural Networks, Backpropagation , Gradient Descent (GD) Principal Component Analysis: Eigenvalues and eigenvectors, Eigenvalue Decomposition Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition.

Unit – II

Autoencoders: Under complete Auto encoders, Regularization in auto encoders, De-noising auto encoders, Sparse auto encoders, Contractive auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Noise Robustness

Unit - III

Convolutional Neural Networks: The Convolution Operation, Motivation, Pooling, Le Net, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.

Unit - IV

Recurrent Neural Networks: Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, LSTMs, GRUs, The Challenge of Long-Term Dependencies, Attention Mechanism.

Books:

1. Neural Networks and Deep Learning A Textbook, Charu C. Aggarwal, Springer
2. Deep Learning from Scratch, Building with Python from First Principles, Seth Weidman, O'Reilly

Reference Books:

1. Deep Learning by Ian Good fellow, Yoshua Bengio and Aaron Courville MIT press

M. Sc. (Information Technology)
Semester IV

Elective 4: MIT4T15
Paper IV: REINFORCEMENT LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:

- Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
- Understand and work with tabular methods to solve classical control problems.
- Recognize current, advanced techniques and applications in RL.

Course Outcome:

- Implement in-code common algorithms following code standards and libraries used in RL.
- Understand and work with approximate solutions.
- Explore imitation learning tasks and solutions.
- Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.
- Understand and work with tabular methods to solve classical control problems.
- Recognize current advanced techniques and applications using RL.

Unit I

Reinforcement Learning Primitives: Introduction and Basics of RL, Defining RL Framework. Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Cumulative Distribution Function and Expectation. Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.

Unit II

Markov Decision Process and Dynamic Programming: Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP, Dynamic Programming: Polices (Evaluation, Improvement, Iteration, Value Iteration), Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.

Unit III

Monte Carlo Methods and Temporal Difference Learning: Monte Carlo: Prediction, Estimation of Action Values, Control and Control without Exploring Starts, Off-Policy Control, Temporal Difference Prediction: TD(0), SARSA: On-Policy TD control, Q-Learning: Off-Policy TD control, Games, After states, and Other Special Cases.

Unit IV

Deep Reinforcement Learning: Deep Q-Networks, Double Deep-Q Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay). Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm and Stochastic Policy Search.

Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.
3. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002

M. Sc. (Information Technology)
Semester IV

Elective 4: MIT4T15
Paper IV: CYBER FORENSICS

Hours/Week : 4
Credits : 4

Course Objective: The course offers to Identify, gather, and preserve the proof of a law-breaking and to track and prosecute the perpetrators in an exceedingly court of law.

Course Outcomes:

On successful completion of this subject students should be able to:

- To learn investigation tools and techniques, analysis of data to identify evidence.
- To analyze the technical Aspects & Legal Aspects related to cyber crime.

Unit – I

Recent amendments in IT Act, internet & web technologies, web hosting and development, attributes in cyberspace and legal framework of cyberspace, hacking, virus, obscenity, pornography, programme manipulation, Copyright, Patent, software piracy, intellectual property rights, trademark, domain disputes, and computer security, etc., Encryption and Decryption methods. Search and seizures of evidence. Investigation of cyber crimes and tools for analysis.

Unit – II

Information security: Domains, Common Attacks, Impact of Security Breaches. Protecting Critical Systems (Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security) Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats File protection mechanism, Authentication: Authentication basics, Password, Challenge response, Biometrics. Network Security: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec. Principles of network forensics, Attack Trace-back and attributes, Critical Needs Analysis. IDS: Network based Intrusion Detection and Prevention Systems, Host based Intrusion Prevention System. Cloud Computing-Its Forensic and Security Aspects.

Unit – III

Cyber Crime Investigations: Where Evidence Resides on Windows systems, Conducting a Windows investigation, File Auditing and Theft of information, Handling the Departing Employee, Steps in a Unix Investigation, Reviewing Pertinent Logs, Performing Keywords Searches, Reviewing Relevant Files, Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships, Detecting Trojan Loadable Kernel Models. Finding Network based Evidence, Generating Session data with TCP Trace, Reassembling sessions using TCP flow and Ethereal.

Unit – IV

Open source tools for digital forensics and Registry Forensic- Open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host, Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools) Registry Analysis, Understanding Windows Registry and Registry Structure.

Books:

1. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
2. Computer Forensic Investigating Data and Image Files, EC Council Press
3. Robert Jones, Internet Forensics Using Digital Evidence to Solve Computer Crimes, O'Reilly Media Publication
4. Forouzan Data Communication and Networking McGraw Hill
5. Stallings, "Cryptography And Network Security: Principles and practice"
6. Kevin Mandia, Chris Prosise and Matt Pepe, Incident response and computer forensics, McGraw Hill Publication
7. Cory Altheide, Harlan Carvey, Digital Forensics with Open source Tools, Syngress Publication
8. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003
9. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.

Two Year Master of Commerce (M. Com.) Degree Examination

Scheme of Examination for Two Year Master of Commerce (M.Com.) Program from Academic Session 2023-24

Preamble:

The Academic Council of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur has adopted the Government Resolution No. NEP-2022/प्र.क्र.09/विशी-3/शिक्षण1 dated 16th May 2023 issued by the Government of Maharashtra in its meeting held on 5th June 2023 in view of implementation of National Education Policy, 2020. The teaching and examination scheme for Master of Commerce (M. Com.) program has been prepared by the 'Task Force' constituted for the purpose by Hon'ble Vice-Chancellor, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur and is approved by all Boards of Studies under the Faculty of Commerce and Management in a meeting scheduled on 4th July 2023.

1. **Details of eligibility for M.Com. semester 1 examination**

A) For the **M.Com. 1st Semester,** the examinee shall have Passed the B. Com or B. Com with Computer Applications or BBA degree examination of Rashtrasant Tukadoji Maharaj Nagpur University or any other equivalent degree of any other recognized university;

B) The course leading to the Master Degree in Commerce being full time regular course in nature, the students enrolled for this course shall not be permitted to join any other course in this University or any other University simultaneously.

2. **Duration of the Program, student progression path and provisions for Multiple Entry and Exit**
   a. Duration of the M. Com. Program shall be TWO years with the provision for multiple exit as mentioned here:
      a. A student can exit the program after successful completion of 1st and 2nd semesters having earned requisite number of credits as mentioned in the scheme of examination. Such a student shall be eligible for the award of 'Post Graduate Diploma in Commerce' with a major by the University.

         OR

         a student can continue the program in 2nd year in order to become eligible for the award of 'Master of Commerce' degree with a major subject by the university.
   b. Re-entry or Lateral Entry
      a. Students, opting for exits at any level, will have the option to re-enter the programme from where they have left off, in the same or in a different higher education institution within three years of exit and complete the degree programme within the stipulated maximum period of SEVEN years from the date of admission to first year.
      b. Re-entry at various levels for lateral entrants in academic programmes shall be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions and proficiency test records.
      c. Lateral entry into the programme of study leading to the UG Diploma / Three Year UG Degree / Four Year Bachelor's Degree with Honours/Research will be based on the validation of prior learning outcomes achieved and subject to availability seats based on intake capacity.

Semester Completion	No. of Minimum Credits Required	Additional Credit Requirement	Eligible For
I and II	40	Nil	Post Graduate Diploma in Commerce with Major
III and IV	82	Nil	Master of Commerce Degree with Major

3. **Selection of 'Major' Subject**
   A student admitted to this program is required to select any one of the following subjects as 'Major' subject to the availability of a particular subject in a particular college and is required to undergo and successfully complete the 'Core' and 'Elective' courses as mentioned in the scheme of examination of the selected 'Major' subject.

4. **Availability of 'Major' and 'Intake Capacity'**
   All colleges affiliated to the University for offering **Master of Commerce (M. Com.)** Program/s in the Faculty of Commerce and Management shall adhere to the following:

Affiliated Program	Sanctioned Intake	'Major' to be offered
M. Com.	As approved by the University	• Accounting and Taxation • Business Studies • Industrial Relations • Computer Management

NOTES:
- Total intake capacity for the program as approved by the university shall remain the same and be divided amongst the 'Major' subjects allowed for M. Com. program.
- The COLLEGE may offer a particular 'Major' subject depending on the availability of students and teachers.
- The COLLEGE is not expected to force any student to opt for a particular subject where a choice is provided in the scheme of examination.

5. All colleges affiliated to the University offering B. Com. Program are required to put up a list of 'Major' and 'Minor' subjects it is offering on the Notice Board as well as on the website of the college to make students aware about the availability of subjects. Moreover, colleges are expected to define and display the 'Standard Operating Procedures' for the college staff members and students to facilitate the process of selecting 'Major' and 'Minor' subjects.

6. In pursuance with the National Education Policy 2020 and a Government Resolution No. NEP-2022/प्र.क्र.09/विशी-3/शिकाना dated 16th May 2023 issued by the Government of Maharashtra, the credit framework for B. Com. Program shall be as mentioned in **Annexure – I.**

7. **M. Com. Program Outcomes**

   a. Apply knowledge of theories and procedures related to accountancy, economics, management, and other allied areas to solve problems of business organizations.
   b. Foster Analytical and Critical thinking abilities for data-based decision making
   c. Ability to develop Value Based Leadership ability
   d. Ability to understand, analyze and communicate global, economic, legal, and ethical areas of business.
   e. Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.

e. Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.

8. Research Methodology Course:

'Research Methodology' is a compulsory course and the curriculum and evaluation pattern is common for all 'Major Subject' **(Annexure – IV)**

9. Evaluation Scheme for OJT/FP/CEP and RP

A student of M. Com. Semester – II has to compulsorily undergo 'On Job Training' during a summer break after second semester. A 'Field Project' or 'Community Engagement Project' of same duration shall be considered as equivalent to OJT.

Similarly, a student of M. Com. Semester – III and IV is required to undertake a 'Research Project'.

Scope of these courses and their detailed evaluation scheme is appended in **Annexure – III**.

10. Teaching and Examination Scheme

Teaching and Examination Schemes for all available 'Major' subjects for Master of Commerce (M. Com.) degree are appended in **Annexure – II**.

11. Grade Conversion Table and Computation of SGPA and CGPA

Grade Conversion Table (Theory)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 – 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	C	5.00 - < 5.50	50 - < 55	Average
7	P	4.00 - < 5.00	40 - < 50	Pass
8	F	Below 4	Below 40	Fail
9	AB	0	-	Absent

Grade Conversion Table (Practical)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 – 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	P	5.00 - < 5.50	50 - < 55	Pass
7	F	Below 5	Below 50	Fail
8	AB	0	-	Absent

Computation of SGPA & CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \Sigma(Ci \times Gi) / \Sigma Ci$$

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \Sigma(Ci \times Si) / \Sigma Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. CGPA to Percentage (%) conversion formula:

Percentage (%) = (CGPA) * 10

12. Credit Specifications:

a. Theory/Tutorial Courses: One hour/credit/week (a minimum of 15 hours of teaching per credit is required in a semester.
b. Laboratory/Performance Based Courses: A minimum of 30 hours in laboratory or Performance Based activities is required in a semester. Performance based activities include Studio activities, Workshop based activities, internship, Apprenticeship, Field based learning, community engagement learning, etc.
c. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.

13. Assessment

- The final total assessment of examinees shall made in terms of Continuous Internal Assessment (CIE) for 20% component and Session End Examination (SEE) for 80% component for each THEORY course mentioned in the scheme of examination.
- 'On Job Training/SIP' being a PRACTICAL course shall be assessed at college/department level as per the 'Evaluation Rubrics' mentioned in **Annexure – III**.
- 'Research Project' being a PRACTICAL course shall be assessed at college/department level as per the 'Evaluation Rubrics' mentioned in **Annexure – III**.
- Expected Performance Based Activities shall consist of the following: (a) Group Discussion (b) Seminars (c) Power Point Presentations (d) Elocution (e) Debate (f) Role Play (g) Case Studies (h) Educational Games. The teacher is expected to undertake a minimum of four of the aforesaid activity.

Continuous Internal Assessment

1a	Attendance of the student during a particular semester	05 Marks
1b	An assignment based on curriculum to be assessed by the teacher concerned	05 Marks
1c	Subject wise class test or Performance Based Activities conducted by the teacher concerned	10 Marks
1	**Continuous Internal Evaluation Total marks**	**20**

- The CIE marks will be communicated to the University at the end of each semester, but before the semester end examinations / as instructed by the university. These marks will be considered for the declaration of the results.
- The record of CIE marks, evaluation & results should be maintained for a period of one year by the respective institute/college for verification by the competent authority.

14. Attainment of Course Outcomes

a. Continuous Internal Assessment shall be carried out at college/department level in such a way the attainment of prescribed learning outcomes can be measured. The college/department concerned is required to define evaluation rubrics for 'Performance Based Activities' conducted for CIE.

b. Semester End Examinations are conducted by the university. The question papers for these examinations are required to be set in such a way that the attainment of prescribed learning outcomes can be measured.

15. Standard of Passing

The scope of the subject, percentage of passing in Theory and Project and Internal Assessment will be governed as per following rules:

(i) In order to pass the Master of Commerce (MB.Com.) 1st, 2nd, 3rd and 4th Semester Examinations, an examinee shall obtain not less than 40 % (Grade 4) marks in each theory course/paper, taking CIE & SEE together. Whereas, for practical/performance-based examination an examinee shall obtain not less than 50 % (Grade 5) marks in each practical, taking CIE & SEE together. Moreover, a student is required to secure not less than 50% marks in aggregate i.e. taking all courses together in order to become eligible for the award of M. Com. degree.

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fresh fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

16. Rules for ATKT (Allowed to Keep the Term):

An unsuccessful examinee at any semester examination shall be **ALLOWED TO KEEP TERM as per following conditions:**

Admission to Semester	**Eligibility for admission and taking University Examination**
Semester – I	Candidate should have passed the qualifying examination as per the relevant Direction governing the course.
Semester – II	Candidate should have completed the term of the Ist semester and filled examination form.
Semester – III	Candidate should have completed the term of the IInd semester, filled the examination form of the same and has obtained exemption in 2/3rd passing heads of the Ist and IInd semesters taken together.

Semester – IV	Candidate should have completed the term of the IIIrd semester and filled the examination form of the same.

17. Abbreviations Used:

CIE: Continuous Internal Evaluation SEE: Semester End Examination

OJT: On Job Training (Internship/Apprenticeship), RM: Research Methodology, RP: Research Project

18. Provision for Transfer of Credits

The M.Com. program offered under this direction provides enhanced academic flexibility to students in terms of selecting the courses they want to learn. A student can opt for any course from any statutory/recognized University or a MOOC from SWAYAM/NPTEL in lieu of a course mentioned in this scheme of examination as 'Elective' course. The mechanism for transfer of credits earned through these courses to be adhered is mentioned here:

1. Every student is mandatorily required to create an ID on Academic Bank of Credits (ABC) and shall submit her/his ID to the college.
2. Any Course mentioned in this scheme of examination under 'Elective' can be opted out by a student for taking a MOOC from SWAYAM/NPTEL learning platform.
3. A student cannot opt out any 'Core' course.
4. If a student is willing to opt out any 'Elective' course, he/she will have to mention this while submitting the examination form to the University for respective semester.
5. A certificate of completion of such an ODL/Online course shall be submitted by the student to the University through college before end term evaluation.
6. Such a certificate shall mandatorily have the number of credits, duration of the course and grades/marks obtained by the student and shall preferably have a QR code for verification.
7. The college shall submit the grades and marks obtained by the student to the University along with Internal Assessment marks for the concerned examination.
8. If a student has opted for an ODL/Online course in a particular semester and failed to submit the certificate within prescribed time, the student will be marked for 'Absent' for a particular course in that examination. Such a student will be required to fill in the examination form in the consecutive attempt and submit the passing certificate in order to get his/her corrected result.
9. A separate guideline 'Transfer of Credits' issued by the University will be applicable to the students of M. Com. Program from the date of its issuance.

NOTE: This scheme of teaching and examination for Two Year Master of Commerce (M. Com.) Program shall be effective from the academic session 2023-24 and a comprehensive direction for other regulations in this connection shall be soon issued by the University.

Annexure - I

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

CREDIT FRAMEWORK FOR 2 YEAR MASTER OF COMMERCE (M. COM.) DEGREE PROGRAM

Level	Semester	Major Subject		RM	OJT, RP	Cum. Cr/Sem	Degree / Cum. Cr.
		Mandatory	Electives				
6.0	I	3 Courses – 4 Cr.	1 Course – 4 Cr.	1 Course – 4 Cr.		20	PG Diploma with Major – 40 Cr.
	I	3 Courses – 4 Cr.	1 Course – 4 Cr.	–	OJT – 4 Cr.	20	
	Cum. Cr.	**24**	**8**	**4**	**4**	**40**	
Exit Option for Post Graduate Diploma after Three Year Degree (40 Credits)							
6.5	III	3 Courses 4 Cr.	1 Course – 4 Cr.	--	RP – 4 Cr.	20	Post Graduate Degree – 82 Cr.
	IV	3 Courses – 4 Cr.	1 Course – 4 Cr.	--	RP – 6 Cr.	22	
	Cum. Cr.	**24**	**8**	-	**10**	**42**	
Total Cum. Cr.		**48**	**16**	**4**	**14**	**82**	

Abbreviations:

- RM – Research Methodology
- OJT – On Job Training / Summer Internship Program
- RP – Research Project

SANJAY KAVISHWAR

POST GRADUATE PROGRAM IN SOCIOLOGY

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

POST GRADUATE (CBCS) (NEP) SEMESTER SYLLABUS

2023-2024

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester I

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/ point (40%)	Total
						Internal Evaluation	End SEM Exam.		
6.0	Major	Mandatory	PGSO1M01	Classical Sociological Thinkers	4	20	80	B/6	100
			PGSO1M02	Perspective on Indian Society -I	4	20	80	B/6	100
			PGSO1M03	Constitution and Social Change in India	4	20	80	B/6	100
			PGSO1M04	Sociology of Religion - 1	2		50	B/6	50
		Elective	PGSO1E05	G1P1: Family, Kinship and Marriage	4	20	80		100
			PGOS1E06	G2P1: Gender and Society.					
			PGSO1E07	G3P1: Sociology of Social Movement					
			PGSO1E08	G4P1: Sociology of Education					
	RM		PGSO1M09	Quantitative Research Methodology **OR** Qualitative Research Methodology	4	20	80	B/6	100
	Cumulative Credit/ Marks				22				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RM: Research Methodology, RP: Research Project, C5: 40%

Dr. J.R. Bhange

5/7/23

17/07/23

POST GRADUATE PROGRAM IN SOCIOLOGY
Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.
First Year: Semester II

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.0	Major	Mandatory	PGSO2M01	Contemporary Sociological Theory	4	20	80	B/6	100
			PGSO2M02	Perspectives on Indian Society-II	4	20	80	B/6	100
			PGSO2M03	Sociology of Change and Development	4	20	80	B/6	100
			PGSO2M04	Sociology of Religion - II	2		50	B/6	50
		Elective	PGSO2E05	G1P2: Rural and Urban Transformation	4	40	60	B/6	100
			PGSO2E06	G2P2: Women In Indian Society					
			PGSO2E07	G3P2: Social Movement in India					
			PGSO2E08	G4P2: Education and Society in India					
	OJT/FP		PGSO2M09	Field project FP	4	100		B/6	100
	Cumulative Credit/ Marks				22				550
	Cumulative Credit for PG diploma (Sem. 1+2)				44				
	Exit option: PG Diploma (40 Credits) after three years UG Degree								

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters. **RM: Research Methodology** **OJT: On Job Training: Internship/Apprenticeship** **C5: 40 %**

Dr V R Bhatpe

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester III

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Exam		
6.5	Major	Mandatory	PGSO3M01	Modern Sociological Theories	4	20	80	B/6	100
			PGSO3M02	Feminist Sociological Thinkers	4	20	80	B/6	100
			PGSO3M03	Globalisation and Society	4	20	80	B/6	100
			PGSO3M04	Social Problems in Contemporary India	2		50	B/6	50
		Elective	PGSO3E05	G1P3: Sociology of Social Stratification	4	40	60	B/6	100
			PGSO3E06	G2P3: Sociology of Social Exclusion					
			PGSO3EO7	G3P3: Media and Society					
			PGSO3E08	G3P3: Environment and Society					
	RP		PGSO3M09	Research Project	4	100		B/6	100
	Cumulative Credit/ Marks				66				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project

C5: 40%

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester IV

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.5	Major	Mandatory	PGSO4M01	Postmodern Social Theories	4	20	80	B/6	100
			PGSO4M02	Recent trends in Social Theories	4	20	80	B/6	100
			PGSO4M03	Economy and Society	4	20	80	B/6	100
		Elective	PGSO4E04	G1P4: Sociology of Marginalized Communities	4	20	80	B/6	100
			PGSO4E05	G2P4: Science, Technology and Society					
			PGSO4E06	G3P4: Culture and Symbolic Transformation					
			PGSO4E07	G4P4: State, Politics and Development					
	RP		PGSO4M08	Research Project	6	150		B/6	150
	Cumulative Credits/ Marks				22				550
	Cumulative Credit for 2-year PG degree				88				

2 Year - 4 Semester PG Degree (80 credits) after three-year UG degree

OR

1 Year- 2 Sem PG Degree (40 credits) after four year of UG degree

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project, CS: 40%

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

P.G. CBCS (NEP) Semester Pattern Syllabi of SOCIOLOGY

STRUCTURE OF THE CBCS (NEP) SEMESTER PATTERN P.G. PROGRAM

The P.G. CBCS semester pattern shall come into force from the academic year2023 - 2024 for the students seeking enrollment in semester I. While the students of semester III and semester IV shall go through the CBCS semester pattern examinations.

1. The CBCS (NEP) semester pattern P.G. PROGRAM shall give sufficient opportunity to the students of all departments for choice of subjects as shown in major electives.
2. The whole course shall be of full-time course of two years duration.
3. The semester I, II and III shall have four major mandatory papers (compulsory papers) and one core elective paper (optional papers) in four groups offering wider choice to the students to opt for any one group of them. The semester IV shall have three major mandatory papers (compulsory papers). There shall be again one core elective paper, which is in continuation of the group, which opt in first semester.
4. In semester I, students shall have a choice to choose any one of the course from RM (Research methodology) which he want to use in research projects of semester III & IV. RM is mandatory course.
5. In semester II, student himself shall engage in fieldwork and submit a fieldwork report to the institution/department. Based on hours engage in fieldwork and report submitted to institution/department, his/her credits will be evaluated. University will provide the direction time to time on the process of evaluation of fieldwork and other issues related to this course.
6. In semester III and IV, student shall avail a course RP (Research Project) which is mandatory and divided into two parts. The courses Research Project - I and Research Project - II, which shall opt by students, are the part of Semester III and Semester IV simultaneously. Student in the guidance of supervisor shall decide the topic of this course. The conditions of supervisor-ship and other issues will be decided by university time to

time.

7. 2100 marks, i.e. 88 credits in order to be awarded M.A. degree in Sociology by RTM Nagpur University.
8. The CBCS P.G. course shall be based on continuous internal evaluation of the students out of 20 marks in each paper (except 2 credits paper), along with the external evaluation based on a descriptive written examination of 80 marks by the university.

   Regarding 2 credits papers, University or Board of studies will declare the policy as per further notifications.

CODE OF EXAMINATION

Written Examination:

1. There shall be a written external examination of descriptive type in each paper at the end of every semester.
2. Each 4-credit paper shall be of 80 marks of external examination of 3 hours duration and 2-credit papers shall be of 50 marks of external examination of 2 hours duration.
3. The question paper shall contain 5 questions (four long questions and one short question) with an internal choice except for the short question. The short question shall be put like A, B, C and D at the question No. 5 i.e. the last question of the paper. The students shall have to answer all questions including all A, B, C and D of Q No.5.
4. Each question shall carry an equal value of 16 marks in 4-credit course and 10 marks in 2-credit course.

Nature of Internal Evaluation:

1. There shall be an internal evaluation of each student of 20 marks in each theory paper at the end of every semester in 4-credit course. It should be note that there is no internal evaluation in 2-credit courses.
2. Out of 20 internal marks in each theory paper, 10 marks shall be for Home Assignment and another 10 marks for daily attendance, viva-voce test and seminar presentation of the students based on the course content. The viva-

voce tests and seminar presentations shall be conducted by a committee consisting of the Head of the Department/Principal of the college/Director of the Institute or Centre running the P.G. Course and the teacher of the concerned subject.

3. The teacher of the concerned subject shall decide the task to be assigned to the students for home assignment, viva-voce test and seminar presentation. The students' evaluation shall be done on consensus among all the members of the committee conducting the viva-voce test and seminar presentation.

Passing Marks

1. The students shall be required to score a minimum of 40 marks in each paper out of 100 including internal marks in order to pass in the examination.
2. Scheme of Marking for Research Paper - I and II

A. Examination and Evaluation scheme for field Project)FP)

Sr.	Contents	hours	Marks Distribution
1	Orientation of Field Project	10 (2*5)	-
2	Field Work	96hours (16*6)	40
3	Field Diary	Related to FW	10
4	Report Writing	12 hours (2*6)	20
5	Presentation	2 hours	10
6	Internal Viva-voce	---	20

Internal Viva-voce conducted on the objectives of Field project with Power point Presentation. Its Field Diary and Field Report should be consider a basic document for viva-voce.

B. EXAMINATION SCHEME FOR RESEARCH PAPER - I : DISTRIBUTION OF 80 MARKS

*Research method adopt as per Research Method Paper (RM) avail in Semester I.

Sr. No.	Topic	Maximum Marks Allotted
1	Introduction (Theoretical Framework)	25
2	20 Research reviews	15
3	Research Gap	05
4	Formulation of Research Question	05
5	Formulation of objectives and tentative hypothesis	10 (5 marks each)
6	Research Method* - Justification of selection of sample & sample size & tools of data collection	15
7	Proper referencing and /or Bibliography (Use of APA Method)	05

Note: Internal Marks (max. 20) should be allotted according to his library work

C. EXAMINATION SCHEME FOR RESEARCH PAPER - I I : DISTRIBUTION OF 80 MARKS

* For analysis of data in quantitative methods SPSS and for qualitative method Atlas-ti is prescribing.

Sr. No.	Topic	Maximum Marks Allotted
1	Making of proper Questionnaire	10
2	Socio-economic Background of Respondents* (Chapter 1)	10
3	Chapters According to Objectives* (proper presentation with related referencing) (min. 3 chapters)	30 (10 per chapter)
4	Presentation of Data in Tables and Cross tables form	10
5	Presentation of Data in Graphical Form	10
6	Final Chapter i.e. Conclusion	05
7	Proper referencing and /or Bibliography (Use of APA Method)	05

Note: Internal Marks (max. 20) should be allotted according to his pilot study, field work, etc.

PROGRAM OUTCOMES FOR MA SOCIOLOGY PROGRAM

Targeted Graduated Attributes: Disciplinary Knowledge, Critical thinking, Problem solving, Analytical Reasoning, Communication Skill, Teamwork, Moral and Ethical Awareness

1. **P01** The student will be able to develop aptitude to manifest wide and extensive knowledge in the field of sociology.
2. **P02** Courses are designed in such a way that constitutional values will be imparted to students.
3. **P03** It develops the way to substantiate critical reading of literary text in order to conduct research in the field of sociology.
4. **P04** Students will be able to gain life skills as well as advanced skills necessary for professional advancement.
5. **P05** It also develops the ability of intensive research, investigation and critical analysis, usually in response to specific research question and hypothesis.
6. **P07** Courses in the program in sociology designed in such a way that the student must gain the knowledge of requirement of job market and skills required for job market in advancing societies.

COURSE WISE COURSE-OUTCOME

SEMESTER FIRST

COURSE CODE	TITLE OF COURSE	COURSE OBJECTIVES
PGSO1M01	CLASSICAL SOCIOLOGICAL THINKERS	1. Students develop critical thinking and analytical skills. 2. To learn to analyze complex social phenomena, understand the underlying structures of society, and critically evaluate different perspectives on social issues. 3. To enable students to approach social problems and phenomena with a deeper understanding and the ability to analyze them from multiple angles, leading to informed decision-making and problem-solving in various personal, academic, and professional contexts.
PGSO1M02	PERSPECTIVES ON INDIAN SOCIETY - I	1. To develop cultural awareness and sensitivity towards diverse social perspectives and experiences in India. 2. students will gain insights into the complexities of Indian society, particularly with regards to tribes, caste, gender, family, and kinship. 3. enable students to understand and appreciate the diverse cultural practices, beliefs, and social structures that exist in India.
PGSO1M03	CONSTITUTION AND SOCIAL CHANGE IN INDIA	1. To develop students constitutional literacy and understanding. 2. To critically analyze the constitutional provisions related to education, employment, health, social justice, individual rights, minority rights, and the rights of weaker sections. 3. Students will develop a deep appreciation for the constitutional framework that guides the social, economic, and political aspects of Indian society, equipping them to participate actively in democratic processes and advocate for social change.
PGSO1M04	SOCIOLOGY OF RELIGION - I	1. To develop a comprehensive understanding of the sociology of religion as a scientific discipline. 2. Explore the relationship between religion and morality, religious beliefs, and values, and gain insights into different ideologies such as theism, atheism, secularism, and fundamentalism.
PGSO1E05	C1P1 : FAMILY, KINSHIP AND MARRIAGE	1. To develop a comprehensive understanding of family, kinship, and marriage theories and concepts, including structural-functionalism, alliance theory, and cultural approaches. Examine constitutional laws related to inheritance, succession, and authority within families.

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		2. To analyze power dynamics, gender relations, and changing gender roles within families. Investigate the conditions of children, youth, and families, with a focus on the influence of gender on power dynamics. 3. Study the intersection of family, laws, and violence, including domestic violence, crimes against women, and honor killings within the context of marriage, family, and caste dynamics.
PGSO1E06	G2P1 : GENDER AND SOCIETY	1. To develop a comprehensive understanding of the social construction of gender, including the role of patriarchy and socialization in shaping gender norms and expectations. 2. Explore the dilemmas associated with gender, such as the tension between biology and gender, equality and difference, and the public and private spheres. 3. To examine different feminist theories, including liberal feminism, Marxist feminism, radical feminism, and black feminism.
PGSO1E07	G3P1 : SOCIOLOGY OF SOCIAL MOVEMENT	1. To develop a comprehensive understanding of social movements by exploring reform, revival, revolutionary, protest, and counter movements and to examine theories of social movements. 2. To analyze the relationship between social movements and social transformation. 3. Study the scenario of social movements in India, examining leadership, organizations, and the role of ideology. 4. Analyze different types of ideology associated with social movements and their impact on guiding movements and creating social unrest.
PGSO1E08	G4P1 : SOCIOLOGY OF EDUCATION	1. To examine the influence of gender, caste, and class on education and recognize the significance of studying the sociology of education in understanding social dynamics. 2. To analyze traditional perspectives of education. 3. To understand the key concepts and theories proposed by these sociologists in relation to education and to explore new theoretical perspectives in the sociology of education.
PGSO1M09	RM1 : QUANTITATIVE METHOD IN SOCIAL RESEARCH OR RM2 : QUALITATIVE METHOD IN SOCIAL RESEARCH	1. To develop a comprehensive understanding of social research, including its meaning, nature, and ethical considerations. 2. Explore the formulation of research problems, research design, sampling techniques, and data collection methods. 3. Understand the fundamentals of quantitative and qualitative research approaches. 4. To gain practical skills in data analysis and interpretation for both quantitative and qualitative research.

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SEMESTER SECOND

COURSE CODE	TITLE OF COURSE	COURSE OBJECTIVES
PGSOZM01	CONTEMPORARY SOCIOLOGICAL THEORY	1. To gain a comprehensive understanding of contemporary sociological theories by exploring the works of influential theorists. 2. To examine key sociological perspectives, including structuralism, functionalism, conflict theory, and symbolic interactionism. 3. Analyze the anthropological perspectives within structuralism, the concept of analytical functionalism within functionalism, the role of conflicts in social dynamics within conflict theory.
PGSOZM02	PERSPECTIVES ON INDIAN SOCIETY - II	1. studying perspectives on social change and development, students can develop a deep understanding of the factors that shape Indian society. 2. To analyze and navigate the complexities of social, economic, and political transformations in their personal and professional lives. 3. Develop a critical understanding of power dynamics and social movements.
PGSOZM03	SOCIOLOGY OF CHANGE AND DEVLOPMENT	1. To Develop a comprehensive understanding of social change and its dynamics. 2. To critically analyse and interpret social change processes in contemporary societies, including India. 3. Explore different approaches to development and their implications.
PGSOZM04	SOCIOLOGY OF RELIGION - II	1. To Develop a critical understanding of 2. To explore the place of religion in rational dialogue, its function in society, its social construction, and its manifestation as a social practice. 3. to critically analyze the complexities of religion in contemporary social contexts and develop a nuanced perspective on its significance.
PGSOZE05	G1P2 : RURAL AND URBAN TRANSFORMATION	1. To Develop a comprehensive understanding of rural community changes. 2. To explore the ruralization of tribes, migration patterns, and mutual adaptations. 3. to analyze the complexities of rural communities, including caste-tribal settlements and their implications for social dynamics.
PGSOZE06	G2P2 : WOMEN IN INDIAN SOCIETY	1. To Develop a comprehensive understanding of the changing profile of women in India 2. examine the demographic profile, gender gaps, and the intersection of gender with caste, class, and religion.

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		3. to critically analyze the social, cultural, and structural factors that shape women's experiences in Indian society. 4. to Examine the dynamics of patriarchy and women's experiences in India
PGSO2E07	G3P2 : SOCIAL MOVEMENT IN INDIA	1. To Develop a comprehensive understanding of social movements in India. 2. To explore the interplay between caste, class, and social movements, understanding the diverse factors that mobilize individuals and groups for social change. 3. to critically analyze the context, drivers, and outcomes of social movements in India.
PGSO2E08	G4P2 : EDUCATION AND SOCIETY IN INDIA	1. To Develop a comprehensive understanding of the socio-historical context of education in India. 2. To explore the significance of education in shaping social, cultural, and economic aspects of Indian society. 3. to critically analyze the influences and legacies of different historical periods on the present education system.
PGSO2M09	FIELD PROJECT	1. To Develop practical research skills. 2. To learn research design, data collection techniques, and data analysis methods relevant to their specific field of study. 3. To practical training enhances students' research skills, critical thinking abilities, and problem-solving capacities, which are valuable in various professional contexts.

SEMESTER THREE

COURSE CODE	TITLE OF COURSE	COURSE OBJECTIVES
PGSO3M01	MODERN SOCIOLOGICAL THEORY	1. To Develop a comprehensive understanding of contemporary sociological theories. 2. To explore concepts such as agency and structure, culture and agency, signifier and deconstructionism, knowledge and power, critical social theories, and phenomenological and ethnomethodological perspectives. 3. Enhance critical thinking and analytical skills.
PGSO3M02	FEMINIST SOCIOLOGICAL THINKERS	1. To Develop a comprehensive understanding of feminist sociological theories. 2. To explore existentialist perspectives on gender, critiques of traditional gender roles, politics of sexuality, reconstructions of historical materialism, psychoanalysis and feminism, intersectionality, and deconstructions of sex and gender. 3. Foster critical thinking and awareness of gender issues.

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PGSO3M03	GLOBALIZATION AND SOCIETY	1. To Develop a critical understanding of globalization. 2. To explore different perspectives on globalization, including Westernization, Easternization, Americanization, and Anti-Americanization. 3. critically analyze the role of the nation-state, civil society, cultural hybridization, and cultural convergence in shaping the global structure.
PGSO3M04	SOCIAL PROBLEMS IN CONTEMPORARY INDIA	1. To Develop a comprehensive understanding of social problems in India. 2. To explore the issues of casteism, atrocities, unequal distribution of power, gender inequality, and its socio-economic and political consequences. 3. To analyze the challenges posed by population growth, urbanization, and their impact on health, habitat, natural resources, and socio-economic conditions.
PGSO3E05	G1P3 : SOCIOLOGY OF SOCIAL STRATIFICATION	1. To Develop a comprehensive understanding of social stratification. 2. To explore the distinction between social inequality and biological/natural inequality, recognizing that social stratification is a product of social processes rather than inherent biological differences. 3. to critically analyze the mechanisms and consequences of social stratification in different societies.
PGSO3E06	G2P3 : SOCIOLOGY OF SOCIAL EXCLUSION	1. To Develop a comprehensive understanding of social exclusion. 2. to critically analyze the mechanisms and consequences of social exclusion in diverse contexts. 3. Analyze social categories and social exclusion: Students engage with various social categories and their relationship with social exclusion.
PGSO3E07	G3P3 : MEDIA AND SOCIETY	1. To Develop a comprehensive understanding of media in society. 2. To explore theories of mass media, including the pluralist, Marxist, and neo-Marxist perspectives, which provide different frameworks 3. To Analyze the role and influences of media.
PGSO3E08	G4P3 : ENVIRONMENT AND SOCIETY	1. To Develop a comprehensive understanding of the environment and its impact on society. 2. enables students to critically analyze the interdependencies between society and the environment. 3. Analyze the social dimensions of environmental issues.
PGSO3M09	RESEARCH PROJECT	1. To equip students with the necessary skills and knowledge to effectively write a comprehensive research report. 2. writing a research report, students will

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		develop essential skills in research methodology, critical analysis of literature

SEMESTER FOUR

COURSE CODE	TITLE OF COURSE	COURSE OBJECTIVES
PGSO4M01	POSTMODERN SOCIAL THEORIES	1. To Explore and analyze postmodern perspectives on society. 2. Critically evaluate the implications of postmodern social theories
PGSO4M02	RECENT TRENDS IN SOCIAL THEORIES	1. To Explore and critically analyze recent trends in social theories. 2. Examine the impact of information technology and digital society.
PGSO4M03	ECONOMY AND SOCIETY	1. To develop a nuanced understanding of the interconnections between economic systems, social structures, and power dynamics. 2. to critically analyze key economic concepts, debates, and emerging trends, enabling them to navigate and contribute to socio-economic environments.
PGSO4E04	G1P4 : SOCIOLOGY OF MARGINALIZED COMMUNITIES	1. To Understand the concept of marginalized communities and the bases of marginalization. 2. To explore the socio-economic and political factors that contribute to marginalization, including discrimination, deprivation, exploitation, segregation, and poverty. 3. Examine marginalized communities in India and explore means of eradicating marginality.
PGSO4E05	G2P4 : SCIENCE, TECHNOLOGY AND SOCIETY	1. To Explore the historical development of science and technology. 2. To analyze changing notions of time and space, including the shift from physical to virtual spaces. 3. Examine the social implications of science and technology.
PGSO4E06	G3P4 : CULTURE AND SYMBOLIC TRANSFORMATION	1. gain a critical awareness of the complexities of cultural dynamics and their implications for various aspects of society. 2. to develop skills in cultural analysis, allowing them to navigate and contribute to the ever-evolving cultural landscape, understand the interplay of cultural forces with religion, politics, and societal trends.
PGSO4E07	G4P4 : STATE, POLITICS AND DEVELOPMENT	1. To develop interest politics, understanding the concepts of interest, ideology, and political fractions. 2. to provide a solid foundation in state, politics, and development, enabling them to comprehend the complexities of political systems, analyze social issues, and contribute to societal progress and transformation.
PGSO4M08	RESEARCH PROJECT	1. To equip students with the necessary skills

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		and knowledge to effectively write a comprehensive research report. 2. writing a research report, students will develop essential skills in research methodology, critical analysis of literature, academic writing, and proper citation. These skills are highly valuable in academic and professional settings, including research careers, policy-making, and further studies at the graduate level.

Content

SEMESTER FIRST

	COURSE CODE	TITLE OF COURSE	CREDIT
MANDATORY	PGSO1M01	CLASSICAL SOCIOLOGICAL THINKERS	4
	PGSO1M02	PERSPECTIVES ON INDIAN SOCIETY - I	4
	PGSO1M03	CONSTITUTION AND SOCIAL CHANGE IN INDIA	4
	PGSO1M04	SOCIOLOGY OF RELIGION - I	2
ELECTIVE (select any GROUP which will Continue in next semesters)	PGSO1E05	G1P1 : FAMILY, KINSHIP AND MARRIAGE	4
	PGSO1E06	G2P1 : GENDER AND SOCIETY	
	PGSO1E07	G3P1 : SOCIOLOGY OF SOCIAL MOVEMENT	
	PGSO1E08	G4P1 : SOCIOLOGY OF EDUCATION	
RM	PGSO1M09	RM1 : QUANTITATIVE METHOD IN SOCIAL RESEARCH OR RM2 : QUALITATIVE METHOD IN SOCIAL RESEARCH	4

SEMESTER SECOND

	COURSE CODE	TITLE OF COURSE	CREDIT
MANDATORY	PGSO2M01	CONTEMPORARY SOCIOLOGICAL THEORY	4
	PGSO2M02	PERSPECTIVES ON INDIAN SOCIETY - II	4
	PGSO2M03	SOCIOLOGY OF CHANGE AND DEVLOPMENT	4
	PGSO2M04	SOCIOLOGY OF RELIGION - II	2
ELECTIVE (Continue the group as per previous semester)	PGSO2E05	G1P2 : RURAL AND URBAN TRANSFORMATION	4
	PGSO2E06	G2P2 : WOMEN IN INDIAN SOCIETY	
	PGSO2E07	G3P2 : SOCIAL MOVEMENT IN INDIA	
	PGSO2E08	G4P2 : EDUCATION AND SOCIETY IN INDIA	
FP	PGSO2M09	FIELD PROJECT	4

SEMESTER THREE

	COURSE CODE	TITLE OF COURSE	CREDIT
MANDATORY	PGSO3M01	MODERN SOCIOLOGICAL THEORY	4
	PGSO3M02	FEMINIST SOCIOLOGICAL THINKERS	4
	PGSO3M03	GLOBALIZATION AND SOCIETY	4
	PGSO3M04	SOCIAL PROBLEMS IN CONTEMPORARY INDIA	2
ELECTIVE (Continue the group as per previous semesters)	PGSO3E05	G1P3 : SOCIOLOGY OF SOCIAL STRATIFICATION	4
	PGSO3E06	G2P3 : SOCIOLOGY OF SOCIAL EXCLUSION	
	PGSO3E07	G3P3 : MEDIA AND SOCIETY	
	PGSO3E08	G4P3 : ENVIRONMENT AND SOCIETY	
RP	PGSO3M09	RESEARCH PROJECT	4

SEMESTER FOUR

	COURSE CODE	TITLE OF COURSE	CREDIT
MANDATORY	PGSO4M01	POSTMODERN SOCIAL THEORIES	4
	PGSO4M02	RECENT TRENDS IN SOCIAL THEORIES	4
	PGSO4M03	ECONOMY AND SOCIETY	4
ELECTIVE (Continue the group as per previous semesters)	PGSO4E04	G1P4 : SOCIOLOGY OF MARGINALIZED COMMUNITIES	4
	PGSO4E05	G2P4 : SCIENCE, TECHNOLOGY AND SOCIETY	
	PGSO4E06	G3P4 : CULTURE AND SYMBOLIC TRANSFORMATION	
	PGSO4E07	G4P4 : STATE, POLITICS AND DEVELOPMENT	
RP	PGSO4M08	RESEARCH PROJECT	6

SEMESTER: I

MANDATORY PAPERS

PAPER CODE : PGSO1M01

CLASSICAL SOCIOLOGICAL THINKING

Unit 1. Karl Marx:

A. Class Formation and Class Struggle

B. Dialectical Materialism and the Theory of Social Change

C. Alienation, Surplus Value and Exploitation

Unit 2. Max Weber:

A. Social Action: Theory and Types of Social action

B. Protestant Ethic in the Emergence of Modern Capitalism

C. Ideal Types of Authorities and Bureaucracy

Unit 3. Emile Durkheim:

A. Social Facts: Its Characteristics and importance

B. Division of Labour: Its Causes and Functions, Mechanical and Organic Solidarity

C. Religion: Sacred and Profane elements in the Context of Religion

Unit 4. Sigmund Freud

A. Theory of Personality and dream

B. Theory of Religion

C. Psychosexual development, Feminity

Suggested Readings:

1. George Ritzer, 1996, Sociological Theory, The McGRAW-HILL International Editions.
2. Parsons Talcott, The Structure of Social Action, Vol. I & II, McGraw Hill, New York.
3. Nisbet, 1966, The Sociological Tradition, Heinmann Educational Books Ltd, London.
4. Zetlin Irving, 1981, Ideology and the Development of SociologicalTheory, Prentice Hall.
5. Dahrendorf Ralph, 1959, Class and Class Conflict in Industrial Society.
6. Bendiz Rinehard, 1960, Max Weber, An Intellectual Portrait.
7. Popper Karl, 1945, Open Society and its Enemies, Routledge, London.
8. Aron Raymond, Main Currents in Sociological Thought, Vol. I & II, Penguin.
9. Coser L.A., 1977, Masters of Sociological Thought, New York.
10. Giddens Anthony, 1997, Capitalism and Modern Social Theory.
11. Writings of Marx, Durkheim and Weber, CambridgeUniversityPress.
12. R.N. Mukherjee and Arunansu Ghoshal, Social Thought, Vivek Prakashan, Delhi.
13. Francis Abraham and John Henry Morgan, Sociological Thought.
14. Michael Haralambos and Martin Holborn, 2000, Sociology: Themes and Perspectives, Harper Collins, London.
15. H.E. Barnes, Introduction to Sociology.
16. N.S. Vaidya, Samajik Vicharvant.

PAPER CODE : PGSO1M02

PERSPECTIVES ON INDIAN SOCIETY - I

Unit 1. Perspectives on Tribe

A. **G.S. Ghurye** : Tribes as Backward Hindus and Their Future

B. **Virginius Xaxa** : Tribes as Indigenous People of India

Unit 2. Perspectives on Caste

A. **B.R. Ambedkar** : Caste as a Socio-Cultural, Economic and Political System. Ways of Annihilation of Caste

B. **Gopal Guru** : Humiliation in Caste; Experiencing Caste and Everyday Social

Unit 3.Perspectives on Gender

A. **Kamala Bhasin** : Macsulanity, Patriarchy and Gender

B. **Uma Chakravatri** : Gendering Caste

Unit 4 Family and Kinship

A. **Irawati Karve**: Kinship Organization in India.

B. **Patricia Uberoi**: Family, Kinship and Marriage.

Suggested Readings

1. Surinder Jodhka, (2013) Interrogating India's Modernity: Democracy, Identity, and Citizenship, Oxford University Press.
2. Pathak Avijit. 1998, Indian Modernity, Aakar Books.
3. Pathak Avijit. 2006, Modernity Globalization and Identity, Aakar Books.
4. Hamilton Lawrence. 20200 How to read Amartya Sen, Penguin Random House
5. Banerjee Abhijit; Duflo Esther. 2011, Poor Economics: Rethinking Poverty & the Ways to End it, Penguin Books.
6. Banerjee Abhijit; Duflo Esther. 2019, Good Economics for Hard Times: Better Answers to Our Biggest Problems. Juggernaut.
7. Rege Sharmila. 2006, Writing Caste/Writing Gender, Zubaan Publication.
8. Rege Sharmila. 2018. Gendering Caste: Through A Feminist Lens, Sage.
9. Rege Sharmila. 2003, Sociology of Gender: The Challenge of Feminist Sociological Thought, Sage.
10. Uberoi Patricia. 1997, Family Kinship and Marriage in India, OIP.
11. Bhasin Kamla. 2000, Understanding Gender, Kali for women.
12. Bhasin Kamla. 2004, Exploring Masculinity, Women Unlimited.
13. Gopal Guru, Sundar Sarukkai. 2019 Experience, Caste, and the Everyday Social, Oxford University Press.
14. Gopal Guru, Sundar Sarukkai. 2018, The Cracked Mirror: An Indian Debate on Experience and Theory, Oxford University Press.

15. Xaxa Virginius. 2008, State, Society and Tribes: Issues in Post-Colonial India, Pearson.
16. Xaxa Virginius. 2012, Social Exclusion and Adverse Inclusion: Development and Deprivation of Adivasis in India (Ed.), OUP.
17. Xaxa Virginius & Jagannath Ambagudia. 2020, Handbook of Tribal Politics in India. Sage.
18. DeSouza, P.R. (ed), 2000, Contemporary India-Transitions, New Delhi, Sage.
19. Dhanagare, D.N. 1993, Themes and Perspectives in Indian Sociology, Jaipur, Rawat.
20. Dube, S.C. 1973, Social Sciences in a Changing Society, LucknowUniversity Press.
21. Dube, S.C. 1967, The IndianVillage, London, Routledge, 1955.
22. Karve, Irwati. 1961, Hindu Society: An Interpretation, Poona, DecanCollege.
23. Momin, A.R. 1996, The Legacy of G.S. Ghurye: A Centennial Festschrift, Popular Prakashan, Bombay.
24. Mukherjee, D.P. 1958, Diversities, People"s Publishing House, Delhi.
25. Singh, Y. 1986, Indian Sociology: Social Conditioning and Emerging Concerns, Delhi Vistaar.
26. Singh, Y. 1973, Modernization of Indian Tradition, Delhi, Thomson Press.
27. Srinivas, M.N. 1960, India"s Villages, Asia Publishing House, Bombay.
28. Tylor, Stephen: India;An Anthropological Perspective.
29. Guha, Ranjit (ed), 1982, Subaltern Studies: Writings on South Asian History and Society, Oxford.
30. Desai, A.R. 1948, Social Background of Indian Nationalism, Popular, Bombay.
31. Ambedkar, B.R. Speeches and Letters, Bombay.
32. Sinha, Surajit. 1980, Tribes and Indian Civilization, In Manin India.
33. Bose, Nirmal Kumar, Problems of Indian Nationalism, Calcutta.
34. Singhi, N.K.1996, Theory and Ideology in Indian Sociology, Rawat, Jaipur.

PAPER CODE : PGSO1M03

CONSTITUTION AND SOCIAL CHANGE IN INDIA

1. **Understand the Objectives of Indian Constitution**
   A. Welfare state and Socialism : Education, Employment, Health and Social Justice
   B. Secularism : Rights of Individual, Minorities and Weaker Section, Development Scientific Perspective (Directive Principles)
   C. Constitution as Social Document : Constitutional Values: Values in Preamble, Fundamental Duties and Directive principles
2. **Constitution and Transformation in India**
   A. Social Transformation : Capitals & Changes in Caste, Gender and Women's Rights; Marital Laws, Education Rights
   B. Economic Transformation : Changes in Occupational Structure, Labour laws and Property Rights
   C. Political Transformation: Democratic-Electoral Politics, 73rd Amendment: Grassroots' Democracy, Emergence of caste Politics
3. **Constitutional Development and Indian Society**
   A. Social Structure and Constitution: Social Structure as an inhibiter of Constitutional development with reference to Caste, Religion and Gender
   B. Cultural and Constitution : Emergence of Multiculturalism and Secular Culture
   C. Class and Constitution : Industrialization, Migration and Urbanization
4. **Modernization, Globalization and Constitution**
   A. Values of Modernization in Indian Constitution
   B. Globalization and Indian Constitution : Critical Analysis - Rise in Inequality and degradation of Welfare State
   C. Media and Constitution: Right to Expression, Monopolization of Media and Control of Political opinions.

Reference Books

1. Indian Constitution
2. Oxford Handbook of Indian Constitution, OUP
3. Indian Social Structure and Change, K.L. Sharma, Rawat

4. Constitutional Debates Debates
5. Introduction to Indian Constitution : D.D. Basu,
6. Liberlism, Constitutionalism and Democracy, Russel Hardin, OUP
7. Evolution of a Revolution, Li-ann Thio and Kevin YL Tan, Routledge
8. The Constitution of Society, Anthony Giddens, Polity Press, Cambridge
9. A Constitutional Hhistory of India, A.B. keith, , Methuen & Co. Ltd. London
10. Working a Democratic Constitution: The Indian Experience, Granville Austin , OUP
11. Discourse and Social Change, Norman Fairclough, Polity Press, Cambridge
12. Dynamics of Caste and Law: Dalit Oppressions and Constitutions, Cambridge
13. Deterring Democracy, Noam Chomsky, RHUK
14. Politics and Ethics of Indian Constitution, Rajiv Bhargav, OUP
15. Democracy in India, N.G Jayal, OUP
16. Makers of Modern India, R. Gunah, penguin
17. Law and Social Transformation in India, Oliever Mendelsohn, OUP

PAPER CODE : PGSO1M04

SOCIOLOGY OF RELIGION - I

Unit 1. Introduction:

A. Sociology of religion: Religion as a science

B. Religion and morality, religious beliefs and values

C. Theism, atheism, secularism and fundamentalism

Unit 2. Sociological Perspectives on Religion:

A. Durkheim: Religion for integration

B. Weber: Religion, rationality and development

C. Karl Marx: Religion as illusion

Suggested Readings:

1. Weber, M. The Sociology of Religion, Boston, Mass: Beacon Press, 1963.
2. Eliade, H. The Sacred and the Profane: The Nature of Religion, New York: Harcourt, Brace and World, 1959.
3. Durkheim, E. The Elementary Forms of Religious Life, London: Allen and Unwin, 1915.
4. Fischer, M.N.J. Iran: From Religious Dispute to Revolution, Cambridge, Mass: Harvard University Press, 1980.
5. Baird, Robert D, (ed.) 1995 (3rd edition) Religion in Modern India, Delhi, Manohar.
6. Jones, Kenneth W., 1989, Socio-Religious Reform Movements in British India, The New Cambridge History of India III - I),Hyderabad, Orient Longman.
7. Madan T.N. (ed.) 1992, (enlarged edition), Religion in India, New Delhi, Oxford Press.
8. Mazumdar H.T., 1986, India's Religious Heritage, New Delhi, Allied Publishers.
9. Roberts, Keith A., 1984, Religion in Sociological Perspective, New York, Dorsey Press.
10. Shakir Moin (ed.) 1989, Religion, State and Politics in India, Delhi,Ajanta Publications.
11. Turner Bryan. S., 1991 (2nd edition) Religion and Social Theory, London, Sage Publications.
12. Robinson, Rowena, 2004, Sociology of Religion in India, Sage, India.

ELECTIVE COURSES

Important Note : Opt any group as an elective course throughout whole PG program. Once you opt a group, cannot be change in any further semesters. In following coding, 'G' stands for group (i.e. G1 means group 1) and 'P' stands for paper/course (i.e. P1 means course/paper 1).

PAPER CODE : PGSO1E05

G1P1 : FAMILY, KINSHIP AND MARRIAGE

Unit 1. Theory and some concepts.

A. Theoretical Approaches: Structural-Functionalist, Alliance and Cultural

B. Constitutional laws of inheritance, succession and authority

Unit 2. Power and Gender dynamics

A. Condition of Child, youth and family

B. Gender relations and power dynamics

C. Gender and gender role in transition, sexuality in India and reproduction-controlling fertility, zero child and delayed parenting.

Unit 3. Change in marriage Family and support System

A. Changing Marriage practices in contemporary society and emerging patterns of marriage.

B. Emergent forms of family - Single parent family, Consensual Unions.

C. Changing care and support system at the age of globalisation and emerging problems.

Unit 4. Laws, Family and violence

A. Family Laws- Hindu and Muslim.

B. Domestic violence and Crime against women -Causes and Consequences

C. Honour killing - causes and pattern maintenance (marriage, family and caste).

Suggested Readings:

Schwartz Marry Ann & Scott BarBara, Marriage and Families: Diversity and Change, 3rd ed., Prentice Hall, New Jersey, 1999.

Macionis & Ken Plummer, *Sociology: Global Introduction*, 5th Ed. Pearson

Haralambos M., *Sociology: Themes and Perspective*, 8th Ed., Harper Collins Publishers Limited, 2013.

Giddens A. & Sutton P. W., *Sociology*, 7th ed., Wiley, 2013.

Patel Tulsi, ed., *The Family in India: Structure and Practice*, Sage India, 2005.

Imtiaz Ahmad, ed., *Family, Kinship and Marriage among Muslims in India*, Manohar Publishers & Distributors, 2020.
Breman Jan, *Beyond Patronage and Exploitation*, Oxford India Paperback, 1993.
Uberoi Patriia, ed., *Family, Kinship and Marriage in India*, Oxford in India Reading, 1993.
Ahuja Ram, *Social Problems in India*, 5th ed., Rawat Publication.
Veena Das, ed., Sociology and Social Anthropology, Vol. 1 & 2, Oxford, India, 2003.

PAPER CODE : PGSO1E06

G2P1 : GENDER AND SOCIETY

Unit 1. Social Construction of Gender:

A. Socialization and gender construction, patriarchy and gender construction

B. Dilemmas: Gender vs. biology, equality vs. difference, private vs. public

Unit 2. Feminist Theories:

A. Liberal Feminism, Marxist Feminism

B. Radical Feminism, Black Feminism

Unit 3. Gender inequality in society:

A. Unequal distribution of power and authorities

B. Patriarchal concept of labor and sexual division of labor,

C. Political participation and male dominance

Unit 4. Strategies to Overcome Gender Inequality:

A. Contemporary women's movement

B. Women's participation in politics and decision making

C. Women empowerment: Equal opportunity and development

Suggested Readings:

1. Altekar, A.S., 1983, The Position of Women in Hindu Civilization, Delhi, Motilal Banarasidas, Second Edition, Fifth Reprint.
2. Chodrow, Nancy, 1978, The Reproduction of Mothering, Berkely University of California Press.
3. Desai Neera and M Krishnaraj, 1978, Women and Society in India, Delhi, Ajanta.
4. Dube Leela et al (eds.) 1986, Visibility and Power: Essays on Women in Society and Development, New Delhi, OUP.
5. Forbes G., 1998, Women in Modern India, New Delhi, Cambridge University Press.
6. Maccoby, Eleaner and Carol Jackin, 1975, The Psychology of Sex Differences, Stanford, ,Stanford University Press.
7. Mc Cormack, C and M. Strathern (ed.) 1980, Nature, Culture and Gender, Cambridge, Cambridge University Press.
8. Kumkum Roy (ed.) 2005 Women in early Indian Society, Manohar Publishers and Distributors, New Delhi.
9. Myers, Kristen Anderson et al, (eds.) 1998, Feminist Foundations: Towards Transforming Sociology,New Delhi, Sage.
10. Oakely, Ann., 1972, Sex, Gender and Society, New York, Harper and Row.
11. Sharma, Ursula, 1983, Women, Work and Property in North-West India, London, Tavistock.
12. Shulamitz, Reinharz and Lynn Davidman, 1991, Feminist Research Methods, New York, OxfordUniversity Press.
13. Srinivas, M.N., Caste Its Modern Avatar, New Delhi, Penguin (Leela Dube's Article on Caste and Women)

14. Vaid, S and K Sangari, 1989, Recasting Women Essays in Colonial History, New Delhi.
15. Agarwal, B, 1994, A Field of One"s Own Gender and Land Rights in South Asia, Cambridge University Press.
16. Channa Karuna, 1988, Socialization, Women and Education: Explorations in GenderIdentity, New Delhi, Orient Longman.
17. Agarwal, B, 1994, A Field of One's Own Gender and Land Rights in South Asia,Cambridge University Press.
18. Channa Karuna, 1988, Socialization, Women and Education: Explorations in GenderIdentity, New Delhi, Orient Longman.
19. Dube Leela, 1997, Women and Kinship: Comparative Perspectives on Gender in South and South-East Asia, Tokyo, United Nations University Press.
20. Gandhi, N and N. Shah, 1992, The Issues at Stake: Theory and Practice in the Contemporary Women"s Movement in India, New Delhi.
21. Ghadially, Rehana, (ed.) 1988, Women in Indian Society, New Delhi, Sage. Jaywardene, Kuman, 1991, Feminism and Nationalism in the Third World, New Delhi.
22. Miss Maria, 1980, Indian Women and Patriarchy: Conflicts and Dilemmas of Students and Working Women, New Delhi, Concept.
23. Omvedt Gail, 1975, Caste, Class and Wome"s Liberation in India, Bulletin of Concerned Asian Scholars.
24. Pardeshi, Pratima, 1988, Dr. Ambedkar and the Question of Women's Liberation in India,Pune, WSC, University of Pune

PAPER CODE : PGSO1E07

G3P1 : SOCIOLOGY OF SOCIAL MOVEMENT

Unit 1. Understanding Social Movements:

A. Defining Features and Types of Social Movements, viz. Reform, Revival, Revolutionary, Protest, Counter Movements

B. Theories of Social Movement : Relative deprivation theory, structural strain theory, resource mobilization theory and political process theory

Unit 2. Social Movements and Social Transformation:

A. Bases of Social Movements: Caste, Class, Gender, Religion and Ethnicity

B. Issues in Social Movement: social structure and social movement, identity, culture and social movement, socio-economic and political interests and social movement

Unit 3. Scenario of Social Movements in India:

A. Leadership and organizations in social movements

B. Ideology in social movements: Types of ideology and social movements, ideology guiding movement and creating unrest

Unit 4. Social Movements in the Contemporary Times:

A. Media and social movement, public opinion social movement, democracy and social movement

B. Diffusion, absorption, and fragmentation of social movement

C. Counter movements and social transformation

Suggested Readings:

1. Banks, J.A., 1972, The Sociology of Social Movements, London, Macmillan.
2. Desai, A.R., (ed.) 1979, Peasant Struggles in India, Bombay, OxfordUniversity Press.
3. Dhanagare D.N., 1983, Peasant Movements in India 1920-1950, Delhi, OUP.
4. Gore M.S., 1993, The Social Context of an Ideology: Ambedkar's Political and Social Thoughts, New Delhi, Sage.
5. Oommen T.K., 1990, Protest and Change: Studies in Social movements, Delhi, Sage.
6. Rao M.S.A., 1979, Social Movements in India, New Delhi, Manohar.
7. Singh K.S., 1982, Tribal Movements in India, New Delhi, Manohar.
8. Selliot Eleanor, 1995, From Untouchable to Dalit: Essays on the Ambedkar Movement, New delhi, Manohar.
9. Gouldner A.W., 1950, (ed.) Studies in Leadership, New York, Harper and Brothers.
10. Oommen T.K., 1972, Charishma, Stability and Change: An Analysis of Bhoodan Gramdan Movement, New Delhi, Thomas Press.
11. Shah Ghanshyam, 1990, Social movements in India: A Review of the Literature, Delhi, Sage.
12. Shah Nandita, 1992, The Issues at Stake: Theory and Practice in the Contemporary Women's Movements in India.
13. Shiva Vandana, 1991, Ecology and the Politics Survival, New Delhi, Sage.

PAPER CODE : PGSO3E08

G4P1 : SOCIOLOGY OF EDUCATION

Unit 1. Understanding the Importance of Sociology of Education:

A. Definition, meaning and scope of sociology of education

B. Education: gender, caste and class

C. Significance of sociology of education

Unit 2. Traditional Perspectives of Education:

A. Functionalist perspectives: Emile Durkheim and Talcott Parsons

B. Conflict perspectives: Bowles & Gintis, and Paul Willis

Unit 3. Sociology of Education and New Theoretical Perspectives:

A. Social democratic perspective

B. Postmodern perspective: Robin Usher and Richard Edwards

C. Feminist Perspective

Unit 4. Education and Society:

A. Education: socialization, social identities

B. Education, social mobility, social change and development

C. Education: market and employment

Suggested Readings:

1. Haralambos, Michael, Martin Holborn and Robin Heald, 2000, Sociology: Themes and Perspectives, Fifth Edition, Collins, London.
2. Acker, S, 1994, Gendered Education: Sociological Reflections on Women, Buckingham: Open University Press.
3. Banks, Olive, 1971, Sociology of Education, (2nd Ed.), London: Batsford.
4. Banks, James A. and Lynch, James (eds.) 1986, Multicultural Education in Western Societies, London: Holt Saunders.
5. Blackledge, D. and Hunt, B., 1985, Sociological Interpretations of Education, London: Croom Helm.
6. Brint, Steven, 1998, Schools and Societies, Thousand Oaks, Calif: Pine Forge Press, A Division of Sage.
7. Uttam B. Bhoite, 2009, Higher Education in India: A System on the Verge of Chaos, Sociological Bulletin, Vol.58, No.2, May-August.
8. Channa, Karuna, 1988, Socialization, Education and Women: Explorations in Gender Identity, New Delhi: Orient Longman.
9. Chanana, Karuna, 1979, „Towards a Study of Education and Social Change". In Economic and Political Weekly, 27, 14 (4): 157-64.
10. B.K. Swain, 1998, Changing Occupational Structure in Vidarbha, India, Himalaya Publishing House, Mumbai.
11. Chitnis, Suma and P.G. Albach, 1993, Higher Education Reform in India, Experience and

Perspectives, New Delhi: Sage.
12. Craft, Maurice, (e.d), 1970, Family, Class and Education: A Reader, London: Longman.
13. Dreze, Jean and Amartya Sen, 1995, Indian Economic Development and Social Opportunity, Oxford: OxfordUniversity Press.
14. Gandhi, M.K., 1962, Problems of Education< Ahmedabad: Navjeevan Prakashan.
15. Gore, M.S. et.al. (ed.), 1975, Papers on the Sociology of Education in India, New Delhi, NCERT.
16. Halsey, A.H., Hugh Lander, Phillips Brown and Amy S. Wells, 1997, Education, Culture, Economy and Society, Oxford, OxfordUniversity Press.
17. Jejeebhoy, Shireen, 1995, Women's Education, Autonomy and Reproductive Behaviour, Oxford: Clarendon Press.
18. Meighan, Ronald and Iram Siraj- Blatchford, 1997, Sociology of Educating, London: Cassell, Third Edition.
19. Robinson, P., 1987, Perspectives in the Sociology of Education: An Introduction, London: Routledge and Kegan Paul.
20. Sen, Amartya, 1992, Inequality re-examined, Delhi: Oxford University Press.
21. Shatrugan, M., 1988, Privatising Higher Education, EPW. Pp. 2624.
22. Ahmad Karuna, 1984, Social Context of Women's Education 1921-81, New Frontiers in Higher Education, No.3, pp.1-35.
23. Durkheim,Emile, 1956, Education and Sociology, New York, Free Press.
24. Friere, Paulo, 1972, Pedagogy of the Oppressed, Harmondsworth: Penguin Books.
25. Halsay, A.K. et.al., 1961, Education, Economy, and Society: A reader in the Sociology of Education, New York: Free Press.
26. Jayaram, N, 1990, Sociology of Education in India, Jaipur: Rawat Publication.
27. Jefferey, R. and Alaka M. Basu, 1996, Girls' Schooling, Women's Autonomy and fertility Change in South Asia, New Delhi: Sage.
28. Kamat, A.R., 1985, Education and Social Change in India, Bombay: Somaiya.
29. Karabel, J. and A.H. Halsey (eds.) 1977, Powers and Ideology in Education, New York: OxfordUniversity Press.
30. Naik, J.P., 1975, Quality, Quantity and Equality in Education, Naw Delhi: Allied Publishers, Whole Book.
31. Tyler, William, 1977, The Sociology of Educational Inequality, London: Methuen.

MANDATORY RM

Important Note: Mandatory RM Course (i.e. Research Methodology) has two options, i.e. Quantitative Method in Social Research and Qualitative Method in Social Research. Student can opt that RM Course which he/she has to be applying in his/her research project of Semester Three and Semester Four of this PG program.

PAPER CODE : PGSO1M09

RM1 : QUANTITATIVE METHOD IN SOCIAL RESEARCH

Unit 1. Understanding Social Research:

A. Meaning and nature of social research, research ethics and plagiarism

B. Formulation of problem in social research, social survey and social research, research review and research gap

C. References and citation in social research: APA, MLA,etc.

Unit 2. Quantitative Social Research:

A. Objectives and hypotheses

B. Exploratory, descriptive, diagnostic and experimental designs

C. Sampling methods: Techniques and types

Unit 3. Methods of Data Collection in Quantitative Research:

A. Observation: Participatory and Non-participatory, merits and demerits

B. Questionnaire: Open and close ended questions, merits and demerits of questionnaire

C. Structured interview: its merits and demerits

D. Use of Digital tools: Google Form, Survey Sparrow, Formplus, JotForm, Epocollect5

Unit 4. Analysis and Interpretation of Data in Quantitative Research:

A. Use of SPSS in Calculation of Central Tendencies, Standard deviation and Correlations

B. Issues in the presentation and interpretation of quantitative data

C. Testing of hypothesis

Suggested Readings:

1. Wilkinson, T. S., and P. L. Bhandarkar., Methodology and Techniques of Social Research,

Himalaya Publishing House, Mumbai, (Reprint, 2004)
2. Bryman, Alan, Quality and Quantity in Social Research, UnwinHyman, London, 1988.
3. Hughes, John., The Philosophy of Social Research, Longman, London, 1987.
4. D.A.de Vaus, Surveys in Social research, George Relen and Unwin, London, 1986.
5. Bose, Pradip Kumar, Research Methodology, ICSSR, New Delhi.
6. Madge, John., The Origins of Scientific Research, Tavistock, London,1970.
7. Punch, Keith, Introduction to Social Research, Sage Publications, New Delhi, 1986.
8. Srinivas, M.N. and A.M. Shah, Field Worker and the Field, Oxford University press, New Delh, 1979.
9. Beteille A., and T.N. Madan, Encounter and Experience:Personal Accounts of Fieldwork, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.
10. Barnes, John A., Who Should Know What? Social Science, Privacy and Ethics, Harmondsworth, Penguin, 1979.
11. Mukherjee, P.N., Methodology in Social Research: Dilemma and Perspectives, Sage Publications, New Delhi, 2000.
12.Shipman, Martin, The limitations of Social Research,Longman, London, 1988.
13. Sjoberg, Gidden and Roger Nett., Methodology for Social Research, Rawat publications, Jaipur.
14. Smeler, Neil J., Comparative Methods in Social Science,
15. Garett, Henry. E., Statistics in Psychology and Education, David Mckay, Indian Publication, Bombay, Tenth Reprint, 1981.
16. Moser, C.A., Survey Methods in Social Investigation, Heinemann, 1971.
17. Somekh, B and Lewin, C., (eds.), Research Methods in Social Sciences, Vistaar Publication, New Delhi, 2005.
18. Giri, Ananta K., (ed.), Creative Social Research: RethinkingTheories and Methods, Vistaar Publication, New Delhi, 2004.
19. Whyte, W.F., Street Corner Society.
20. Daniel Bell, Doing Sociological Research.
21. Bhandarkar, P.L., Samajik Sanshodhan Padhati (Marathi).

PAPER CODE : PGSO1M09

RM2 : QUALITATIVE METHOD IN SOCIAL RESEARCH

1. **Introduction to Qualitative Research:**
   A. Difference between Quantitative and Qualitative Research, triangulation of method
   B. Ethics in qualitative research
   C. Research questions: Types, sensitizing concept and concept map

2. **Research Designs in Qualitative Research:**
   A. Construction of Research Design: Components, Linear and Circular Process
   B. Case Studies, Comparative Studies, Retrospective Studies, Oral History
   C. Snapshot and Longitudinal studies

3. **Sampling and Data Collection:**
   A. Theoretical sampling, Purposive sampling and Focus groups
   B. Interviews: Focused, Semi-Standardized, Problem-centered, Expert and Ethnographic, In-depth interviews, Narrative Interviews, Episodic Interviews
   C. Digital Research data tools: VisionsLive, LiveMinds, Kernwert, FocusVision, FlexMR, itracks, Recollective

4. **Analysis and Interpretation:**
   A. Documentation: Transcription, coding-types and content analysis
   B. Data analysis: theoretical triangulation Content Analysis, techniques and tools, Atalas-ti, NVivo
   C. Issues in presenting, analyzing and interpreting qualitative data

Suggested Readings:

1. Wilkinson, T. S., and P. L. Bhandarkar., Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai, (Reprint, 2004)
2. Hughes, John., The Philosophy of Social Research, Longman, London, 1987.
3. D.A.de Vaus, Surveys in Social research, George Relen and Unwin, London, 1986.
4. Bose, Pradip Kumar, Research Methodology, ICSSR, New Delhi.
5. Madge, John., The Origins of Scientific Research, Tavistock, London,1970.
6. Barnes, John A., Who Should Know What? Social Science, Privacy and Ethics, Harmondsworth, Penguin, 1979.
7. Mukherjee, P.N., Methodology in Social Research: Dilemma and Perspectives, Sage Publications, New Delhi, 2000.
8. Moser, C.A. and Kalton, G, Survey Methods in Social Investigation, Heinemann, 1971.
9. Bhandarkar, P.L., Samajik Sanshodhan Padhati (Marathi).

SEMESTER: II

MANDATORY PAPERS

PAPER CODE : PGSO2M01

CONTEMPORARY SOCIOLOGICAL THEORY

Unit 1. Structuralism:

A. A.R. Radcliffe-Brown : Anthropological Perspective

B. Claude Levi-Strauss : Language, Mind and Society

Unit 2. Functionalism:

A. Bronislaw Malinowski : Anthropological Approach

B. Robert K. Merton : Paradigms and Codification

C. Talcott Parsons : Analytical Functionalism

Unit 3. Conflict Theory :

A. Ralf Dahrendorf : Conflicts in Industrial Society

B. Lewis Coser : Conflict Functionalism

Unit 4. Symbolic Interactionism

A. G.H. Mead : Mind, Self and Society

B. Erving Goffman : Dramaturgy

Suggested Readings:

1. Ritzer, George. Sociological Theory, Mac-Graw-Hill, 2000.
2. Ritzer, George. Encyclopedia of Social Theory. Vol.I&II. Sage Pub. 2005.
3. Giddens and Turner (eds.). Social Theory Today, Cambridge: Polity Press, 1987.
4. Abraham, M.F. Modern Sociological Theory, New Delhi: OUP, 1990.
5. Haralambos and Holborn. Sociology: Themes and Perspective. Fifth Edition, Collins, 2000.
6. Calhoun, Craig, Rojek, Chris & Bryan Turner. The Sage Handbook of Sociology, Sage Publications, 2005.
7. Ritzer, George and Barry Smart. Handbook of Social Theory. Sage Publications, 2001.
8. Ruth A. Wallace and Alison Wolf. Contemporary Sociological Theory. 6th Edition, Eastern Economy Edition, Prentice-Hall of India, New Delhi, 2008.
9. David Ashley and David, Michael Orenstein. Sociological Theory, Sixth Edition, Pearson Education, 2005.
10. Tim Delaney. Contemporary Social Theory, Pearson Education, 2008.
11. Jonathan, H. Turner. The Structure of Sociological Theory, Rawat Publications, Jaipur, 1987.
12. Anthony Elliott. Contemporary Social Theory, London: Routledge and Kegan Paul, 2009, Indian Reprint, 2010

PAPER CODE : PGSO2M02

PERSPECTIVES ON INDIAN SOCIETY - II

Unit 1. Social Change in Indian Society

A. **Avijit Pathak:** Secular Modernity, Culture as an Arena of Struggle.

B. **Dipankar Gupta :** Modernization of Social, Economic and Political Life

Unit 2. Perspectives on Development

A. **Amartya Sen:** Development as Freedom, Capability, Choice and Social Welfare.

B. **Abhijeet Banerjee:** Experimental Approach in Development Economics, Development and Poverty Elevation, Universal Ultra Basic Income.

Unit 3. Power Politics and Social Change

A. **A R Desai:** Social Background of Indian Nationalism, Peasant Struggles and Transformation

B. **M.K. Gandhi:** Swadeshi, Satyagrah, Basic Education, Issue of untouchability

Unit 4. Civilization Perspective

A. **Surjit Sinha:** Tribe-Caste Continuum, Tribe-Peasant Continuum. Tribal Movements.

B. **N.K. Bose :** Indian civilization and tribal assimilation in Hindu main stream

Suggested Readings

1. Surinder Jodhka, (2013) Interrogating India's Modernity: Democracy, Identity, and Citizenship, Oxford University Press.
2. Pathak Avijit. 1998, Indian Modernity, Aakar Books.
3. Pathak Avijit. 2006, Modernity Globalization and Identity, Aakar Books.
4. Hamilton Lawrence. 20200 How to read Amartya Sen, Penguin Random House
5. Banerjee Abhijit; Duflo Esther. 2011, Poor Economics: Rethinking Poverty & the Ways to End it, Penguin Books.
6. Banerjee Abhijit; Duflo Esther. 2019, Good Economics for Hard Times: Better Answers to Our Biggest Problems. Juggernaut.
7. Rege Sharmila. 2006, Writing Caste/Writing Gender, Zubaan Publication.
8. Rege Sharmila. 2018. Gendering Caste: Through A Feminist Lens, Sage.
9. Rege Sharmila. 2003, Sociology of Gender: The Challenge of Feminist Sociological Thought, Sage.
10. Uberoi Patricia. 1997, Family Kinship and Marriage in India, OUP.
11. Bhasin Kamla. 2000, Understanding Gender, Kali for women.
12. Bhasin Kamla. 2004, Exploring Masculinity, Women Unlimited.

13. Gopal Guru, Sundar Sarukkai. 2019 Experience, Caste, and the Everyday Social, Oxford University Press.
14. Gopal Guru, Sundar Sarukkai. 2018, The Cracked Mirror: An Indian Debate on Experience and Theory, Oxford University Press.
15. Xaxa Virginius. 2008, State, Society and Tribes: Issues in Post-Colonial India, Pearson.
16. Xaxa Virginius. 2012, Social Exclusion and Adverse Inclusion: Development and Deprivation of Adivasis in India (Ed.), OUP.
17. Xaxa Virginius & Jagannath Ambagudia. 2020, Handbook of Tribal Politics in India. Sage.
18. DeSouza, P.R. (ed), 2000, Contemporary India-Transitions, New Delhi, Sage.
19. Dhanagare, D.N. 1993, Themes and Perspectives in Indian Sociology, Jaipur, Rawat.
20. Dube, S.C. 1973, Social Sciences in a Changing Society, LucknowUniversity Press.
21. Dube, S.C. 1967, The IndianVillage, London, Routledge, 1955,
22. Karve, Irwati. 1961, Hindu Society: An Interpretation, Poona, DecanCollege.
23. Momin, A.R. 1996, The Legacy of G.S. Ghurye: A Centennial Festschrift, Popular Prakashan, Bombay.
24. Mukherjee, D.P. 1958, Diversities, People's Publishing House, Delhi.
25. Singh, Y. 1986, Indian Sociology: Social Conditioning and Emerging Concerns, Delhi Vistaar.
26. Singh, Y. 1973, Modernization of Indian Tradition, Delhi, Thomson Press.
27. Srinivas, M.N. 1960, India"s Villages, Asia Publishing House, Bombay.
28. Tylor, Stephen: India;An Anthropological Perspective.
29. Guha, Ranjit (ed), 1982, Subaltern Studies: Writings on South Asian History and Society, Oxford.
30. Desai, A.R. 1948, Social Background of Indian Nationalism, Popular, Bombay.
31. Ambedkar, B.R. Speeches and Letters, Bombay.
32. Sinha, Surajit. 1980, Tribes and Indian Civilization, in Manin India.
33. Bose, Nirmal Kumar, Problems of Indian Nationalism, Calcutta.
34. Singhi, N.K.1996, Theory and Ideology in Indian Sociology, Rawat, Jaipur.

PAPER CODE : PGSO2M03

SOCIOLOGY OF CHANGE AND DEVLOPMENT

Unit 1. Understanding Social Change:

A. Related concepts of social change: evolution, progress, growth, development and transformation

B. Theories of social change: socio-psychological and conflict theories

C. Factors of social change: demographic, economic, religious, bio-tech, info-tech and media

Unit 2. Processes of Social Change in Contemporary India:

A. Sanskritization and Westernization

B. Modernization and Secularization

C. Industrialization, Migration and Urbanization

Unit 3. Approaches to Development:

A. Modernization approach

B. Dependency approach

C. Neo-liberal approach (MNCs, TNCs, WTO)

Unit 4. Social Structure and Development:

A. Structure as a facilitator/inhibitor of development

B. Culture as an aid or impediment to development

C. Development and displacement, sustainable development

Suggested Readings:

1. Bryce F. Ryan. Social and Cultural Change, The Ronald Press Company, New Tork,1969.
2. Wood Charles, Roberts Bryan (ed), 2005, Rethinking Development in Latin America, Peen State Press.
3. Preston P.W., 1982, The Theories of Development, London Routledge, Kegan Paul.
4. Abraham, M.F., 1990, Modern Sociological Theory: An Introduction, New Delhi, OUP.
5. Agarwal, B., 1994, A Field of One's Own: Gender and Land Rights in South Asia,Cambridge, Cambridge University Press.
6. Appadurai, Arjun, 1997, Modernity at Large: Cultural Dimensions of Globalization, New Delhi, OUP.
7. Dereze, Jean and Amartya Sen, 1996, India: Economic Development and Social Opportunity, New Delhi, OUP.
8. Desai A.R., 1985, India's Path of Development: A Marxist Approach, Bombay, Popular Prakashan (Chapter 2).9. Desai A.R., 1971, Essays on Modernization of Underdeveloped Societies, Thacker and Co, Bombay.
9. Giddens Anthony, 1996, "Global Problems and Ecological Crisis", in Introduction to Sociology, IInd Edition, New York, W.W. Norton & Co.

11. Harrison, D., 1989, The Sociology of Modernization and Development, New Delhi, Sage.

12. Haq, Mahbub Ul, 1991, Reflections on Human Development, New Delhi, OUP.
13. Moore Wilbert E., and Robert Cook, 1967, Social Change, New Delhi, Prentice-Hall of India.
14. Sharma S.L., 1980, "Criteria of Social Development", Journal of Social Action, Jan-Mar.
15. Sharma S.L., 1986, Development: Socio-Cultural Dimensions, Jaipur, Rawat (Chapter I).
16. Sharma S.L., 1994, "Salience of Ethnicity in Modernization: Evidence from India", Sociological Bulletin, Vol.39, Nos. 1 & 2. pp. 33-51.
17. Srinivas M.N., 1966, Social Change in Modern India, Berkley, University of Berkley.
18. Symposium on Implications of Globalization, 1995, Sociological Bulletin, Vol.44, (Articles by Mathew, Panin and Pathy).
19. UNDP. Sustainable Development, New York, OUP.
20. World Bank. 1995, World Development Report, New York.
21. Amin, Samir, 1979, Unequal Development, New Delhi, OUP.
22. Giddens Anthony, 1990, The Consequences of Modernity, Cambridge, Polity Press.
23. Kiely, Ray and Phil Marfleet (eds.), 1998, Globalization and the Third World, London, Routledge.
24. Sharma, S.L., 1992, "Social Action Groups as Harbingers of Silent Revolution", Economic and Political weekly, Vol. 27, No. 47.
25. Sharma, S.L., 1994, "Perspectives on Sustainable Development in South Asia: The Case of India" in Samad (ed.), Perspectives on Sustainable Development in Asia, Kuala Lumpur, ADIPA.
26. Sharma, S.L., 2000, "Empowerment Without Antagonism: A Case for Reformulation of Women's Empowerment Approach", Sociological bulletin, Vol.49., No.1,
27. UNDP. 1997, Human Development Report, New York, Oxford University Press.
28. Wallerstein Immanual, 1974, The Modern World System, New York, OUP,
29. Waters, Malcoln, 1995, Globalization, New York, Routledge and Kegan Paul.
30. World Commission on Environment and Development, 1987, Our Common Future, (Brundland Report), New Delhi, OUP.
31. Daniel Lerner. The Passing of Traditional Society, Glencoe: The Free Press, 1958.
32. Alan Peshkin and Ronald Cohen. The Values of Modernization, Journal of Developing Areas, Vol. 2, 1967.
33. Leslie A. White. The Evolution of Culture: The Development of Civilization to the Fall of Rome, New York: McGraw-Hill, 1959.
34. Julian Steward. Theory of Culture Change: The Methodology of Multilinear Evolution, University of Illinois Press, 1955.
35. Alex Inkeles, The Modernization of Man, in Rajendra Pandey (ed.), Modernization and Social Change, Criterion Publications, New Delhi, 1988.
36. Myron, Weiner. Modernization: The Dynamics of Growth (ed.), New York: Basic Books, 1966.
37. S.C. Dube. Modernization and its adaptive Demands on Indian Society, in Rajendra Pandey (ed.), Modernization and Social Change, Criterion Publications, New Delhi, 1988.
38. S.C. Dube, Understanding Change, Vikas Publishing House Pvt. Ltd., New Delhi, 1992.
39. Haralambos and Holborn. Sociology: Themes and Perspective. Fifth Edition, Collins, 2000.
40. Moor, Wilbert and Robert Cook, Social Change, New Delhi: Prentice-Hall of India, 1967.

PAPER CODE : PGSO2M04

SOCIOLOGY OF RELIGION - II

Unit 1. Religion in Contemporary Society:

A. Jürgen Habermas: The place of religion in rational dialogue

B. Niklas Luhmann: Religion as function

C. Peter L. Berger and Thomas Luckmann: Religion as social construction

D. Pierre Bourdieu: Religion and social practice

Unit 2. Religion in Public Sphere:

A. Religious nationalism

B. Religion and political power

C. Religious movements

D. Proselytism

Suggested Readings:

1. Weber, M. The Sociology of Religion, Boston, Mass: Beacon Press, 1963.
2. Eliade, H. The Sacred and the Profane: The Nature of Religion, New York: Harcourt, Brace and World, 1959.
3. Durkheim, E. The Elementary Forms of Religious Life, London: Allen and Unwin, 1915.
4. Fischer, M.N.J. Iran: From Religious Dispute to Revolution, Cambridge, Mass: Harvard University Press, 1980.
5. Baird, Robert D, (ed.) 1995 (3rd edition) Religion in Modern India, Delhi, Manohar.
6. Jones, Kenneth W., 1989, Socio-Religious Reform Movements in British India, The New Cambridge History of India III - I),Hyderabad, Orient Longman.
7. Madan T.N. (ed.) 1992, (enlarged edition), Religion in India, New Delhi, Oxford Press.
8. Mazumdar H.T., 1986, India"s Religious Heritage, New Delhi, Allied Publishers.
9. Roberts, Keith A., 1984, Religion in Sociological Perspective, New York, Dorsey Press.
10. Shakir Moin (ed.) 1989, Religion, State and Politics in India, Delhi,Ajanta Publications.
11. Turner Bryan. S., 1991 (2nd edition) Religion and Social Theory, London, Sage Publications.
12. Robinson, Rowena, 2004, Sociology of Religion in India, Sage, India.

ELECTIVE COURSES

Important Note : Continue your elective's group in second seminar. For example, if you opt G1P1 in first semester, then opt G1P2 in second. It is equally applicable to all four groups.

PAPER CODE : PGSO2E05

G1P2 : RURAL AND URBAN TRANSFORMATION

Unit I : Changing Rural Community

A. Changing Inter-Community Relations - Decline of Jajmani System, From Caste to Class, Impact of Globalization and Democratic Politics, Caste violence, Caste-Tribal Conflicts

B. Caste-Tribal Settlement - Ruaralization of Tribes, Migration of Tribes-Castes, Secured Forests, Mutual Adaptations

Unit II : Changing Agrarian System

A. Changing Agrarian Economy - Decline of Agrarian System, Factors of De-Peasantization of Rural Population and impact, Factors of Migration to cities and Impact.

B. Changing Agrarian Relations - Factors responsible for Changing Agrarian Social Structure, Inter-community relations and violence. Land Ownership & Change in Agrarian Relations, Emergence of Class relations in rural society, Agrarian Unrest and Peasant Movements

Unit III : Changing Urban Community

A. Urbanism - Concept and Meaning, Development of Urbanity, Factors and Impact Urbanization

B. Towns, Cities and Mega-Cities - Concepts, Development and Variance in Issues, Industries, Service Sectors and Businesses as Factors and Network-Builder of Urbanization.

Unit IV : Changing Human Relations in Urban Society

A. Urban Middle Class - Factors of Emergence and its Impact. Township - Emergence of Gated Communities and Exclusiveness. Changing Neighborhood within gated communities.

B. Slums - Factors of Development and issues. Bastis in Cities - Ethnic, Class, Religion and Caste based issues of settlement of Bastis. Different Urban Movements and Urban Violence

Suggested Reading:

1. Beyond Hindu and Muslim: Multiple identity in Narratives from village India, Peter Gottschalk, OUP, 2000
2. Caste, Class and Power, Andre Beteille, University of California Press, 1965
3. New Directions in the Sociology of Global Development, Vol 11, Fredrick H. Buttel & Philip McMichael, Elsevier, Amsterdam, 2005
4. City, Phil Hubbard, Routledge, New York, 2006

Urbanization unlimited: A Thematic Journey, Johannes Fiedler, Springer, New York, 2004

5. The City , Gary Bridge & Sophie Watson, Wiley-Blackwell, Chichester, 2011
6. Cosmopolitan Urbanism, J. Binnie, J. Holloway and others, Routledge, London, 2006
7. Cities and Urban Cult

PAPER CODE : PGSO2E06

G2P2 : WOMEN IN INDIAN SOCIETY

Unit 1. The Changing Profile of Women in India:

A. The changing status of women in pre-colonial, colonial and post-colonial India

B. The demographic profile - the gender gap (Census, NSS) C. Gender in caste, class and religion

Unit 2. Patriarchy and Women in India:

A. Women's role in decision making: family, health and reproductive behavior.

B. Women's situation in India: Socio-cultural taboos, economic and political deprivation, sexual exploitation, etc.

Unit 3. Women and Social Institutions:

A. Education: Gender based participation in educational institutions

B. Economy: Sexual division of labour, unequal payments, and marginalization of women

C. Polity: Gender based participation in politics; reservations for women and political empowerment

Unit 4. Women and Social Issues:

A. Development

B. Communalism

C. Crime and violence

D. Education, employment and empowerment

Suggested Readings:

1. Altekar, A.S., 1983, The Position of Women in Hindu Civilization, Delhi, Motilal Banarasidas, Second Edition, Fifth Reprint.
2. Chodrow, Nancy, 1978, The Reproduction of Mothering, BerkelyUniversity of California Press.
3. Desai Neera and M Krishnaraj, 1978, Women and Society in India, Delhi, Ajanta.
4. Dube Leela et al (eds.) 1986, Visibility and Power: Essays on Women in Society and Development, New Delhi, OUP.
5. Forbes G., 1998, Women in Modern India, New Delhi, Cambridge University Press.
6. Maccoby, Eleaner and Carol Jackin, 1975, The Psychology of Sex Differences, Stanford, Stanford University Press.
7. Mc Cormack, C and M. Strathern (ed.) 1980, Nature, Culture and Gender, Cambridge, CambridgeUniversity Press.
8. Myers, Kristen Anderson et al, (eds.) 1998, Feminist Foundations: Towards Transforming Sociology,New Delhi, Sage.

9. Oakely, Ann., 1972, Sex, Gender and Society, New York, Harper and Row.
10. Sharma, Ursula, 1983, Women, Work and Property in North-West India, London, Tavistock.
11. Shulamitz, Reinharz and Lynn Davidman, 1991, Feminist Research Methods, New York, OxfordUniversity Press.
12. Srinivas, M.N., Caste Its Modern Avatar, New Delhi, Penguin (Leela Dube"s Article on Caste and Women)
13. Vaid, S and K Sangari, 1989, Recasting Women Essays in Colonial History, New Delhi.
14. Agarwal, B, 1994, A Field of One"s Own Gender and Land Rights in South Asia, Cambridge University Press.
15. Channa Karuna, 1988, Socialization, Women and Education: Explorations in GenderIdentity, New Delhi, Orient Longman.
16. Dube Leela, 1997, Women and Kinship: Comparative Perspectives on Gender in South and South-East Asia, Tokyo, United Nations University Press.
17. Gandhi, N and N. Shah, 1992, The Issues at Stake: Theory and Practice in the
Contemporary Women"s Movement in India, New Delhi.
18. Ghadially, Rehana, (ed.) 1988, Women in Indian Society, New Delhi, Sage.
19. Jaywardene, Kuman, 1991, Feminism and Nationalism in the Third World, New Delhi.
20. Miss Maria, 1980, Indian Women and Patriarchy: Conflicts and Dilemmas of Students and Working Women, New Delhi, Concept.
21. Omvedt Gail, 1975, Caste, Class and Wome"s Liberation in India, Bulletin of Concerned Asian Scholars.
22. Pardeshi, Pratima, 1988, Dr. Ambedkar and the Question of Women"s Liberation in India, Pune, WSC, University of Pune.

PAPER CODE : PGSO2E07

G3P2 : SOCIAL MOVEMENTS IN INDIA

Unit 1. Understanding Social Movements in India:

A. History and origin of social movements in India

B. Causes and consequences of social movements

C. Caste, class and social movements in India

Unit 2. Traditional Social Movements:

A. Peasant and tribal Movements

B. Women's movement

C. Trade union and nationalist movements

Unit 3. New Social Movements:

A. Dalit and ethnic movements

B. Students' Movements

C. Ecological and environmental movements

Unit 4. Consequences of Social Movements:

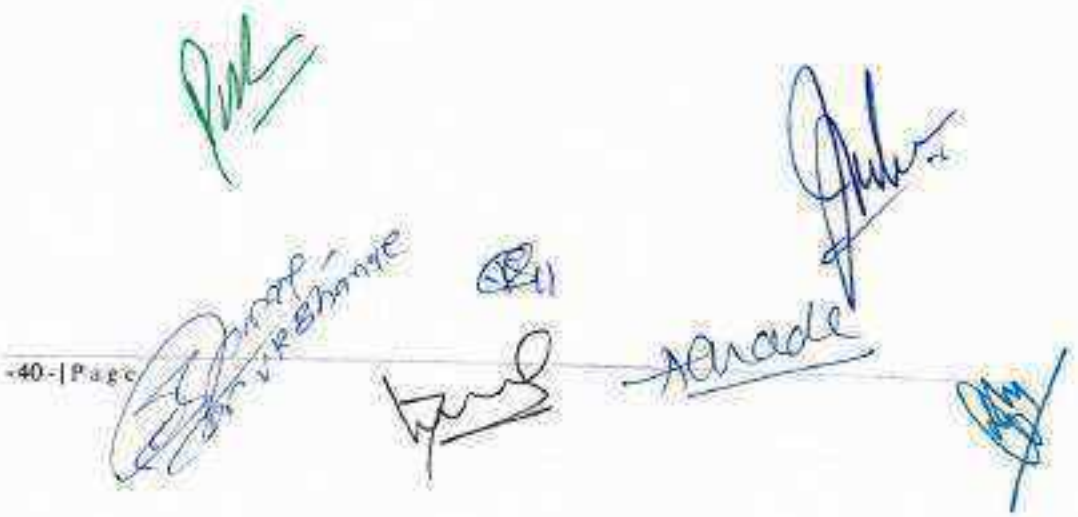
A. Social movements, state and civil Society in India

B. Social movements, social change and development

Suggested Readings:

1. Banks, J.A., 1972, The Sociology of Social Movements, London, Macmillan.
2. Desai, A.R., (ed.) 1979, Peasant Struggles in India, Bombay, OxfordUniversity Press.
3. Dhanagare D.N., 1983, Peasant Movements in India 1920-1950, Delhi, OUP.
4. Gore M.S., 1993, The Social Context of an Ideology: Ambedkar's Political and Social Thoughts, New Delhi, sage.
5. Oommen T.K., 1990, Protest and Change: Studies in Social movements, Delhi, Sage.
6. Rao M.S.A., 1979, Social Movements in India, New Delhi, Manohar.
7. Singh K.S., 1982, Tribal Movements in India, New Delhi, Manohar.
8. Selliot Eleanor, 1995, From Untouchable to Dalit: Essays on the Ambedkar Movement, New delhi, Manohar.
9. Gouldner A.W., 1950, (ed.) Studies in Leadership, New York, Harper and Brothers.
10. Oommen T.K., 1972, Charishma, Stability and Change: An Analysis of Bhoodan Gramdan Movement, New Delhi, Thomas Press.
11. Shah Ghanshyam, 1990, Social movements in India: A Review of the Literature, Delhi, Sage.

12. Shah Nandita, 1992, The Issues at Stake: Theory and Practice in the Contemporary Women's Movements in India.
13. Shiva Vandana, 1991, Ecology and the Politics Survival, New Delhi, Sage



PAPER CODE : PGSO2E08

G4P2 : EDUCATION AND SOCIETY IN INDIA

Unit 1. Socio-historical Context of Education in India:

A. Education in pre-colonial and colonial India

B. Education in post-colonial and modern India

C. Significance of education in India

Unit 2. Equality of Educational Opportunity:

A. Educational diversities and disparities: region, tribe, caste, gender and rural urban community

B. Equity and equality: positive discrimination and constitutional provisions

C. Debate of equity, excellence and efficiency

Unit 3. Issues in education:

A. Privatization of education

B. Intervention of state in education

C. Education, scientific attitudes and modernization

Unit 4. State and Education in India:

A. Basic education and social development

B. Education: skill development, globalized market and social mobility

C. Crisis in higher education system, governance and finance

Suggested Readings:

1. Haralambos, Michael, Martin Holborn and Robin Heald, 2000, Sociology: Themes and Perspectives, Fifth Edition, Collins, London.
2. Acker, S, 1994, Gendered Education: Sociological Reflections on Women,, Buckinghum: Open University Press.
3. Banks, Olive, Sociology of Education, (2nd Ed.). London: Batsford, 1971.
4. Banks, James A. and Lynch, James (eds.) 1986, Multicultural Education in Western Societies, London: Holt Saunders.
5. Blackledge, D. and Hunt, B., 1985, Sociological Interpretations of Education, London: Crom Helm.
6. Brint, Steven, 1998, Schools and Societies, Thousand Oaks, Calif: Pine Forge Press, A Division of Sage.
7. Uttam B. Bhoite, 2009, Higher Education in India: A System on the Verge of Chaos, Sociological Bulletin, Vol.58, No.2, May-August.
8. Channa, Karuna, 1988, Socialization, Education and Women: Explorations in Gender Identity, New Delhi: Orient Longman.
9. Chanana, Karuna, 1979, „Towards a Study of Education and Social Change". In Economic and Political Weekly, 27, 14 (4): 157-64.
10. B.K. Swain, 1998, Changing Occupational Structure in Vidarbha, India, Himalaya Publishing House, Mumbai.

11. Chitnis, Suma and P.G. Albach, 1993, Higher Education Reform in India, Experience and Perspectives, New Delhi: Sage.
12. Craft, Maurice, (e.d), 1970, Family, Class and Education: A Reader, London: Longman.
13. Dreze, Jean and Amartya Sen, 1995, Indian Economic Development and Social Opportunity, Oxford: Oxford University Press.
14. Gandhi, M.K., 1962, Problems of Education< Ahmedabad: Navjeevan Prakashan.
15. Gore, M.S. et.al. (ed.), 1975, Papers on the Sociology of Education in India, New Delhi, NCERT.
16. Halsey, A.H., Hugh Lander, Phillips Brown and Amy S. Wells, 1997, Education, Culture, Economy and Society, Oxford, Oxford University Press.
17. Jejeebhoy, Shireen, 1995, Women's Education, Autonomy and Reproductive Behaviour, Oxford: Clarendon Press.
18. Meighan, Ronald and Iram Siraj- Blatchford, 1997, A Sociology of Educating, London: Cassell, Third Edition.
19. Robinson, P., 1987, Perspectives in the Sociology of Education: An Introduction, London: Routledge and Kegan Paul.
20. Sen, Amartya, 1992, Inequality re-examined, Delhi: Oxford University Press.
21. Shatrugan, M., 1988, Privatising Higher Education, EPW. Pp. 2624.
22. Ahmad Karuna, 1984, Social Context of Women's Education 1921-81, New Frontiers in Higher Education, No.3, pp.1-35.
23. Durkheim,Emile, 1956, Education and Sociology, New York, Free Press.
24. Friere, Paulo, 1972, Pedagogy of the Oppressed, Harmondsworth: Penguin Books.
25. Halsay, A.K. et.al., 1961, Education, Economy, and Society: A reader in the Sociology of Education, New York: Free Press.
26. Jayaram, N, 1990, Sociology of Education in India, Jaipur: Rawat Publication.
27. Jefferey, R. and Alaka M. Basu, 1996, Girls' Schooling, Women's Autonomy and fertility Change in South Asia, New Delhi: Sage.
28. Kamat, A.R., 1985, Education and Social Change in India, Bombay: Somaiya.
29. Karabel, J. and A.H. Halsey (eds.) 1977, Powers and Ideology in Education, New York: OxfordUniversity Press.
30. Naik, J.P., 1975, Quality, Quantity and Equality in Education, Naw Delhi: Allied Publishers, Whole Book.
31. Tyler, William, 1977, The Sociology of Educational Inequality, London: Methuen.

MANDETORY : FP

PAPER CODE : PGSO2M09

FIELD PROJECT

Directions :

1. To Develop Understanding of Sociological Concept, Methodology and Theory with field interaction/Induction (Practical assignment)
2. Field Project must be 4 credits (120 hours: 2 days orientation before field induction, 16 days field engagement (6 hours per-day), Report writing, Presentation, and subject viva-voce)
3. Selection of topic - Student should discuss with supervisor and finalize the topic and field area/setting.
4. Orientation about field project - Department/institution should provide orientation workshop for field work, its procedure, report writing, documentations (written, audio-visual, etc.), field-diary, certification, etc.
5. Field work - Field work should be in any community, or with any NGO/GO/CBO, or with any Institution.
6. Report writing -
   A. Daily Report writing: Objectives, Work done, Observation and daily reflection on field
   B. Final Report writing: Field Project report (Introduction of FP, Methodology, Process, Discussion, Outcomes and Concluding remark, learning and critical reflection of sociological thoughts)
7. Field Dairy: It is must for assessment of the students. It should mention reporting time, date and day, write field Notes/points/memos during field interaction.
8. Attendance and Certification (for 96 hours field engagement): Student should submit the certificate from authority where he/she/they complete his/her/their field-work, viz. Formal head (Sarpanch/Member of Municipal Corporation etc.) of Community or authority of NGO/GO/CBO, or Institution regarding his/her/their attendance and field work in field setting.

SEMESTER: III

MANDATORY PAPERS

PAPER CODE : PGSO3M01

MODERN SOCIOLOGICAL THEORY

Unit 1 : Structuration

A. Anthony Giddens : Agency and Structure

B. Margaret Archer : Culture and Agency

Unit 2. Post-structuralism

A. Jacques Derrida - Signifier, significant & Deconstructionism

B. Michel Foucault - Knowledge and Power, Archaeology of Knowledge

Unit 3. Critical Theories

A. George Lukacs, Antonio Gramsci, Louis Althusser

B. Max Horkhemer, Theodor Adorno, Herbert Marcuse

Unit 4. Phenomenology & Ethnomethodology

A. Phenomenology : Alfred Schutz, Peter Berger

B. Ethnomethodology : Harold Garnfinkel, Clifford Geertz

Suggested Readings:

1. Ritzer, George. Sociological Theory, Mac-Graw-Hill, 2000.
2. Ritzer, George. Encyclopedia of Social Theory. Vol.I&II. Sage Pub. 2005.
3. Giddens and Turner (eds.). Social Theory Today, Cambridge: Polity Press, 1987.
4. Abraham, M.F. Modern Sociological Theory, New Delhi: OUP. 1990.
5. Haralambos and Holborn. Sociology: Themes and Perspective. Fifth Edition, Collins, 2000.
6. Calhoun, Craig, Rojek, Chris & Bryan Turner. The Sage Handbook of Sociology, Sage Publications, 2005.
7. Ritzer, George and Barry Smart. Handbook of Social Theory, Sage Publications, 2001.
8. Ruth A. Wallace and Alison Wolf. Contemporary Sociological Theory, 6th Edition, Eastern Economy Edition, Prentice-Hall of India, New Delhi, 2008.
9. David Ashley and David, Michael Orenstein. Sociological Theory, Sixth Edition, Pearson Education, 2005.
10. Tim Delaney. Contemporary Social Theory, Pearson Education, 2008.
11. Jonathan, H. Turner. The Structure of Sociological Theory, Rawat Publications, Jaipur, 1987.
12. Anthony Elliott. Contemporary Social Theory, London: Routledge and Kegan Paul, 2009, Indian Reprint, 2010

PAPER CODE : PGSO3M02

FEMINIST SOCIOLOGICAL THINKERS

Unit 1 : Classical Liberal Feminism

A. Simone de Beauvoir : The Second Sex - existentialist perspective

B. Betty Friedan : The Feminist mystique and critique on Freud

Unit 2 : Radical Feminism

A. Kate Millett : Politics and Revolution of Sexuality

B. Shulamith Firestone Reconstruction of Historical Materialism and Dialectics of Sex

Unit 3 : Marxist and Socialist Feminism

A. Juliet Mitchell : Women's Estate, Psychoanalysis and Feminism

B. Sheila Rowbotham : Critique of Marxism and Marxist Feminism

Unit 4 : Post Modern and Black Feminism

A. Judith Butler : Deconstruction of Sex and Gender, Politics of Gender

B. Issues in Black feminism and inequality in oppression

Suggested Reading

Simon de Beauvoir, The Second Sex, Penguin Books, (1981)

Simon de Beauvoir, The Ethics of Ambiguity, Philosophical Library, New York (1947)

Shulamith Firestone, the Dialectics of Sex : The case for Feminist Revolution, Frogmore, Paladin

Betty Friedan, The Famine Mystique, Penguin, Harmondsworth, 1979

Betty Friedan, The Second Stage, Summit Books, New York, 1981

Kate Millett, Sexual Politics, Ballantine Books, New York, 1980

Juliet Mitchell, Women's Liberation, Marxism and the Socialist Family, in Bikku Parekh's the Concept of Socialism, Ambika Publication, Delhi, 1976

Juliet Mitchell, Psychoanalysis and Feminism, Penguin Books, Harmondsworth, 1974

Juliet Mitchell, Women the Longest Revolution, Pantheon Books, New York, 1984

Sheila Rowbotham, Socialist Feminism, Pluto Press, London, 1978

Sheila Rowbotham, Women, Resistance and Revolution, The penguin, London, 1972

Stevi Jackson and Jackie Jones, Contemporary Feminist Theories, Rawat, Jaipur, 2011

Stanlie James and Abena Busia, Theorizing Black Feminism, Routledge, 1993

Sara Salih, Judith Butler, Routledge, New York, 2002

Gill Jagger, Judith Butler: Sexual Politics, Social Change and Power of Performative, Routledge, 2008

PAPER CODE : PGSO3M03

GLOBALIZATION AND SOCIETY

Unit 1. Understanding Globalization:

A. Concept: definition and distinctive characteristics of globalization

B. Processes of globalization: Westernization, Easternization, Americanization and Anti-Americanization

Unit 2. Global Structure:

A. Neo-liberalism and Neo-Marxian alternatives, nation-state, imagined community

B. Civil Society, cultural hybridization, cultural convergence

Unit 3. Agencies of Globalization

A. Economic agencies, viz. Multinational Corporations (MNCs), WTO; Political agencies, viz. Government & Non-Governmental Organizations (NGOs)

B. Cultural Agencies: Mass Media & ICT

Unit 4. Challenges of Globalization:

A. Inequality, poverty, rural-urban &, majority-minority divide

B. Religious fundamentalism, conflict over natural resources

Suggested Readings:

1. Appadurai, Arjun, 1997, Modernity at Large: Culture Dimensions of Globalization, New Delhi, OxfordUniversity Press.
2. Applebaum R. and Robbison W., 2005, Critical Global Studies Routledge, New York.
3. Cohen Robin and Shirin M, (ed), Global Social Movements, The Athlone Press, London.
4. Dubhashi P.R., 2002, Peoples Movement against Globalism Capitalism: EPW Feb. 9,
5. Drezem Jean and Amartya Sen, 1996, Indian Economic Development and Social Opportunity, Delhi, OUP.
6. Giddens Anthony, 2000, Runawat World: How globalization is reshaping our lives, Routledge, New York.
7. Escobar, Arturo, 1995, Encountering Development: The Making and Unmaking of the Third World, Princeton, Princeton University Press.
8. Hoogvelt, Ankie, 1997, Globalization and the Post-Colonial World - The New Political Economy of Development, London, Macmillan.
9. Hoogvelt, Ankie, 1998, The Sociology of Development, London, Macmillan.
10. Jha Avinash, 2000, Background to Globalization, Centre for education and Documentation, Mumbai.
11. Kofman and Young, 2003, Globalization, Theory and Practice, Continuum, London.

12. Kiely, Ray and Phil Marfleet (eds.) 1998, Globalization and the Third World, London, Routledge.
13. Lechner F. and Boli J. (ed), 2000, The globalization, Blackwell Oxford.
14. Preston, P.W., 1996, Development Theory - An Introduction, Oxford, Blackwell.
15. Schuurman Frans J. (ed), 2002, Globalization and Development Studies, Sage Publications, New Delhi.
16. Waters, Malcolm, 1996, Globalization, London, Routledge.

PAPER CODE : PGSO3M04

SOCIAL PROBLEMS IN CONTEMPORARY INDIA

Unit 1. Problem of inequality:

A. Casteism and atrocities: Unequal distribution of power, oppression and discrimination, caste struggle and atrocities; **Inclusive policy**: Political Reservations and Reservation in education and Government Services, SC & OBC Commission, Atrocity Act

B. Gender inequality: Patriarchal and patrilineal structure and denial of powers & authorities, sex roles, discrimination; socioeconomic-political consequences of sexism, constitutional provisions and gender sensitization

Unit 2. Population, Space and Social problems:

A. Population and Urban Problems: urban transformation due to migration, overpopulation, urban explosion; urban problems: health, habitat, natural resources, socio-economic and political problem; rapid modernization and use of technology

B. Environment, social problems and solutions to social problems

Suggested Readings:

1. Jogan, Sankar. (ed.), Social Problems and Welfare in India, Ashish, New Delhi, 1992.
2. Madan, G.R. Indian Social Problems, Vol. I and II, Allied, Bombay, 1973.
3. Ahuja, Ram. Social Problems in India, Rawat, Jaipur, 2002.
4. Jain, Prabha Shasi and Singh Mamta. Violence Against Women, Radha, New Delhi, 2001.
5. Mishra, Girish and Pandey Brajkumar. White-Collar Crimes, Gyan, New Delhi, 1998.
6. Ahmad, Siddique. Criminology (5th ed.), Eastern Book Company, New Delhi, 2005.
7. Paranjape, N.P. Criminology (12th ed.), Central, Allahabad, 2005.
8. Attar, Chand. Poverty and Underdevelopment: New Challenges, Gyan, New Delhi.
9. Horton, Paul B and Leslie, Gerald R. The Sociology of Social Problems (Fifth ed.), Prentice-Hall, New Jersey, 1974.
10. Weinberg, M.S., Rubington Earl Sue Kiefer Hammersmith. The Solution of Social Problems-Five Perspectives, (2nd Edition), OUP, New York, 1981.

ELECTIVE COURSES

Important Note : Continue your elective's group in second seminar. For example, if you opt G1P1 in first semester, then opt G1P2 in second and G1P3 in third. It is equally applicable to all four groups.

PAPER CODE : PGSO3E05

G1P3 : SOCIOLOGY OF SOCIAL STRATIFICATION

Unit 1. Understanding Social Stratification:

A. Definition, characteristics and types of social stratification

B. Social Differentiation and Social Stratification

C. Social inequality vs. biological/natural inequality

Unit 2. Theoretical Perspectives on Social Stratification:

A. Functional perspectives: Talcott Parsons, Kingsley Davis & Wilbert E. Moore

B. Conflict perspectives: Karl Marx, Pierre Bourdieu

Unit 3. Class Identity and Culture:

A. Class and Types of Capitals, Attitudes to class and identity,

B. Class ambivalence, Culture and Class Conflict

Unit 4. Social Mobility and Social Stratification:

A. Ascription and Achievement, types of mobility: Absolute, relative, Intergenerational, intra-generational, upward, downward

B. Caste, Gender and mobility; the death of class

Suggested Readings:

Haralambos, Michael, MartinHolborn and Robin Heald. Sociology: Themes andPerspectives, Collins, 2000.

Gordon,L. „On „Difference", Gender, 1991.

Gupta, D. „Hierarchy and Difference", in Dipankar Gupta (ed.): Social Stratification (1-21), Delhi: OUP, 1991.

Dahrendorf, R. Essays in the Theory of Society, London: Routledge and Kegan Paul, 1968. (Chapter 1)

Beteille, A. „Introduction", in Andre Beteille (ed.): Equality and Inequality: Theory and Practice (1-27), OUP, Delhi, 1983.

Beteille, A. Inequality among Men, Oxford: BasilBlackwell, 1977.

Mencher, J. „The Caste System Upside Down", in Dipankar Gupta (ed.): Social Stratification (93-109), Delhi:OUP, 1991.
Vasanth and Kannabiran K. „Caste and Gender: Understanding Dynamics of Power and Violence", in Anupama Rao (ed.) Gender and Caste (249-60, Delhi: Kali for Women.
Weber, M. 1978. Economy and Society, Berkeley: University of California Press, (Vol. 1, Part-1, Chapter 4:, Vol. 2, Part-2, Chapter 9, Section 6).
Wesolowski, W. 1979. Classes, Strata and Power, London: Routledge and Kegan Paul. (Chapters 1 and 3)
Wright, Olin E. 1985. Classes, London: Verso (Chapter 3)
Marx, K. 1975. The Poverty of Philosophy, Moscow: Progress Publishers (Chapter 2, Section 5).
Miliband, R. 1983. Class, Power and State Power, London: Verso (Chapter 1).
Beteille, A. 1983. The Idea of Natural Inequality and other Essays, Delhi: OUP, pp. 7-32
Sen, A. 1990. „Gender and Cooperative Conflicts", in Irene Tinker (ed.): Persistent Inequalities (123-49), New York: OUP.
Patriwala, R. 2000. „Family: Power Relations and Power Structures", in C. Kramarae and D. Spender 9eds.): International Encyclopedia of Women: Global Women's Issues and Knowledge, vol.2: 669-74), London: Routledge.
Mazumdar, V and Sharma, K. 1990. „Sexual Division of Labour and the Subordination of Women: A Reappraisal from India", in Irene Tinker (ed.): Persistent Inequalities (185-97), New York: OUP.
Chakravarti, U. 1995. „Gender, Caste, and Labour", EPW, 30 (36): 2248-56.
Kapadia, K. 1996. Sive and Her Sisters: Gender, Caste, and Class in Rural South India, Delhi: OUP. (Part 3).
Chowdhry, P. 1997. „Enforcing Cultural Codes: Gender and Violence in Northern India",EPW, 32(19): 10119-28.

PAPER CODE : PGSO3E06

G2P3 : SOCIOLOGY OF SOCIAL EXCLUSION

Unit 1. Understanding the Concept of Social Exclusion:

A. Meaning, definition and nature of social exclusion

B. Western Theories: Marxist - Capitalism and social exclusion, Amartya Sen: Deprivation and social exclusion

Unit 2. Social Categories and Social Exclusion:

A. Caste and social exclusion

B. Gender, patriarchy and social exclusion

C. Ethnicity and social exclusion, with reference to tribes

Unit 3. Socio-Revolutionary Movements and Social Exclusion in India:

A. Mahatma Jyotibha Phule and Savitribai Phule

B. Chhatrapati Shahu Maharaj and Dr. B.R. Ambedkar

C. Periyar Ramasamy,

Unit 4. Social Exclusion and Inclusive Policies in India:

A. Education, natural/ecological resources and weaker sections

B. Privatization and politics of inclusive policies

C. Positive discriminations and social exclusion

D. Empowerment and social exclusion

Suggested Readings:

Ram, Ahuja. Society in India, Rawat Publications, 2004.

Rao, Shankar. Sociology of Indian Society. S. Chand and Company, New Delhi, 2004.

Ghurye, G.S. Caste and Race in India, Popular Prakashan, Bombay, 1969.

Guha, Ranjit. (ed.), Sabaltern Studies: Writings on South Asian History and Society, Oxford, Delhin 1982.

Michael, Haralambos. Sociology:Themes and Perspectives, 13th edition, OUP, Delhi, 1994.

Forbes, G. Women in Modern India, New Delhi: CambridgeUniversity Press, 1998.

Oakley, Ann. Sex, Gender and Society, New York: Harper and Row, 1972.

Malcolm. Globalization, London: Routledge, 1996.

Betelle, Andre. The Backward Classes in Contemporary India, Delhi, OUP, 1992.

Zelliot, Eleanor. From Untouchable to Dalit: Essays on the Ambedkar Movement, New Delhi, Manohar, 1995.

Ambedkar, B.R. The Untouchables: Who were they and why they become untouchables, New Delhi, 1948.-

Rajendra K. Sharma Alantic Publishers and Distributors, New Delhi

PAPER CODE : PGSO3E07

G3P3 : MEDIA AND SOCIETY

Unit 1 : Understanding Media in Society:

A. Mass Media: the concept, definition and forms of mass media

B. Theories of Mass Media: Pluralist, Marxist, Neo-Marxist

Unit 2 : Role and Influences of Media

A. Hypodermic, normative, interpretative and structured interpretative model

B. Hyper reality, interpretative community, violence and media

Unit 3 : Images and Social Group in Media:

A. Representation of gender, caste, class & religion

B. Children, Gender, Sexuality and Media Effect

Unit 4 : Media in Globalized World:

A. Media, Market and Popular Culture

B. Capitalist and state ideology in Media

Suggested Readings:

1. Asa Briggs and Peter Burke, A Social History of the Media, Polity Press, Cambridge, 2005.
2. Benjamin, W. The Work of Art in the age of Mechanical Reproduction, Illuminations, New York, Schocken Books, 1969.
3. Williams, R. Communications, Penguin: Harmondsworth, 1962.
4. Hall, S. „Cultural studies: two paradigms", Media, Culture and Society, 1980.
5. Herman, Edward S. and Chomsky, Noam. Manufacturing Consent: The Political Economy of Mass Media, Pantheon Books, 1988.
6. John Corner. Dick Pels (eds.), Media and the Restyling of Politics: Consumerism, Celebrity, and Cynicism, London: Sage, 2000.
7. Desai, A.R. The Role of the Press in the Development of Indian Nationalism, in Social Background of Indian Nationalism, Bombay: Popular Prakashan, 1948.
8. Kohli, V. The Indian Media Business, London: Sage, 2003.
9. Jeffrey, Robbin. India"s Newspaper Revolution. Capitalism, Politics and the Indian language, New York: Martins Press, 2000.
10. Kumar, K.J. Mass Communication in India, Jaico Publishing House, 2010.
11. Gans, H.J. Deciding What"s News, Northwestern University Press, 2004.
12. Appadurai, Arjun. Modernity at Large: The Cultural Dimensions of Globalization, OUP,1996.
13. Sohat, Ella and Robert Stam. Unthinking Eurocentrism: Multiculturalism and the Media, Routledge, 1994.
14. Uberoi, Patricia. Freedom and destiny: gender, family, and popular culture in India, OUP, 2006.
15. Hall, Stuart. "The Whites of their eyes: racist ideologies in the media." In Gail Hymes and Jean M. Hume zeds Gender, race, and class in media: a text reader, Sage, 2003.

16. Said, Edward. Covering Islam: How the Media and Experts Determine How We See the Rest of the World, New York; Pantheon, 1981.
17. C. Berry and F. Martin. (eds.). Mobile Cultures: New Media in Qeer Asia, Duke University press, 2003.
18. Khan, R. and D. Keller. "New Media and Internet Activism: From the "Battle of Seattle to Blogging." New Media and Society, 2004.

PAPER CODE : PGSO3E08

G4P3 : ENVIRONMENT AND SOCIETY

Unit 1: Environment and human ecology

A. Diverse forms of Social and Cultural Ecology

B. Technological change, Agriculture and Biodiversity.

C. Environmental pollution, Public Health and Disability.

Unit 2: Ecology and Human response

A. Ecological degradation and migration

B. Development, displacement and rehabilitation.

C. Disaster and community response

Unit 3: Environment and Indigenous people.

A. Indigenous knowledge system and ethno-medicine

B. Forest policies, Adivasis and exclusion

C. Climate change, epidemics and international policies.

Unit 4. Unequal distribution of resources.

A. Gender and environment.

B. Water and social exclusion.

C. Environmental movements.

Suggested Reading

Macionis & Ken Plummer, *Sociology: Global Introduction*, 5th Ed. Pearson

Haralambos M., *Sociology: Themes and Perspective*, 8th Ed., Harper Collins Publishers Limited, 2013.

Giddens A. & Sutton P. W., *Sociology*, 7th ed., Wiley, 2013.

Ahuja Ram, *Social Problems in India*, 5th ed., Rawat Publication.

Veena Das, ed., Sociology and Social Anthropology, Vol. 1 & 2, Oxford, India, 2003.

Sen Amartya and Dreze Jean, Indian Development: Selected Regional Perspectives, Oxford, 2010.

Banerjee Debdas, Globalisation, Industrial Restructuring and Labour Standards: Where India Meet the Global, 2005, Sage India.

Sikdar Soumyen, Contemporery Issues in Globalisation: An Introduction to Theory and policy in India, Oxford India, 2003.

Sklair Leslie, Globalisation: Capitalism and its Alternatives, 3rd ed., Oxford, 2002.

Bhagwati Jagdish, In Defence of Globalisation, Oxford India, 2004.

Bhalla Surjit S., Imagine There's No Country: Poverty, Inequality and Growth in the Era of Globalisation, Penguin India, 2003.

Bhattacharya Malini, Globalisation: perspectives in Women's Studies, Tulika Books, 2004.

D'Souza Rohan, ed., Environment, Technology and Development: Critical Subversive Essays, Orient Black Swan, 2012.

Newton Tim, Nature and Sociology, Orient Black Swan, 2012.

Hannigan John, Environmental Sociology, 2nd ed., Manohar Publishers & Distributors, 2008.

MANDATORY RP

Important Note: Mandatory RP Course (i.e. Research Project) is continuous process which start at third semester and end in fourth semester with same topic. The research methodology adopted in this process is same which opt in first semester of this course. The first part (which describe in course syllabus) should be completed and evaluated in third semester only and end part of this project should be submitted and evaluated in fourth semester only.

PAPER CODE : PGSO3M09

RESEARCH PROJECT

Student should submit a report of 50 - 60 pages to University which content the following topics.

1. **Introduction**
   A. Sociological Theory related to Topic (should cover concept / variables which are focused in topic, theory / theories related to concept/s i.e. Variables)
   B. Introduction of respondents / population / stake-holders (which are the subjects of research)
   C. Geographic area (which are involve in field survey)
   D. References ; APA referencing should be follow writing

2. **Review of Literature** (should follow the standard procedure)
   A. Categorization of Review of Literature (according to topic and subjects i.e. stake-holders) (nearby 20)
      Regional level context / National level context / International level/context
   B. Significance of the study
   C. Research Gap
   D. Statement of Problem
   E. Relevance of Study

F. References; APA referencing should be follow at the time of writing

3. **Research Methodology** (the subtopics of methodology should be framed according to quantitative / qualitative methods which used for study)
   A. Universe and field of study
   B. Research Design
   C. Research questions (for qualitative study)
   D. Objectives (maximum four)
   E. Hypothesis (for quantitative study)
   F. Sample design of research, techniques of data collection (field work)
   G. References ; APA referencing should be follow writing

4. **Bibliography**

Suggested Readings:

The students shall have to refer to the selected reading materials suggested for the papers on Quantitative and Qualitative Methods in Social Research as they opt in Semester- I

SEMESTER: IV

MANDATORY PAPERS

PAPER CODE : PGSO4M01

POSTMODERN SOCIAL THEORIES

Unit 1 : Early Theorizing of Post-modernity

A. Jean Francois Lyotard : Language game, knowledge in Computerised society

B. Zygmunt Bauman : Society of Consumers, Morality & Violence

Unit 2 : Structure in Complex Society - I

A. Pierre Bourdieu : Capitals - Construction of Habitus and Field

B. Jürgen Habermas : Colonialization of Life World

Unit 3: Structure in complex Society - II

A. Ulrich Beck : Risk Society, Democratization of Science

B. Anthony Giddens : Globalization and de-traditionalization

Unit 4 : Post Modern theories

A. Jean Baudrillard : Symbolic Exchange, Hyper-reality

B. Fredric Jameson : Cultural Logic of Late Capitalism, Commodity Culture and Consumer Society

Suggested Reading

1. Braaten, Jane. 1991. *Habermas's Critical Theory of Society*. Albany: State University of New York Press.
2. Alexander, Jeffrey C, 1987, Twenty Lectures: Sociological Theory since World War II, New York, ColumbiaUniversity Press.
3. Craib, Ian, 1992, Modern Social Theory: From Parsons to Habermas (2nd edition), London, Harvester Press.
4. Collins Randall, 1997 (Indian edition), Sociological Theory, Jaipur and New Delhi, Rawat Publications.
5. Giddens Anthony, 1983, Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis, London, Macmillan.
6. Kuper Adam and Jessica Kuper (ed.), The Social Science Encyclopedia, London and New York, Routledge.
7. Ritzer George, 1992, Sociological Theory, New York, McGraw-Hill.
8. Sturrock John, (ed.), 1979, Structuralism and since: From Levi-Strauss to Derida, Oxford, OUP.
9. John Rex, Key Problems of Sociological Theory, Routledge, London.
10. Turner, Jonathan H., 1995, The Structure of Sociological Theory, Jaipur and New Delhi, Rawat Publications.
11. Zeitlin, Irving M., 1998, Rethinking Sociology: A Critique of Contemporary Theory, Jaipur and New Delhi, Rawat Publications.
12. Skidmore William, Theoretical Thinking in Sociology, CambridgeUniversity Press.
13. Narendra Kumar Sindhi, 1998, Samajsashtriya Sidhanta: Vivechan abam Bakhya, Rawat Publications (in Hindi).
14. S.L. Doshi, and M.S. Trivedi, 1996, Uttar Samajsashtriya Sidhanta, Rawat Publications.

PAPER CODE : PGSO4M0Z

RECENT TRENDS IN SOCIAL THEORIES

Unit 1 : Cultural Theories

A. Gayatri Spivak and the Subaltern, Slavoj Zizek - Strategic essentialism and Subaltern

B. Edward said - Culture and Imperialism Paul Virilio and Hypermodernism

Unit 2 : Theories of Globalization

A. George Ritzer: Hyperrationality, McDonaldization and Americanization

B. Ernesto Laclau and Chantal Mouffe - Hegemony and Radical Democracy

Unit 2 : Information and Network Theories

A. Manuel Castells: Theory of Network Society.

B. Donna Haraway: Theory of Cyborg, Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene.

Unit 4 : Theories of Future / Digital Society

A. Paul Levinson : Society in Cyber Space

B. Ori Schwarz: The digital objectification of social life

Suggested Reading

August, V. (2022). Network concepts in social theory: Foucault and cybernetics. *European Journal of Social Theory, 25*(2), 271-291.

Bell, W. (1996). The Sociology of the Future and the Future of Sociology. Sociological Perspectives, 39(1), 39-57. https://doi.org/10.2307/1389342

Calhoun, C., Gerteis, J., Moody, J., Pfaff, S., & Virk, I. (Eds.). (2012). *Contemporary sociological theory*. John Wiley & Sons.

Deborah Eade (Ed.). 2002. Development and Culture: Selected Essays from Development in Practice. Oxford: Oxfam GB in association with World Faiths Development Dialogue

Fuchs, C. (2007). *Internet and society: Social theory in the information age* (Vol. 9). Routledge.

Gary Alan Fine, Tiny Publics: A Theory of Group Action and Culture (New York: Russell Sage, 2012).

Jayapalan, N. (2014). *Sociological Theories*. New Delhi: Atlantic Publishers & Distributors (P) LTD.

Lawrence Harrison and Samuel Huntington (Eds.). 2001. Culture Matters: How Values Shape Human Progress. New York: Basic Books.

Mannheim, K. (1952). The Problem of Generations. In P. Kecskemeti (Ed.), Essays on the Sociology of Knowledge (pp. 276-320). London: Routledge and Kegan Paul.

Ori Schwarz 2021. Sociological Theory for Digital Society: The Codes that Bind Us Together. Publisher: Polity ISBN: 9781509542970

Singer, J. A., & Salovey, P. (1988). Mood and memory: Evaluating the Network Theory of Affect. *Clinical Psychology Review*, *8*(2), 211-251. https://doi.org/10.1016/0272-7358(88)90060-8
Ziauddin Sardar, 2004. Introducing Cultural Studies. Cambridge: Icon Books Ltd.
Paul Levinson, Digital Macluhan, Routledge, New York, 1999

PAPER CODE : PGSO4M03

ECONOMY AND SOCIETY

Unit 1. Concepts and Debates

A. Concepts: Exchange, Gift, capital, Labour, Market, Consumption

B. Digital economy, E-commerce

C. Mode of production debates - Socialist, Capitalist and neo-liberal

Unit 2. Property relations and Social setting.

A. Property and property relations in family and society

B. Property and exclusion (Socio-Political) and

C. Business and family - in Traditional and Neo-liberal society.

Unit 3. State and emerging trends in the age of neo-liberalisation

A. State and Market: Welfare-ism and Neoliberalism

B. Models of economic development

C. Global business and Corporates

D. Tourism - Immerging trends and Indian condition.

Unit 4. Labour in the era of neo-liberalism.

A. Factory and industry system - in liberal and neo-liberal era.

B. Changing nature of labour relations in global market of labour.

C. Gender and labour relations - prospects and exploitation

Bibliography

Macionis & Ken Plummer, *Sociology: Global Introduction*, 5th Ed. Pearson

Haralambos M., *Sociology: Themes and Perspective*, 8th Ed., Harper Collins Publishers Limited, 2013.

Giddens A. & Sutton P. W., *Sociology*, 7th ed., Wiley, 2013.

Ahuja Ram, *Social Problems in India*, 5th ed., Rawat Publication.

Veena Das, ed., Sociology and Social Anthropology, Vol. 1 & 2, Oxford, India, 2003.

Sen Amartya and Dreze Jean, Indian Development: Selected Regional Perspectives, Oxford, 2010.

Balkrishnan Pulapre, ed., *Economic Reforms and growth in India*, Orient Black Swan, 2012.

Tonkiss Fran, Contemporary Economic Sociology: Globalisation, Production & Inequality, Manohar Publishers & Distributors, 2006.

Banerjee Debdas, Globalisation, Industrial Restructuring and Labour Standards: Where India Meet the Global, 2005, Sage India.

Sikdar Soumyen, Contemporery Issues in Globalisation: An Introduction to Theory and policy in India, Oxford India, 2003.

Sklair Leslie, Globalisation: Capitalism and its Alternatives, 3rd ed., Oxford, 2002.

Bhagwati Jagdish, In Defence of Globalisation, Oxford India, 2004.

Bhalla Surjit S., Imagine There's No Country: Poverty, Inequality and Growth in the Era of Globalization, Penguin India, 2003.

Bhattacharya Malini, Globalization: perspectives in Women's Studies, Tulika Books, 2004.

ELECTIVE COURSES

Important Note : Continue your elective's group in second seminar. For example, if you opt G1P1 in first semester, then opt G1P2 in second and G1P3 in third. As well, avail G1P4 in fourth semester. It is equally applicable to all four groups.

PAPER CODE : PGSO4E04

G1P4 : SOCIOLOGY OF MARGINALIZED COMMUNITIES

Unit 1. Understanding Marginalized Communities and the Bases of Marginalization

A. The meaning and definition of marginalized communities

B. Bases of marginalization: socio-economic and political, discrimination, deprivation, exploitation, segregation and poverty

Unit 2. Theories of Marginalizati

A. Caste theory of marginalization

B. Racial theory of marginalization

C. Religious and cultural theory of marginalization

D. Economic (Marxist) theory of marginalization

Unit 3. Marginalized Communities in India:

A. SCs, STs, OBCs, women and minorities

B. Socio-economic status, mobility and problems among the marginalized communities

Unit 4. Means of Eradicating the Situation of Marginality:

A. Education, employment and political participation

B. Access to health and civic amenities

C. Socio-cultural assimilation and absorption

Suggested Readings:

1. Ahuja, Ram. Indian Social System, Rawat Publications, Jaipur, 1993/2002.
2. Beteille, Andre. Backward Classes and the New Social Order, OUP, Delhi, 1981.
3. Beteille, Andre. The Backward Classes in Contemporary India, OUP, Delhi, 1992.Charsley, S.R. and G.K. Karanth (Eds.), Challenging Untouchability, Sage Publications, Delhi, 1998.
4. Chaudhuri, S.N. Changing status of depressed castes in contemporary India, Daya Publishing House, Delhi, 1988.

5. Gore, M.S. The Social Context of an Ideology: The Social and Political Thoughts of Babasaheb Ambedkar, Sage, New Delhi, 1993.
6. Gupta, Dipankar. Social Stratification, OUP, New Delhi, 1991.
7. Jogdand, P.G. New Economic Policy and Dalits (Jaipur: Rawat)2000.
8. Jogdand, P.G. Dalit Movement in Maharashtra, Kanak Publications, New Delhi, 1991.
9. Mane Suresh. Glimpses of Socio-Cultural Revolts in India, Samrudh Bharat, Mumbai, 2006.
10. Omvedt, Gail. Dalit Visions: The anti-caste movement and the construction of an Indian identity, Orient longman, New Delhi, 1995.
11. Omvedt, Gail. Dalits and the Democratic Revolution, Sage, New Delhi, 1999.
12. Oommen, T.K. Protest and Change: Studies in Social Movements, Sage, Delhi, 1990.
13. Shah, Ghansham. Social Movements in India: A Review of Literature, Sage, Delhi, 1990.
14. Singh, K.S. The Scheduled Castes, Anthropological Survey of India, Delhi, 1998.
15. Singh, K.S. The Scheduled Tribes, OUP, Delhi, 1995.
16. Thorat, Sukhadeo. New Economic Policy and its Impact on Employment and Poverty of the Scheduled Castes, 1997, (PuneUniversity).
17. Zelliot, Eleanor. From Untouchable to Dalit: Essays on the Ambedkar Movement, Manohar, New Delhi, 1995.
18. Venugopal, C.N. Ideology and Society in India: Sociological Essays, Criterion Publications, New Delhi, 1988.

PAPER CODE : PGSO4E05

G2P4 : SCIENCE, TECHNOLOGY AND SOCIETY

Unit 1 : History of Technological Development

A. Meaning of Science and Technology. Science and Technology - from Past to Present

B. Changing notions of Time and Space - physical to virtual. Flows/currents in S&T, Boundaries of S&T

Unit II : Science, Technology and Society

A. Virtual Community - meaning, relations with digitalization of life-world, Media - print, electronics, visual and social

B. Technology and Changing family relations, changing food habits and changing health system

Unit III : Science, Technology and State

A. E-Governance and Surveillance of Society - Aadhar, PAN Card, etc. linking. Emerging Political Processes - media socialization, opinion generation, controlling media, fake news, IT Cells, etc.

B. State Policy - E-Centric governance, digital and non-digital population, digitally excluded and included population

Unit IV : Science, Technology and Cyber Crime

A. Crime against Person - hacking of sites, mails, apps, etc. Selling personal data. Financial crime. Intrusion in digital gazettes, morphing, crime against women

B. Crime against Society: viral rumors or fake news, data theft, pornography, etc.

Suggested Reading

1. Who controls the Internet: Illusions of Borderless World, Jack Goldsmith and Tim Wu, OUP, 2006,
2. Sociology in the age of the Internet, Allison Cavanagh, McGrawhill & Open University Press, New York, 2007
3. Internet and Social Inevalities, James C. Witte and Susan E. Mannon, Routledge, New York, 2010
4. Globaliation: the Basic Text, George Ritzer, Wiley-Blackwell, 2010
5. After Habermas: New Perspectives on the Public Sphere, N.Crosssley and J.M. Roberts, Blackwell Pub. 2010

6. Information Technology and Development, Jeffrey James, Routledge, London, 2004
7. Cyberprotest: New Media, Citizens and Social Movements, W.V. DeDonk, B.D. Loader and others, Routledge, London, 2004
8. News Culture, Stuart Allan, Open University Press, Berkshire, 2004

PAPER CODE : PGSO4E06

G3P4 : CULTURE AND SYMBOLIC TRANSFORMATION

Unit I : Cultural Studies

A. Meaning and elements of Culture - Cognitive Elements, Beliefs & Practices, Signs & Symbols, Norms and Values

B. Material and Non-material Culture - Cultural lag, Civilization and Culture, Technology and Changing Material Culture

Unit II : Culture and Religion

A. Religious Economy : Economy of Religious Culture, Pilgrimage and Religious Tourism, Commodification of Rituals

B. Culture of Religion : Religious Organizations, New Religious Movements, Piety and Spirituality, Moral Economy

Unit III : Politics of Culture

A. Cultural Politics : Communalism and Secularism, Politics of Culture, Culture in Politics

B. Cultural Identity and Mobilization. Culture in Ethics and Morality. Culture of Gender and Body

Unit IV : Cultural Trends

A. Formal and informal Education as a conductor and producer of culture. Arts and Aesthetics

B. Sports and Culture, Culture and Environment

Suggested Readings

1. Jim McGuigan, 2014 Rethinking Cultural Policies, Open University Press, Berkshire.
2. M.G. Durham and Douglas M. Kellner 2006 Media and Cultural Studies, Blackwell Pub. Malden.
3. James Curran and David Morley, 2006 Media and Cultural Theory, Routledge, London.
3. John Haiman, 1998 Talk Is Cheap: Sarcasm, Alienation and Evolution of Language, OUP.
4. Melissa Gregg, 2006 Cultural Studies' Affective Voices, Palgrave, Hampshire.
5. Angela McRobbie 2005 The Uses of Cultural Studies, , Sage, London.
6. Francis Mulhern 2000 Culture/Metaculture, Routledge, New York.
7. Chris Jenks 1993 Culture, Routledge, London.

PAPER CODE : PGSO4E07

G4P4 : STATE, POLITICS AND DEVELOPMENT

Unit I: Development of Polity

A. From Tribe to Nation-State – Concepts of Ancient Republics, City-State, State, Nation-State. From Chieftainship to Grass-root Democracy. Nature of Distribution of Political Powers and Authorities

B. Development of Governance: Bureaucracy, Governance and Development of Society, Development and Relationship of Law and Society. Corruption

Unit II: Politics and Issues of Society

A. Development of Political Culture – the Role of Media, Social Media, Political Parties and Political Processes. Role of International Development Organization in Local Politics.

B. Public Policy and State: Health, Education, Livelihood and Gender-based Development.

Unit III: State and Interest Politics

A. Interest Politics: Interest, Ideology and Political Fractions. Interest and Pressure Group Politics.

B. Reservation: as share in Power and Authorities, Politics in Reservation, Politics for Reservation, Politics of Reservation.

Unit IV: Social Movements and Protest

A. Movements : Types of Movements. Movements and Rights & Redistribution of Powers. Bases of Movements – Caste, Ethnicity, Ideology, Disability, Religion and Region.

B. Democracy and Civil Society : Concept, Meaning and Importance of Civil Society, The issue of Citizenship and Civil Society. Role of NGOs and Leadership in Power Politics,Concept of Activism and its role in Protest Movements.

Suggested Reading

1. Social Justice and Enlightment, Pradeep Kumar Bose & Samir Kumar Das, Sage, New Delhi, 2009
2. Human Rights and Social Justice in a Global Perspectives, Susan C. Mapp, OUP, 2008
3.Gender and Justice in Multicultural Liberal States, Monique Deveaux, OUP, 2006

4. The Modern State, Christopher Pierson, Routledge, London, 1996
5. State and Society, J. Gledhill, Barbara Bender and Others, Routledge, London, 1988
6. The Blackwell Companion of Social Movements, D.A. Snow and Others, Blackwell, Oxford, 2006
7. Dispersing Power: Social Movements as Anti-Sate Forces, Raul Zibechi, AK Press, Oakland, 2010
8. Social Movements: Identity, Culture and the State, D.S. Meyer, Nancy Whittier and others, OUP, 2002
9. The Globalization of Corporate Media Hegemony, Lee Artz and Yahya Kamalipour, State University of New York state, Albany, 2003

MANDATORY RP

Important Note: Mandatory RP Course (i.e. Research Project) is continuous process which start at third semester and end in fourth semester with same topic. The research methodology adopted in this process is same which opt in first semester of this course. The first part (which describe in course syllabus) should be completed and evaluated in third semester only and end part of this project should be submitted and evaluated in fourth semester only.

PAPER CODE : PGSO4M08

RESEARCH PROJECT

Student should submit a report in 100-110 pages to University which content the following topics infollowing format to be followed in preparing Research Paper - II after field study as per research topic sanctioned in semester III for Research Paper - I

1. Socio-economic Background of Respondents
   (it should content the age, income, caste, class, religion, etc. as per requirement of research topic)
   While interoperation of data, relevant theories or references should be used in body text.
2. Chapters related to Objectives (maximum four chapters)
   Chapters should be separately formulated according to objectives of study
   While interoperation of data, relevant theories or references should be used in body text.
3. Final Chapter (Conclusion / summery and suggestions)
4. appendix
   A. Tables
   B. Graphs
   C. Interview schedule / questionnaire / Interview Guide
   D. Bibliography

Suggested Readings:

The students shall have to refer to the selected reading materials suggested for the papers on Quantitative and Qualitative Methods in Social Research in Semester- I

STRUCTURE AND CREDIT DISTRIBUTION OF POST GRADUATE DEGREE PROGRAM

M.A Economics (All Affiliated College)

From the Academic Session 2023-24

PG Diploma after 3 Years Degree

Year	Level	Semester (2 Years)	Major			RM	OJT/FP	RP	Cumulative Credit
			Mandatory	Credit	Electives (Choose Any One)				
	6.0	Semester - I	1. Micro-Economic Theory – I 2. Macro-Economic Theory – I 3. Statistics for Economics 4. Maharashtra Economy	4 4 4 2	1. Agricultural Economics 2. Industrial Economics 3. Mathematics for Economics	Research Methodology	-	-	22
			Credit	**14**	**4**	**4**	**-**	**-**	**22**
		Semester - II	1. Micro-Economic Theory – II 2. Macro-Economic Theory– II 3. Economics of Micro-Finance 4. Economics of Industrial Organization	4 4 4 2	1. Applied Econometrics 2. Labour Economics 3. Political Economy	-	On Job Training/Apprenticeship or Field Projects	-	22
			Credit	**14**	**4**	**-**	**4**	**-**	**22**
			Cumulative Credit for PG Diploma	**28**	**8**	**4**	**4**	**-**	**44**
Exit Option : PG Diploma (44 Credits) after 3 years UG Degree									

Year	Level	Semester (2 Years)	Major			RM	OJT/FP	RP	Cumulative Credit
			Mandatory	Credit	Electives (Choose Any One)				
	6.0	Semester - III	1. Economics of Development & Growth - I 2. International Trade – Theory & Policy 3. Economics of Money & Banking 4. Economics of Sustainable Development	4 4 4 2	1. Indian Public Finance 2. Indian Economy – Issues & Policies 3. Economics of Environment	-	-	Research Project	22
			Credit	**14**	**4**	**-**	**-**	**4**	**22**
		Semester - IV	1. Economics of Development & Growth - II 2. International Trade & Investment 3. Urban & Rural Economy	4 4 4	1. Entrepreneurship Development 2. Energy and Infrastructure Economics 3. Welfare Economics	-		Research Project	22
			Credit	**12**	**4**	**-**	**-**	**6**	**22**
			Cumulative Credit for PG Diploma	**26**	**8**	**-**	**-**	**10**	**44**
			Cumulative Credit for 2 Year PG Degree	**54**	**16**	**4**	**4**	**10**	**88**
2 Years – 4 Semester (88 Credits) after Three Year UG Degree or 1 Year : Two Semester PG Degree (44 Credits) after Four Year UG Degree									
	8.0		Course Work Course Work Course Work	4 4 4	Training in Teaching/Education/ Pedagogy	4	-	-	Ph.D Work
			Credit	**12**		**4**			**16**

Abbreviations: OJT – On Job Training: Internship/Apprenticeship; FP – Field Projects; RM – Research Methodology; RP - Research Project; Cumulative Credits : Cum.Cr

RTM Nagpur University, Nagpur

New Syllabus as per NEP – 2020

Implementation from the Academic Session 2023-24

Post Graduate Syllabus in Economics

M.A (Part-I) First Semester Examination

(Under Choice Based Credit System/CBCS)

MAJOR - MANDATORY – 1

(Credit – 4)

MICRO-ECONOMIC THEORY – I

Learning Objectives:

1. To provide a good understanding and a base to students in applying the concepts and methods of micro-economics in practical field
2. To equip the students themselves in a comprehensive manner with various aspects of micro-economic theory.
3. To develop the ability to synthesize knowledge

Learning Outcomes:

1. The knowledge of consumer behavior enables the students in recommending rational buying decisions and will also help to suggest firm to design suitable marketing strategies.
2. Students get equipped with knowledge and skill in suggesting effective decisions under uncertain market situations
3. Students understand the importance of time application and household management
4. The students will develop the skill for converting technical information into economic relationship between input and output
5. The students will develop skill to identify homogeneity level in production function and be able to estimate production function and shall be able to estimate level of output.
6. The course will help students to give recommendations on allocation of quantities of different factors of production to achieve economies of production and use of learning curves
7. The students will learn about maintain existence of firm in markets and shall be able to recommend to earn profit.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Advances in the theory of Consumer Behavior** - Derivation of demand curve by using of indifference curve approach and revealed preference approach- Hicksian Revision of demand theory, modern utility analysis of choices involving risk and uncertainty- Bernoulli, Neuman-Morgenstern, Friedman-savage, Hypothesis
2	**Theory of Production and Cost** – Relation between return to factor and return to scale – multi product firm- production function-Cobb-Douglas, CES, VES; technical change and production function, Concept of Cost – Derivation of short-run and long-run cost curves- total, average and marginal- economies and diseconomies of scale and cost curves, Modern development in cost theory
3	**Theory of Firm and Price-Output determination in various market structures** – marginal analysis as an approach to price and output determination: Perfect competition – short run and long run equilibrium of firm and industry, monopoly short run and long run equilibrium, price determination, degree of monopoly power, regulation and control of monopoly, Oligopoly – non-collusive oligopoly, kinked demand curve model – collusive Oligopoly – Cartels, mergers, price leadership models, Monopolistic Competition, firm and group equilibrium with product differentiation and selling costs analysis, excess capacity
4	**Advanced approaches to pricing and optimization** – Advanced approaches to pricing and optimization – composite demand and composite supply pricing- Average or full cost pricing – Mark-up pricing, limit pricing - Bains and Silos-Labini model

Books for References:

1. Koutsoyiannis, A. (2005) - Modern Microeconomics, Macmillan press, London
2. Layard, P.R.G. and Walters, A.W. (2001) - Microeconomic Theory, McGraw Hill, London.
3. Sen A(2005). - Microeconomics: Theory and Application, Oxford University Press, New Delhi
4. Stigler, G (2008). - Theory of Price, PHI, New Delhi
5. Varian, H.R.(2005) - Microeconomic Analysis, W.W.Norton, NewYork
6. Mankiw, N.G. (2009), Economics: Principles and Applications, Cengage Learning, India edition
7. Baumol, W.J.(1998): Economic Theory and Operations Analysis, Prentice Hall of India Private Limited
8. Henderson, J.M. & Quandt, and R.E.: Micro Economic Theory, McGraw Hill.
9. Nicholson Walter (2007)- Microeconomic Theory, The Drydon Press, London
10. E.K .Browning and J.M. Browning (2003) - Microeconomics; Theory and Applications, Kalyani Publisher, New Delhi.
11. Maddala, G.S. and Miller, E.: Microeconomics, Theory and Applications; McGraw Hill
12. Pindyck, R.S., Rubinfeld, D.L. & Mehta: Micro Economics, Pearson Education
13. Salvatore. D.: Micro Economics, Theory and Applications, Oxford University Press.
14. Hall Varian: 'Micro Economic Analysis,' Viva
15. Snyder and Nicholson: 'Micro Economics- Basic principles and Extensions' Cengage learning

MAJOR - MANDATORY - 2

(Credit – 4)

MACRO-ECONOMIC THEORY – I

Objectives of the course: -

1. To make students aware of macro – economic models and macro-economic Trends as well as thoughts
2. To deal with international aspects on macro level
3. To critically evaluate the validity of macro models

Learning Objectives of the course: -

1. To demonstrate a good understanding of macro- economic principles, concepts and theories
2. To demonstrate an understanding of implications of Macro-economic decisions and shall be able to form model macro-economic theory
3. To integrate theoretical knowledge to analyse trade-off in deployment of resources to alternate ends and the implications them on society.
4. To make predictions on the happening of different economic things in the different phases of trade cycle and shall be able to derive suggestions.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Macro-economic variables** - General review of classical and Neoclassical economic analysis, systems, Keynesian system – various concepts and measurements of aggregate income and expenditure- Circular flow of four sector model - Rules for computing GDP- Various concepts interpreting GDP
2	**Demand and Supply of Money** – Quality theory of money, Patinkin's views on the relationship between money and prices, Restatement of quantity theory of Money by Milton Friedman – Liquidity approach to money, Radcliffe-Sayers thesis and Gurley – Shaw thesis
3	**Theories of Consumptions and Investment** – Classical of Consumption – The Psychological law of Consumption — Permanent Income Hypothesis – Life Cycle Hypothesis, Normal income Hypothesis, Investment Multiplier, Working and weaknesses **Investment Function** - MEC and rate of interest, Accelerator
4	**Monetary and Fiscal Policies** – Objectives and instrument of monetary policy, Effectiveness of monetary policy during inflation and deflation, Recent changes in monetary policy Fiscal Policy – Objectives and instruments of fiscal policy, Effects of taxation, Public expenditure, Pump priming, Compensatory spending, Public works, Public debt, Problems and limitations of fiscal policy, Monetary and fiscal policy mix, Mundellian Model of internal and external stability

Books for References:

1. Rosalind Levacic and Alexander Rebmann (1982), Macroeconomics: An Introduction to Keynesian Neoclassical Controversies, Macmillan.
2. Errol D'Souza (2008), Macroeconomics, Pearson.
3. David Romer (1996), Advanced Macroeconomics, McGraw-Hill.
4. David, G Pierce and Peter J Tysome (1985), Monetary Economics: theories, evidence and policy, Butter worths.
5. Laidler, D.E.W. (1984), The Buffer Stock Notion in Monetary Economics, Economic Journal 94, 17-34.
6. N. G. Mankiw: Macroeconomics, Pearson.
7. A. B. Abel and B. S. Bernanke: Macroeconomics, Pearson
8. Dorndusch, Fischer and Startz: Macroeconomics, Tata McGraw Hill.
9. Richard T. Froyen: Macroeconomics, Pearson
10. Errol D'Souza: Macroeconomics, Pearson
11. David Romer: Advanced Macroeconomics, 4th edition, McGraw Hill, 2012
12. Sunil Bhaduri: Macroeconomic Theory, New Central Book Agency. 2. Soumyen Sikdar: Principles of Economics, Oxford.

MAJOR - MANDATORY – 3

(Credit – 4)

STATISTICS FOR ECONOMICS

Learning Objectives:

1. To empower the students to master over the technique of classification and analyze data to prove different hypothesis intended to be tested.
2. To provide a tool kit to students to handle massive data and draw inferences from it.
3. To enable the students to interpret the data in nut shell by a averaging, precenting and arranging into different classes through the process of classification
4. To help the student to draw the conclusion in the form of standard deviations, skew nesses and through various co-relations and regressions.
5. To equip the students to represent data in pectoral form and to make it understandable to common masses.

Learning Outcomes:

1. The students will develop the knowledge to interpret the complex statistical tables in graphs given in publish media.
2. The regressions technique shall enable students to predict the future values up to certain time limits.
3. The statistical help in compression and confirm the sample results into population result.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Introduction to Statistics, Data Presentation and Indian Statistics** Statistics in Practice- Application- Data Sources, Descriptive Statistics, Statistical Inference. **Basic Statistical concepts** – Population, Sample, Parameter and Statistics, Variables and Data, **Data Measurement levels-** Nominal, Ordinal, Interval and Ratio, Computer and Statistical Analysis **Construction of Frequency Distribution-** Classification and Tabulation of Data, Graphs and Charts **Indian Statistics:** CSO, NSSO, Recent Population Census, Agricultural and Industrial Statistics
2	**Descriptive Statistics: Numerical Measures** **Measures of Central Tendency:** - Arithmetic Mean, Median, Mode, Geometric, Harmonic Mean, Percentiles and Quartiles **Measure of Variability:** Range, Interquartile Range, Mean Deviation, Variance, Standard Deviation, Coefficient of Variation **Measures of shape** – Skewness
3	**Correlation, Regression Analysis and Index Number** **Correlation Analysis:** Meaning, Importance, Types, Methods of Determining Correlation and Limitations- Karl Pearson's Coefficient of Correlation, Coefficient of Concurrent Deviation, Spearman's Rank Correlation

	Regression Analysis: Meaning, Importance, Types, Methods of Determining Correlation and Limitations- Simple Linear Regression Model, Least Squares Method **Index Number** Time and Factor Reversal Test
4	**Sampling Distributions and Statistical Inference** **Sampling** - Methods of Sampling – Random and Non-random, **Hypothesis Testing**– Meaning, Types, level of Significance, One Tailed and Two Tailed Test, Critical Values and Significant Values. Type I and Type II Errors **Test of Significance** – Small Sample and Large Sample, Chi-Square test and test of 't' test, Analysis of Variance

Books for References:

1. Gupta S.C and Mrs. Indira Gupta: Business Statistics: Himalaya Publishing House; Delhi
2. Gupta, S.C., Fundamentals of Applied Statistics, S. Chand & Sons New Delhi.
3. Gupta, S.P., Introduction to Statistical Methods.,S. Chand& Sons New Delhi.
4. King, W.I.: The Elements of Statistical Methods; The Macmillan Co. New York.
5. Anderson, Sweemey and Villiams, Statistics for Business and Economics, Cengage Learning publication, New Delhi.
6. Elhance, D.N, Practical Problems in Statistics, Kitab Mahal, Allahabad
7. Dr. Gajanan Patil, Fundamental Statistics, Kasturi Publication, Nagpur

MAJOR - MANDATORY - 4

(Credit – 2)

ECONOMY OF MAHARASHTRA

Learning Objectives:

This paper provides a detailed account of various sectors of economy of Maharashtra i.e. natural resources, population, agriculture, industry, infrastructure, fiscal policy and human development. These units will introduce the various challenges faced by the economy of Maharashtra and efforts of the Government to tackle them.

Learning Outcomes:

Students get acquainted with all varied sectors of the economy of Maharashtra. Awareness on challenges to be faced and measures to tackle the challenges

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Features of State Economy** – Geographical structure, administrative set-up, Demographic characteristics, State income, Land, forest, Climate and rainfall, Health, Education, Livestock, Banking, Worker population ratio, Availability of drinking water and sanitation facility, Sector wise real GVA and real GDP, Public distribution system, Beneficiaries under National food security Act - 2013, Deposits and credit of all schedules commercial banks
2	**Sector wise Development in Maharashtra** – Number and area of operational holdings in the state, Area and production of principal crops, Electrification of agricultural pumps, Loan disbursed by various institutions to agriculture, Exports of agricultural produce from State Industrial investment in the state - Industrial units in MIDC, Textile production in the State, Annual survey of industries, No of working factories and employment, Co-operative societies in Maharashtra, Co-operative sugar factories, Progress of health and educational facilities in the state, Transport and communication facilities in the state, Classification of workers as per 2011 Census.

Books for References:

1. Jungale Mangala (2008): Maharashtrachi Arthvyavastha (Marathi), Prashant Publications, 17, Stadium Shopping Centre, Opp. State Bank, Jalgaon –age No. 9 to 19.
2. Kurulkar R. P. (1997): Maharashtrachi Arthvyavastha (Marathi), Vidya Prakashan, Ruikar Marg, Nagpur. Page No. 153 to 179.

3. Munagekar Bhalchandra (2003) :The Economy of Maharashtra – Changing Structure and Emerging Issues, Dr. Ambedkar Institute of Social and Economic Change, Mumbai.

4. Patil J. F. (2010) : Suvarna Mahotsavi Maharashtrachi Badalati Arthvyavastha (Marathi), Abhijit Pratap Pawar, Sakal Papers Ltd., 595, Budhwar Peth, Pune-411002Page No. 41 to 57.

5. Pansare Govind (2012) :Maharashtrachi Arthik Pahani – Paryayi Drushtikon (Marathi), Shramik Pratishthan, Red Plug Bldg.,Bindu Chowk, Kolhapur, Page No. 159 to 195.

6. World Bank (2002) India: Maharashtra Reorienting Govt. to Facilitate Growth and Reduce Poverty.

7. Government of Maharashtra: Economic Survey of Maharashtra, Various Issues.

ELECTIVES – 1

(Credit – 4)

AGRICULTURAL ECONOMICS

Objectives:

1. To provide an understanding to the students about nature and functioning of agrarian economy of India.
2. To enable students to apply economic principles to traditional subsistence agriculture.
3. To equip students to understand process of value generation in agriculture.

Learning Outcomes:

1. The knowledge of nature of Indian Agriculture will enable students to derive suggestions for planning farm operations, for acquiring farm inputs and marketing strategy for selling farm output.
2. It will develop the skills to students for under technical information into economic relation between inputs and output in agriculture.
3. The students will enable to understand the economies of the production and marketing of agricultural products and shall be enable to draw suggestion for practical use.
4. It will help the students to analyse the implication on agricultural policy of government and shall enable them to make practical suggestions for improvement in traditional Indian agriculture.
5. Students are equipped with the knowledge of the emergence of different organizational structures of the farming in India.
6. It will develop the skill in students for analyzing business phenomenon in agriculture in terms of transactions and cost savings.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of each Units

Units No.	Content
1	**Agriculture and the Economy** - Agriculture and economic development – Role of agriculture in Economy, Theories of Agricultural Development – Schultz's views on Transformation of Traditional Agriculture, Lewis, Ranis and Fie models, organizational aspects of farming-Traditional peasant farming, commercial farming, conditions of Indian farmers, farm management
2	**Production function in Agriculture** – Law of variable return and returns to scale in agriculture, rational and Irrational stages in agricultural production function, problem of allocation of resources and least cost combination in agriculture, optimum combination of two products in agriculture Risk and uncertainty in agriculture, WTO and Indian Agriculture- Farm size and agricultural productivity; Mechanization in agriculture; Research and extension in Agriculture, Agricultural technology and green revolution

3	**Marketing of agriculture produce** – Demand and Supply of agricultural products – factors affecting the demand for agricultural products, supply behaviour of agricultural products-Individual and aggregate supply of farm products, Behaviour of agricultural prices-Instability of agricultural prices, agricultural price policy of government, Agricultural Marketing – Approaches to agricultural marketing; problems of agricultural marketing; price spread, marketing margin; marketing efficiency, marketing integration, institutions and organization for agricultural marketing, processing of agricultural products,
4	**Factor Market for Agriculture** –Role of Land, labour and capital in farming, Land Tenancy and efficiency of farming-Land rental contract relationship. Labour market for agriculture – categories of labour, wage good and labour market – Agricultural Credit - characteristics of agricultural, Credit Sources of agricultural credit, Labour in agriculture, Role of land in agriculture, Non-agricultural uses of land

Books for References:

1. Subba Reddy, P.Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi(2008): 'Agricultural Economics' Oxford
2. Sadhu, A.N. & A. Singh: Fundamentals of Agricultural Economics, Himalaya publishing House, Bombay.
3. Soni, R.N.: Leading Issues in Agricultural Economics, Sobhanlal Nagin Chand & Co. Jalandhar
4. Debraj Ray(2012) : 'Development Economics' Oxford India
5. Basu, Kaushik: 'Agrarian Questions' Oxford India 6. Bruch L. Gardner and Gordon C. Rausser : Handbook of Agricultural Economics, North Holland

ELECTIVES – 2

(Credit – 4)

INDUSTRIAL ECONOMICS

Objectives:

1. To make the students aware of new concepts and dynamics in the field of Industries
2. To equip students to understand traditional organizations and modern organization in Industrial establishments
3. To aware students about the process of making investment decisions in Industries.
4. To equip students about industrial locations, finance marketing and pricing
5. To enlighten students about on present Trends in Indian Industrial scenario

Learning Outcomes:

1. The knowledge of Industrial organizations shall enable the students to analyse locational factors of industry and it will enable them to draw suggestions for new proposals of industry.
2. It may promote them to undertake start up schemes on basis local resources and global market. It may enable them to be employment given, rather them employment demanders.
3. The study of industrial financing, accounting and risk analysis will be helpful for students to catch up the opportunities in the field of finance and insurance, where their ample scope for work.
4. Understanding about industrial combination and integration will make them able to analyse public policy and give fruitful suggestions.
5. The students learn about the reasons for existence and expansion of firm and shall be able to analyse efficiency of firms, to offer constructive suggestions.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Industrial Economics and Industrial Organization** - Meaning, scope, need and significance of industrial economics, A new concepts about firm and industry, Business motives- profit maximization, sales maximization, maximization of growth, value maximization and managerial motivations, Industrial Organization- types of industrial organizations, private partnership, company, cooperative and public sector, choice of organizational form.
2	**Industrial location; expansion and efficiency** – Factors affecting industrial location, Theories of Industrial location - Sargant Florence, Weber's Theory, Industrial expansion- Diversification, Vertical integration and mergers, Industrial Efficiency – Productive efficiency and economic efficiency, Future strategy for Industrial growth in India

3	**Industrial Pricing, Investment decisions–** Industrial pricing in practice, Cost-plus pricing, variable cost pricing, Target Rate of Return pricing, group pricing and pricing in public enterprises. **Nature and types of investment decisions-** methods of project evaluation, payback method, NPV and IRR, Social cost benefit analysis, Risk and Uncertainty in Project Appraisal **Industrial Finance** - Need for finance – short term and long term, sources of finance-internal and external, commercial and development banks, Role of foreign capital
4	**Indian Industrial Sector** – Evolution of Indian Industries, Industrial policy in India, small scale Industries, in India, MSME, Industrial sickness, Industrial relations, Private sector industries in India

Books for References:

1. Barthwal, R. "Industrial Economics", Wiley Eastern.
2. Bain, J., "Industrial Organization", John Wiley.
3. Panagariya, A., "India – The Emerging Giant"
4. Sen, A., "Industrial Organisation", Oxford
5. Ahluwalia, I.J. (1985), Industrial Growth in India, Oxford University Press, New Delhi
6. Divine, P.J. and R.M. Jones et. al. (1976), An Introduction to Industrial Economics, George Allen and Unwin Ltd., London
7. Cherunilam, F. (1994), Industrial Economics: Indian Perspective (3rd Edition), Himalaya Publishing House, Mumbai
8. Harndeen, J.B. (1975), The Economics of Corporate Economy, Dunellen Publishers, New York
9. P. Bellaflame and M. Peitz: Industrial Organization and Market Structure 10. Government of India, Economic Survey (Annual)
10. Ahluwalia, I.J. (1985), Industrial Growth in India, Oxford University Press, New Delhi.
11. Brahmananda, P.R. and V.R. Panchamukhi (Eds) (1987), The Development Process of the Indian Economy, Himalaya Publications
12. Barthwal,R.R.(1992), Industrial Economics:An Introductory Text Book, Wiley Eastern Ltd. New Delhi.
13. Cherunilam, F. (1994), Industrial Economics: Indian Perspective, (3rd Edition), Himalaya Publishing House, Mumbai
14. Kuchhal, S.C. (1980), Industrial Economy of India (5th Edition), Chaitanya Publishing House, Allahabad.
15. Reserve Bank of India, Report on Currency and Finance (Annual). And Government of India, Economic Survey (Annual).

ELECTIVES – 3

(Credit – 4)

MATHEMATICS FOR ECONOMICS

Objectives:

1. To make students able to apply methods of mathematics to draw meaningful conclusions from economics data
2. To use mathematical methods to analyse correct economy occurrences
3. To use mathematic techniques for optimization and prediction in economic analysis

Learning Outcomes:

1. The knowledge of mathematical methods will enable students for making the practical suggestions to the optimum consumer and producers' decisions.
2. The students will be able to understand allocation and management of scarce resources.
3. Students will develop the skill to determine homogeneity or non-homogeneity of production function and to estimate the output level for the given input level.
4. Through mathematical predictions, students shall be enabled to find out the cost reduction potential to stand in cur-throat-competitive markets or oligopolistic markets.
5. The knowledge of mathematics shall be useful for students to apply game theory in economic analysis to the markets for obtaining maximum benefits of situation.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Sets, Functions and Basic Functions** - Properties of sets, relations and functions – different forms of functions and graphs- limits and continuity of functions- Basic rules of differentiation, Derivation of implicit functions – and their application in elasticities , costs and revenues, rules of differentiation, partial differentiation, Problem of maxima and minima in single and multivariable functions-application of differentiation in economics rules of integration and their application to economic problems – Derivation of functions from marginal functions
2	**Linear Algebra and Matrices** – Matrices and their applications – Determinants, minors, co-factors and inverse of matrices – Crammers rules- matrices and vectors-Eigen vectors-use in input-output analysis
3	**Differential and Integral Calculus** – Application of partial differentiation in first and higher order partial derivatives – total derivatives – economic application of partial differentiation on elasticity of demand, Homogeneous function, Euler's theorem cobb-dongles and CES Production functions.

	Integral Calculus – Rules of integration, Indefinite and Definite integrals, economic applications, - Integration as total function of economic functions and marginal functions – uses in consumer and producer surplus
4	**Linear Programming and Optimal Control Theory** – Linear Programming – Problem (LLP) and formulation of LPP – Solution of LPP by using graphical and simplex method – duality in LPP- Properties and economic interpretation shadow prices Optimal Control Theory – Calculus of variation and optimal control problem- contrast, state and co-state variables, Hamiltonian – current value and present value, economic application

Books for References:

1. Sydsaeter, Knut and Peter Hammond (2006), Essential Mathematics for Economic Analysis, 2nd Ed. Financial Times, Prentice Hall: Harlow, England.
2. Yamane, Taro (1975), Mathematics for Economists, PHI, New Delhi.
3. Allen, R.G.D. (1974), Mathematical Analysis for Economists, Macmillan Press, New Delhi.
4. Gupta, S.C. (1993), Fundamentals of Applied Statistics., S.Chand, NewDelhi.
5. Chiang, A.C. (1986), Fundamental Methods of Mathematical Economics, McGraw Hill, New York.
6. Handry, A.T. (1999), Operations Research, PHI, New Delhi.

RESEARCH METHODOLOGY

(Credit - 4)

Objectives of the course: -

This course aims at providing the foundation for research methodology. The course is designed to impart basic skills of research and its methodologies. Identify appropriate research topics, review of literature, research gap. Select and define appropriate research problem and parameters. This course also imparts data collection methods, data processing, analysis and interpretation of results. Prepare a project proposal. (To undertake a project) Organize and conduct research (advanced project) in a more appropriate manner. Write a research report and thesis. Prepare a research proposal. (Grants)

Learning Objectives of the course: -

Upon successful completion of this course, students will be able:

1. To help students to develop a thorough understanding of the fundamental theoretical ideas about the research.
2. To help students develop a thorough understanding of the issues involved in research designs and data collection.
3. To help students to understand the importance of sampling methods and analysis of data.
4. To train students in learning how to test hypothesis using computer applications and acquire skills for writing research reports.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Introduction of Research Methodology** Research methodology -meaning, objectives, nature scope and types of research - social- Fundamental, Applied and Action research. Social survey- meaning characteristics, scope, objectives of social survey, steps and types of social research. planning of social survey, merits and demerits of survey. Review of Literature – Meaning, purpose, Style of writing the literature reviews, Citation. Hypothesis -meaning characteristics of good hypothesis, types, importance and limitations. Research design- meaning objectives and types- Applied, Analytical, Exploratory, Descriptive, Diagnostic, Experimental and Case study.
2	**Data Collection methods** Data collection - Primary and Secondary, Sources of primary data - Observation Questionnaire, Schedule, Interview. Merits and demerits of primary data. Sources of secondary data- personal documentary- letters, diary, life history, public documentary sources- published documents, unpublished, documents, Merits and demerits of secondary sources. Merits and demerits of Observation, Schedule, personal interview, mail survey method
3	**Sampling and Data Processing** Meaning of sampling, characteristics of good sampling, merits and demerits of sampling, types of sampling – probability and non-probability, sampling process,

	problems of sampling. Determination of Sample Size. Measurement concept in research, Criterion for good research – Reliability, Validity and Practicality. Data Preparation and preliminary analysis - introduction, validating and editing, coding, data entry, data cleaning and data mining. tabulation.
4	**Hypothesis Testing and Report Writing** Use of statistical techniques for data analysis in research, Mean, Mode, Median, Mean deviation, Standard deviation, Correlation and association. Testing of hypothesis-parametric and non-parametric test. Computer Application, result interpretation, Report writing -objectives, types, content of report, characteristics of good report. Research ethics.

Books for References:

1. Wilkinson and Bhandarkar -Methodology and Techniques of Social research –Pauline, Young-Scientific Social Surveys and Research.
2. Kothari R.C. Research Methodology, Methods and Techniques, New Age International Publishers, IInd revised edition, reprint 2008.
3. Mahore R. Y, Research Methodology, Thakur Publishers, Pune.
4. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
5. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.

RTM Nagpur University, Nagpur
M.A (Economics) First to Fourth Semester Examination
Post-Graduate in Economics Paper Pattern
Implementation Syllabus as per NEP 2023-24
(Under Choice Based Credit System/CBCS as per NEP)

_____Name of Subject

Time: Three Hours} {Maximum Marks:80

Instruction for Candidates:

1. All questions are to be attempted.
2. All questions carry equal marks.
3. Draw neat diagrams wherever necessary.
4. When writing the answer to the sub-questions in the main questions, write the number of themain questions and the sub-question.

Paper Pattern:

1. Answer of the following questions: **(8x2=16)**
   a) Question - From Unit – I **OR** From Unit – I
   b) Question - From Unit – II **OR** From Unit – II

2. Answer of the following questions: **(8x2=16)**
   a) Question - From Unit - III **OR** From Unit – III
   b) Question - From Unit – IV **OR** From Unit – IV

3. Write **ALL** of the following Short Notes: **(4x4=16)**
   a) Question - From Unit - I
   b) Question - From Unit - II
   c) Question - From Unit – III
   d) Question - From Unit - IV

4. Answer **ALL** of the following questions: **(8x2=16)**
   a) Question - From Unit – I
   b) Question - From Unit – I
   c) Question - From Unit – II
   d) Question - From Unit – II
   e) Question - From Unit – III
   f) Question - From Unit – III
   g) Question - From Unit – IV
   h) Question - From Unit – IV

5. Which of the following statements is **Correct or Incorrect** with **explanation**: (4x4=16)
   a) Draft sentences from Unit -I
   b) Draft sentences from Unit -II
   c) Draft sentences from Unit -III
   d) Draft sentences from Unit -IV

RTM Nagpur University, Nagpur

New Syllabus as per NEP – 2020

Implementation from the Academic Session 2023-24

Post Graduate Syllabus in Economics

M.A (Part-I) Second Semester Examination

(Under Choice Based Credit System/CBCS)

MAJOR - MANDATORY – 1

(Credit – 4)

MICRO-ECONOMIC THEORY – II

Learning Objectives:

To identify the characteristic differences between various market structures, and discuss differences in their operations; Analyze resource markets to understand the decision-making of resource allocation and interrelationships among key markets in the economy. To know through distribution of resources how incomes are earned in the production of goods and services and that the value of the productive factor reflects its contribution to the total product. Welfare economics focuses on the optimal allocation of resources and goods and how the allocation of these resources affects individual and the Society through various theories. To understand the role of the government in Economy whenever market fails.

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. The students will be familiar with the Various types of markets through their price and cost.
2. They will be able to explain the role of markets and understand how it impacts individuals and the Market.
3. They will be able to understand the distribution of income in society through the theories of Wage determination, Rent, Interest, and Profit.
4. Students will be able to understand why there is a need to have the welfare for society and individuals.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
I	**Pricing of the factors of the Production** Ricardian and Modern Theory of Rent, Marginal Productivity Theory of Distribution, Wage Determination under Collective Bargaining, Classical Theory of Interest, Loanable Funds Theory and Liquidity Preference Theory of Interest, Theories of Profit

2	Theories of Distribution Ricardian Theory of Distribution, Marxian Theory of Distribution, Kalecki's Theory of Distribution, Kaldor's Theory of Distribution, Neo-classical Theory of Distribution, Technological Progress and Factor shares in Income
3	**Welfare Economics** Meaning of Welfare Economics, Individual and Social Welfare, Concepts of Social Welfare, Value Judgement in Welfare Economics, Concept and Conditions of Pareto Optimality, Pareto Criterion of Social Welfare, Marginal conditions of Pareto optimum, Amartya Sen's Critique of Pareto Optimality, Perfect Competition and Pareto Optimality, New Welfare Economics, Compensation principle, Kaldor-Hicks Welfare Criterion, Scitovsty's Double Criterion of Welfare, Criticism on Compensation Principle, Public Goods and Market Failure, Theory of Second-Best, Bergson-Samuelson Social Welfare Function, Arrow's Theory of Social Choice, Impossibility Theorem, Amartya Sen on Arrow's Impossibility Theorem, Rawls' Concept of Social Justice and Welfare Criterion
4	**Asymmetric Information and Limit Pricing** Information Problem and Market with Asymmetric Information, Asymmetric Information and Market failure, problem of Moral Hazard, Spence Model of Signaling, The Principal-Agent Problem, Theory of Limit Pricing- Sylos-Labini Model, Modigliani's Model, Theory of Games- Prisoners' Dilemma

Books for References:

1. Ahuja H. L., (latest version) Advanced Economic Theory: Microeconomics Analysis, 13th Edition, S. Chand and Co. Ltd., New Delhi.
2. Jhingan M. L., (Latest version) Micro Economic Analysis, Vrinda Publications
3. Koutsoyiannis, A.: Modern Microeconomics, 2nd ed., Macmillan Press, London.
4. Baumol, W.J. (1982), Economics Theory and Operations Analysis, Prentice Hall of India, New Delhi.
5. Dewett K. K., (latest version), Modern Economic Theory, S. Chand & Company Ltd., Revised Edition.
6. Kreps, David M (1990): A Course in Microeconomic Theory, Princeton University Press, Princeton.
7. Sen, A. (1999): Microeconomics: Theory and Applications, Oxford University Press, New Delhi.
8. Stigler, G. (1996): Theory of Price, 4th ed., Prentice Hall of India, New Delhi.
9. Varian, H. (2000): Microeconomic Analysis, W.W. Norton, New York.

MAJOR - MANDATORY – 2

(Credit – 4)

MACRO-ECONOMIC THEORY – II

Learning Objectives:

The course intends to explain the concept of money supply and various theories of demand for money from classical to modern school of thought. The students shall be able to understand the determinants of interest rates and theories of interest rate determination, identify the reasons, types, and effects of inflation and policies used to control inflation. It will also explain business cycles, their theories and measures to control business cycles in an economy.

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Components of money supply and approaches to demand money
2. Understand the classical and modern views on interest and policy impact.
3. Use their knowledge to understand and evaluate the impact of inflation and causes business cycles and controlling measures.
4. Use the knowledge of the subject for employment in competitive examinations, banks and financial institutions.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Theories of Employment and Growth** Classical theory of Employment, Keynesian theory of Employment, Steady Growth, Basic Principles, Models of Steady Growth, Domar Model, Harrod Model, Joan Robinson's Model, Golden Age Model, Solow's Model, Acceleration Principle, Secular Stagnation, Hansen's Thesis
2	**Neo-classical and Keynesian Synthesis** Neo-classical and Keynesian views on interest; The IS-LM model; Extension of IS-LM model with government sector; Relative effectiveness of monetary and fiscal policies; ISLM model in open economy, Monetary approach to balance of payments, Capital flows with fixed exchange rate, trade and capital flows with flexible exchange rate and critical look at IS-LM model
3	**Theory of Inflation** Meaning and Types of Inflation, Demand Pull and Cost Push Theories of Inflation, Inflation and Under developed Economies, Effects of Inflation and deflation, Classical, Keynesian and Monetarist approaches to inflation; Structuralist Theory of Inflation, Measures to control inflation and deflation, Phillips curve, short run and long run Philips Curve, Tobin's modified Philips curve, Quantitative Testing of Inflation
4	**Theories of Business Cycles** Under consumption Theories, Purely Monetary Theory, Monetary Over Investment Theory Non-Monetary Over Investment Theory, Innovation Theory, Mitchell's Theory, The Cob-Web Theory, Theory of Inventory Cycle, Hicks' Theory of Business Cycle, Global Recession, Control of Business Cycles

Books for References:

1. Dornbusch, Fischer, Stratz. Macroeconomics, (Revised Edition), Tata McGraw-Hill. New Delhi
2. Ahuja H. L. Macroeconomics Theory and Policy, S. Chand and Co. Ltd New Delhi.
3. Mankiw, N. G. Macroeconomics, (Revised Edition), Worth Publications. New York. Blackhouse,
4. R. and A. Salansi (Eds.) (2000), Macroeconomics and the Real World (2 Vols), Oxford University Press, London.
5. D'Souza, Errol (2009). Macroeconomics, Pearson Education, Delhi.
6. Gupta R.D. and Rana A.S. (1998): Post-Keynesian Economics, Kalyani Publishers, Ludhiana.
7. Jhingan, M.L.(2020) : Macro Economics, Vrunda Publications, New Delhi.
8. Keynes, J.M (1936): General Theory of Employment, Interest and Money.
9. Gupta, R. D. (1982), "Keynes and Post Keynesian Economics," Kalyani Publishers, Ludhiana.
10. Mithani D. M., (2020), Money, Banking, International trade and public finance, Himalaya Publications, Nagpur.
11. Rakshit, M. (1998), Studies in the Macroeconomics of Developing Countries, Oxford University Press, New Delhi.
12. Rana and Verma, (2016), Macro Economic Analysis, 11th edition, Vishal Publication Jalandhar, Delhi.
13. डॉ. रामदास माहोरे (2018), व्यापार चक्राचे सिध्दांत, साई ज्योती प्रकाशन

MAJOR - MANDATORY – 3

(Credit – 4)

ECONOMICS OF MICRO-FIANCE

Learning Objectives:

To equip the students themselves in compressive manner with various aspects of micro finance activities to be undertaken by banks. To help the students in understanding traditional methods of financing micro enterprises under MSME in India. To understand the effects of micro finance on process of disbursing and recovering the loans through social pressure of SHGS

Learning Outcomes:

1. Basics of micro-finance and various activities conducted through various schemes and institutions in India.
2. Role of NBFCs for the development of microfinance.
3. Regulatory measures used for the development of microfinance.
4. Financial and social performance of microfinance and important institutions of microfinance in India

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Micro-finance- Role and Problems** Micro-finance origin, definition, Types, Objectives, Features, Principles, Benefits and Criticisms, Micro-finance institutions and their types, Micro Finance Companies in India, Challenges faced by micro-finance institutions Self Help Group and Micro Finance, government schemes for self-help groups in India, Deendayal Antyodaya Yojana, National livelihood mission, and poverty Alleviation Programmes, Importance of SHGs, Benefits to Members, Women, Banks, Government, Voluntary Agencies and Society, Microfinance and Women Empowerment
2	**Financial Planning of MFIs** Financial Management of MFIs, Credit risk, types of credit risk, Integrated risk management, Non-banking financial companies and micro-finance, Types of NBFCs, Non-banking financial Companies in India Difference between Bank finance and microfinance, Development in the Microfinance sector, Concerns in the microfinance sector related to consumer protection
3	**Regulatory approaches towards Microfinance** Need to review the current regulatory framework, Microfinance credit lending models, participatory rural approach concepts and prerequisites, Conducting Participatory Assessment, Tools and techniques of Participatory Assessment. Microfinance release protection and guarantee program, Role of Asian Development Bank, Role of Foreign Financial Institutions in Microfinance
4	**Financial and Social Evaluation** Financial rating, measurement of indicators and financial performance analysis, Social performance management definition and principles, social performance analysis, NABARD and microfinance, Role of major banks and financial institution in Microfinance Impact of Microfinance on people and societies, the status of Microfinance in India, Critical study of Microfinance in India, Top Microfinance institutions in India.

Books for References:

1. Rutherford Stuart, (2000), 'The Poor and their Money," Oxford University Press, Delhi.
2. Yunus Muhammad, (2008) 'Creating a World Without Poverty: Social Business and the Future of Capitalism, Public Affairs, New York.
3. Patil R. M., (2011) 'Impact of Microfinance through Self-Help Groups,' Discovery Publishing Pvt. Ltd. Delhi
4. Shrinivasan, N. (2010), 'Micro Finance in India: State of the Sector Report 2010,' Sage Publication, New Delhi
5. Watkins Todd A., (2020) 'Introduction to Microfinance', World Scientific Publisher, Chennai
6. Das Puspita, (2014) 'Empowerment and Microfinance ', Biotech Publisher.
7. V. Rengarajan, (2013), 'Microfinance Principles and Approaches' Notion Publication

MAJOR - MANDATORY – 4

(Credit – 2)

ECONOMICS OF INDUSTRIAL ORGANISATION

Learning Objectives:

This paper will make aware learners about the factors helping industry organization, other areas support it, market structure, also to focus on financial institutions, public policies and theories of location. It also focuses on aspects related to industrial growth.

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Develops students' understanding of the historical background of industrial development, industrialization and antitrust Law.
2. Have a knowledge of various concepts of market power and business strategies.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of Each Units

Units No.	Content
1	**Introduction** Industrial Organization – Meaning, Objectives, types and Functions, Demand and Supply for Industrial Organization, Different Approaches of the study of Industrial Organizations, Macro Economic Models, Public Policy related to Economic Regulation and Antitrust Law, Collusion – Signaling, Mergers and Acquisitions, Industrial Policy
2	**Market Power** Market Power and Product Quality, Product Differentiation, Price Discrimination, Durable Goods and Experience Goods, Business Strategies and Strategic Behaviour – Meaning, Principles and Applications, Secondary Markets and their relationship with Primary Markets, Examples of Industrial Organizations.

Books for References:

1. Luis M. B. Cabral (2017), 'Introductinn to Industrial Organization, 2nd ed., The MIT Press.
2. Jean Tirole (1988), 'The Theory of Industrial Organization', Cambridge, The MIT Press.
3. Bain J. S. (1959), 'Industrial Organization', 2nd ed. New York, Wiley.
4. Bresnahan, T. F. (1959), 'Empirical Studies of Industries with Market Power in Handbook of Industrial Organization', Vol. 2 e. R. Schmalensee and R. D. Wing, Amsterdam, North Holland.
5. Paul Belle Flamme and Martin Peitz (2015), 'Industrial Organization, Markets and Strategies', 2nd ed., Cambridge University Peress.
6. Basu, S. K., K. C. Basu, B. Rajiv, (2012), 'Industrial Organization and Management', Prentice Hall India Learning Private Ltd.
7. Barthwal R. R. (2007), 'Industrial Economics: An Introductory Text Book', New Age International Pub.
8. Lynne Pepall (1998), 'Industrial Organization Contemporary Theory and Practice', South Western.
9. Don F. Waldman, Elikabeth J. Jensen (2019), 'Industrial Organization: Theory and Practice', 5th ed., Routledge.
10. William G. Shepherd, Joanna M. Shepherd (2003), 'Economics .of Industrial Organization', Waveland Press, Inc.

ELECTIVES – 1

(Credit – 4)

APPLIED ECONOMETRICS

Objectives:

The basic objective of the course is to provide knowledge on Econometric applications of Economic theory. This course is designed to define meaning of Econometrics, steps in Empirical Economic Analysis, Different types of data involved in Econometric Analysis. The course involved Simple and Multiple Linear regression model. Basic concept of dummy variable model which will be helpful for future research work with qualitative data. The course also focused on the application of simultaneous equation model and Time Series analysis

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1) Students will have adequate competency in the areas of economic theory and methods

2) Use basic econometric estimation techniques such as Ordinary Least Squares to estimate single and general regression models.

3) Impacts for the violation of the important assumptions for the application of OLS regression.

4) Students will acquire applications of dummy variable techniques and estimation of the dummy variable model.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of each Units

Units No.	Content
1	**Basic Econometrics** Econometrics- Meaning, Nature, Scope, Importance. Methodology of Econometrics, Structure of Economic Data, Simple and General linear regression model – Assumptions, Estimation (through OLS approach) and properties of estimators; Gauss-Markov theorem; Concepts and derivation of R-square and adjusted R- square
2	**Problems in Regression Analysis and Dummy Variable** Problems in Regression -Multicollinearity, Autocorrelation Heteroscedasticity-Meaning, Nature, Consequences and Remedial Measures. Model Specification and Diagnostic Testing Dummy Variable – Meaning, Nature, Importance and Limitation, Use of Dummy Variable Technique in two and more than two categories Dummy Variable Trap, Interaction effects, Seasonal Analysis, Piecewise Linear Regression,
3	**Dynamic Econometric Models** Lagged Variables and distributed lag models – Meaning, Nature, Importance and Estimation Koyck Approach to Distributed Lag Models- the Adaptive Expectation model and Partial Adjustment Model, Estimation of Autoregressive Models, Method of Instrumental variables, Almon Approach to Distributed Lag Models, Causality in Economics

4	**Simultaneous Equation Models and Time Series Analysis** Simultaneous Equation Model – Meaning, Nature, Consequences. Simultaneous equation bias and inconsistency of OLS estimates; The Identification Problem- Rules of Identification – Order and Rank Conditions Concepts - Stationary, Non-Stationary, Unit roots, Co-integration, Spurious regression, Random Walk Model, Dickey-Fuller and Phillips Perron approaches to Unit Root test Forecasting with AR, MA and ARIMA Modeling, Box-Jenkins methodology- Identification, Estimation and Diagnostic Test

Books for References:

1. Gujarati D.N., Basic Econometrics, McGraw Hill, New Delhi.
2. Dougherty C (1992), Introduction to Econometrics, oxford University Press, New York.
3. Koutsoyiannis, A. (1977), Theory of Econometrics (2nd ed), The Macmillan Press Ltd., London.
4. Madani, G.M.K. (2000): Introduction to Econometrics: Principles and applications, Oxford University Publications.
5. William H. Greene. (2008) Econometric Analysis. Pearson Education Publication New Delhi
6. Wooldridge, J., (2009) Introductory Econometrics: A Modern Approach, Cengage Learning Publication.
7. Dhanasekaran K., (2014) Econometrics (Ed. 2), Vrinda Publication, New Delhi.

ELECTIVES – 2

(Credit – 4)

LABOUR ECONOMICS

Objectives:

Students in this course will be exposed to issues pertaining to the labour market, employment policies, wage theories, trade unions and collective bargaining and labour and industry relations. This paper will specifically address to, National Labour Commission in India, Migration and the Impact of Globalization, Rationalization, Exit Policy, the Need for Safety Nets, Technological Change and Modernization of Employment in Organized Private Industry, Concepts of Wage Theories, Industrial Disputes, Labour (Trade) Unions are particularly focused in this subject. This paper exposes students to theoretical as well as empirical issues relating to the labour market with special reference to India.

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Command an in-depth understanding of rural-urban labour problem & Demand-Supply for Labour in relation to the growth of the Labour market.
2. Acquire a basic understanding of the recent reforms in Labour Legislation and the Status of labour poverty & discuss the Role of Government in Employment, Unemployment & Schemes.
3. A critical understanding of the history of work and theory of Wage theories & Determination.
4. Analyze the relationship between Industrial Relations & State Labour Affairs & Students will develop an understanding of labour as a social relation of production.

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of each Units

Units No.	Content
1	**Labour and Labour Markets** Labour Economics-Definition, Nature and Scope, The Genesis and nature of labour problems, socio-economic importance of labour problems, economic development and labour, Labour problems in a developing economy, Labour problems of agricultural, industrial, women and child labour, labour in unorganized sector, measures taken by government to solve labour problems. Industrial labour and labour Market in India, Economic and Social characteristics, of industrial labour in India, Migratory character, Low level of Literacy, Low degree of unionization, High rates of absenteeism and Labour turnover, characteristics and growth of labour market in India
2	**Labour-Management Relations** Trade unionism and Structure, Functions and Role of Trade Unions, Rise and Growth of Trade Unions, Trade Unions and Economic Development, Determinants of Trade Union Growth, Nature and Types of Trade Union Leadership, Industrial peace and Industrial Unrest, their implications Industrial Disputes – Meaning, forms, Causes and consequences. Right to Strike and Lockout, Prevention and Settlement of Industrial disputes, Industrial Relations in Public

	Secor, Causes of Poor Industrial relations in Public Sector, Machinery for Resolving Disputes in Public Sector
3	**Remunerative Aspect** Demand for and supply of labour, affectiveness of the forces of demand and supply of labour, wages - definition, types, characteristics and efficiency of labour, theories of wages determination, classical and neo-classical theories, demand and supply theory, wage determination under imperfect competition. Exploitation of labour, wages differentials, types and setting of wage differentials, system of wage payments and incentives.
4	**Welfare of Employees** Concepts and Social objectives of welfare state, social security, aims and methods of providing social security, social insurance-origin , growth, elements and importance, social security in India – need, social security schemes in India, Workmen's Compensation Act 1923, Maternity Benefit Act, Employees Provident Fund and Miscellaneous Provisions Act 1952, Housing of Industrial Labour, Unemployment Causes, Types, effects, exit policy and remedial measures, National Labour Commission, Manpower Planning, International Labour Organization,- aims, constitution and various committees.

Books for References:

1. Bhagoliwal T.N. (2002), Economics of Labour and Industrial Relations: Sahitya Bhavan, Agra.
2. Bhatia, S.K. (2005), Constructive Industrial Relations and Labour Laws, B.R. World of Books, New Delhi.
3. Das N. (1960), Unemployment, Full Employment and India, Asia Publishing House, Bombay.
4. Datt, G. (1996), Bargaining Power Wages and Employment: An Analysis of Agricultural Labour Markets in India, Sage Publications, New Delhi.
5. Datt, Rudra (2005), Economic Reforms and Employment, BRW, New Delhi.
6. Deshpande and J C Jandesara (Ed.), Wage Policy and Wage Determination in India, Bombay University, 1970
7. Deshpande L.K., Brahmananda P.R. and E.A.G Robinson (eds), Employment Policy in a Developing Economy, vol.I & II, Macmillan, London, (1983).
8. Ghose, Ajit. K. (2003), Jobs and Incomes in Globalizing World, ILO, Geneva.
9. Hajela, P.D. (1998), Labour Restructuring in India: A Critique of the New Economic Policies, Common Wealth Publishers, New Delhi.
10. Kumar Anil, (2005), Labour Welfare and Social Security, BBW, New Delhi

ELECTIVES – 3

(Credit – 4)

POLITICAL ECONOMY

Objectives: This course explores changes in the organization of production, labour market institutions and corporate structure. It goes on to study the consequences of globalization, especially of financial flows, for the role of the state, economic performance, gender issues, environment, human welfare and development. This course explores the development of the structure and institutions of capitalist economies and their relationship to social and political forces. Students are expected to read some classic texts as well as more recent commentaries.

Learning Outcomes: Upon successful completion of this course, students will be able to:
1. Command an in-depth understanding of Economic systems and its achievements and failures.
2. Acquire a basic understanding of functioning of mixed economy, role of public sector and issues.
3. A critical understanding of the functioning of socialist economy and impact of New Economic Policy.
4. Analyze the success and failure of planning in India

Content of Syllabus

Allocation of Teaching Hours: 20 Hrs. of each Units

Units No.	Content
1	**Introduction and Historical Overview** Different types of Economic systems and their broad features, Capitalism, Communism and Mixed Economy, Economic freedom under these three economies, Achievements and failures of capitalism, Transformation of capitalism into welfare State.
2	**Mixed Economies and their problems** Why mixed economy, Role of public sector, Deficiencies of public sector, coordination between public and private sectors, public sector in India and Radical change in Approach, Features of Sweden's Mixed Economy
3	**The Socialism and New Perspectives** Evolution and growth of Socialism, Mandan Socialism, Liberalization, privatization and globalization, Impact of LPG on Indian economy, Inequality and exclusion, Gender in work, Issues in environment and sustainability, Sustainable Development Goals and India's achievements, Role of state
4	**Economic Planning in India** Definition and meaning of planning, Characteristics of economic planning, Role of planning in developed and developing countries, Types of planning, Types of planning on the basis of economic system, time element, region and finance or real output, broad features of India's socialist pattern, Gandhian economics, Economic philosophy of Sarvodaya and its limitations, Role of NITI Aayog

Books for References:

1. Fran Tonkiss, Contemporary Economic Sociology: Globalisation, Production, Inequality, Routledge India 2008

2. G. Gereffi, J. Humphrey and T. Sturgeon, 2005, —The Governance of Global Value Chains Review of International Political Economy, Volume 12
3. Andrew Glyn, —Challenges to Capital, In Capitalism Unleashed: Finance, Globalization and Welfare, Oxford: Oxford University Press, (Ch. One, pp. 1-24), 2006.
4. Gary Dymsky, 2005, —Financial Globalization, Social Exclusion and Financial Crisis, International Review of Applied Economics, Vol. 19
5. E. Stockhammer, —Financialization and the Global Economy, in G. Epstein and M.H. Wolfson (ed.) The Political Economy of Financial Crises, Oxford University Press, 2010.
6. J. Gurley, "The Materialist Conception of History", in R. Edwards, M. Reich and T. Weisskopf (ed.), The Capitalist System, 2nd edition, 1978.
7. O. Lange, Political Economy, vol. 1, 1963,.
8. R.L. Heilbroner, "Capitalism", in The New Palgrave Dictionary of Modern Economics, Macmillan, 1987.
9. P. Sweezy, The Theory of Capitalist Development, Monthly Review Press, 1942,
10. Anwar Shaikh, Entries on "Economic Crises" and "Falling Rate of Profit" in T. Bottomore et al (eds.), The Dictionary of Marxist Thought, OUP, Indian edition, Maya Blackwell, 2000.
11. J. Schumpeter, Capitalism, Socialism and Democracy, George Allen and Unwin 1976,
12. P. Baran (1957), The Political Economy of Growth, Pelican edition, 1973.
13. Amit Bhaduri, —Nationalism and Economic Policy in the Era of Globalization, Deepak Nayyar (ed), Governing Globalization: Issues and Institutions, OUP, 2002

RTM Nagpur University, Nagpur

New Syllabus as per NEP – 2020

Implementation from the Academic Session 2023-24

Post Graduate Syllabus in Economics

M.A (Part-II) Third Semester Examination

(Under Choice Based Credit System/CBCS)

FROM SESSION - 2024-25

MAJOR - MANDATORY – 1

(Credit – 4)

ECONOMICS OF DEVELOPMENT AND GROWTH – I

Learning Objectives of the Course:

The course will introduce students with exciting and challenging branch of economics. In fast moving global economic order, there is a persistent demand to synchronize the approaches, theories and development issues for a better understanding of the problems of developing economies by students.

There is a need for synchronization necessitates considerable restructuring and continuous adoption in tune with the specific socio-economic setting of these countries by students.

The program will empower the students to understand the nature of development which will be more sustainable and equitable. The modules incorporated here are intended to serve the purpose.

Outcomes of the Course:

1. To equip the students with theoretical and empirical material for increasing their capability to understand the basic problems faced by developing societies.
2. To develop conceptual clarity on various aspects of development with in student community.
3. To enable students to identify the strategic factors in development of less developed countries (LDC's)
4. To make students capable to evolve new strategies for achieving sustainable development and inclusive growth.

Course Content

Unit I: Economic Development - an Overviews

Economic Growth and Development- meaning and indicators, factors determining Economic Growth and Development- Characteristics of developing and developed countries- Vicious Circle of poverty, Poverty and underdevelopment.

Measurement of Economic Development – Conventional measurement, PQLI, HDI, GDI, MPI etc. Basic needs approach, Hunger, Entitlement and capabilities.

Human Development and Economic Development – Development Gap – Convergence of Development levels

Unit II: Theories of Economic Growth

Basic features of modern economic Growth, Growth models Harod-Domar Model, Solow-Model, Meade's Model, Golden Rule of accumulation, Kaldor's Model, Kuznets hypothesis of economic growth and income distribution, Theories of balanced and unbalanced economic growth, Theories of Social and technological dualism.

Unit III: Theories of Economic Development

Classical theories of Economic Development, Schumpeter's theory of Development, Marxian theory of Economic Development. Neo classical theory of counter revolution, Centre-periphery model, Gunnar Myrdal's theory of Economic development.

Unit IV: Problems and Policies

Population and growth trends, Population and Economic Development, Human capital formation, Human Capital and Economic Development, Technological change and development, Choice of technique, Environmental and development Environmental degradation, Externalities and market failures

Books for References:

1) Debraj Ray (1998) – Development Economics- Princeton University Press.
2) Michael P Todaro (2017) Economic Development – Pearson Education
3) Misra and Puri – Growth and development- Himalaya Publication (2007) Mumbai.
4) Foster, Greer and Thornback- Poverty Measures- Institute of International Economic Policy- Suite
5) Gunnar Myrdal – Economic theory of Underdeveloped region – (1957) London Duckworth.
6) Encyclopaedia Britannica- Development theory, the neoclassical theory of counter revolution.
7) Dov Chemichovsky and Linda Zangwill- Micro Economic Theory of Howeholds- World Bank Documents.
8) Jean Marie Baland- Natural Resources and Economic Growth – Oxford Academic Pub.

MAJOR - MANDATORY – 2

(Credit – 4)

INTERNATIONAL TRADE: THEORY AND POLICY

Learning Objectives of the Course:

After completion of this syllabus the students will be able to demonstrate mastery of International Economic Theory and empirical techniques that make up the body of knowledge as embodied in professional practice and communication.

Further they will be able to articulate economic arguments using classical and contemporary economic literature on aspects of international trade. Moreover, they can acknowledge and describe the influences of social and political institutions on international trade of a country as well as influences on individual citizens.

It will enable students to successfully pursue careers in Government agencies, the corporate and financial sectors in the international trade of India. It also enables them to development organization, the media and also for further academic research in the field of international trade.

Outcomes of the Course:

1. To provide a deep understanding about the broad principles and theories which tend to govern the free flow of trade in goods, services and capital – both short term and long-term at global level.
2. To prepare the students about the relevance and limitations of the principles, studied in different modules of this syllabus.
3. To enable the students to examine the impact of trade policies followed both at national and international level.

Course Content

Unit I -Nature and Theories of International Trade

Meaning, features and importance of International Trade; International and Interregional Trade, Comparative cost theory of International Trade, Opportunity cost Theory, Reciprocal demand theory of international trade, Heckscher- Ohlin theorem, Leontief paradox, Factor-Price equalization theory- Dynamic factors i.e. change in testes, technology and factors endowment.

Unit II- Recent Advances in Theories of International Trade

Rybczynski theorem, Karvis theory of availability, Linder's theory, Posner's technology Gap theory, Vernon's Product Cycle theory, Gravity model of International Trade, Krugman's theory of Economic Geography, Kenen's and Emmanuel theory of International Trade.

Unit III - Balance of Payments and Foreign Exchange System

Balance of payments, concepts and components, Balance of trade and balance of payments, Disequilibrium in balance of payments, causes, effects and adjustment mechanism of balance of payments, Foreign Exchange rate determination – Traditional and modern theories, Fixed

and flexible exchange rates, Merits and demerits, Exchange control – objective and methods of exchange control, Customs Union – theories of Custom unions

Unit IV -International Trade and Economic Growth

Effects of growth on trade, Effects of growth on technical progress, Terms of trade, factors affecting terms of trade, Effects of terms of trade, Tariffs – Meaning, types and effects, non-tariff barriers and trade Restrictions and economic development.

Books for References:

1) Krugman and Obstfeld – International Economies- theory and Policy (2000) fifth edition – Pub- Addison Wesley –
2) Carbaugh R. J. (1994) International Economies (11th Edition) Pub – Thomson South Western, New Delhi.
3) Jhingan M.L. – International Trade and Finance – 2014 – Vrinda Publication, New Delhi.
4) Mithani D.M. – International Economics, Himalaya Publishing House Nagpur
5) Salvatore D. (2002) International Economics, John Wiley and sons, Singapore.

MAJOR - MANDATORY – 3

(Credit – 4)

ECONOMICS OF MONEY AND BANKING

Learning Objectives of the Course:

This course aims at providing the basic concept and role of money in the economic development. This course will help students to know about the value determination of money. This course also imparts the functioning of the central and commercial banks with their role in economic development.

Outcomes of the Course:

After completion of this course, students will be able to:

1. Understand nature, function and significance of the money
2. Understand the determination of the value of the money and functioning of the money market.
3. Understand the role and function of commercial banks and its importance in the economic development.
4. Understand the functioning and impact of the monetary policy in the development of a county.

Course Content

Unit I: Nature and Significance of Money,

Origin of money, definition and significance of money, classification of money, merits and demerits of standard and token coins, functions of money, Monetary standard – metallic and paper standard. Domestic and international gold standards their merits and demerits, causes of breakdown of gold standard, methods of note issue, Paper currency standard- note issue, characteristics of a good currency system, Digital Rupee.

Unit II: Determination of value of Money

The commodity theory, the quantity theory and Cambridge approach, critical evaluation of Cambridge equation, real balance approach, the Chicago school and the Keynesian theory.

Inflation and Deflation – causes, effects and control.

Unit III: The Commercial Banks

History of commercial banks, definition, principles and functions of commercial banks, credit creation of commercial banks, limits to the powers of commercial banks to create credit.

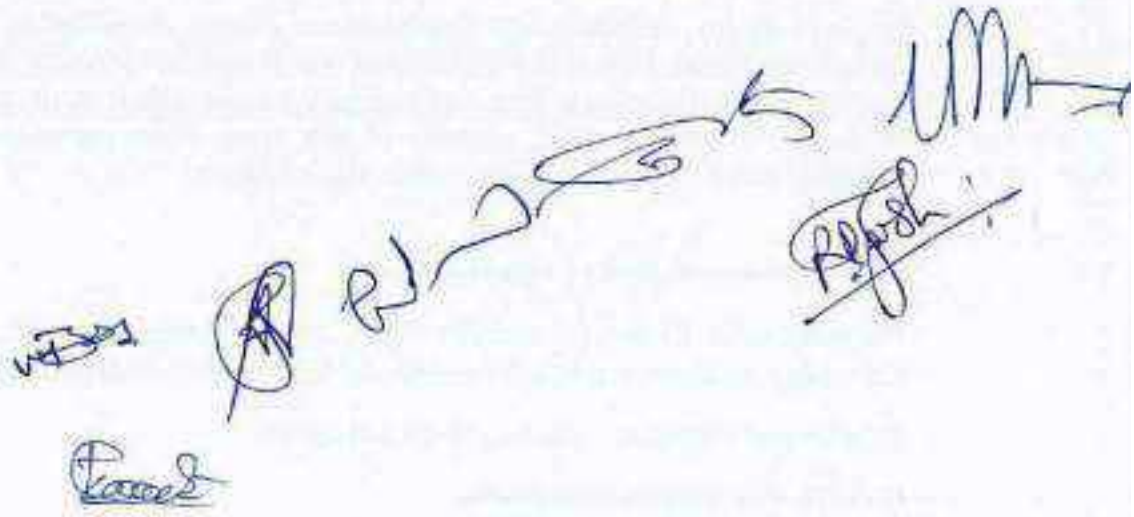
Unit banking and branch banking. Chain banking and group banking. Nationalization of commercial banks. Priority sector financing. Role of commercial banks in economic development, challenges and treads in banking, non-performing assets and their classification.

Unit IV: The Central Bank

Introduction and need for a central bank, definition and principles of central banking. Functions of central banks, credit control, monetary policy- objectives, monetary policy during depression and inflation, demonetization, merits and demerits. Recent changes in monetary policy, Money supply- concepts, components and determinants.

Books for Reference:

1. Bhole L M, Financial Institutions & Markets, Tata McGraw, New Delhi.
2. Mithani D. M., Money Banking, International Trade & Public Finance, Himalaya Publishing House, New Delhi, 2022.
3. Khan M.Y., Indian Financial System, Tata McGraw Hill, New Delhi.
4. Pathak Bharti, 2009, Indian Financial System, Pearson Education Publication, New Delhi
5. Shrivastava P.K., Banking Theory and Practice, Himalaya Publishing House, New Delhi,2009.
6. RBI Bulletin and various RBI Report.
7. E. Gordon & K. Natrajan, Banking Theory, Law and Practice, Himalaya Publishing House, New Delhi.
8. Basava K.D., Money, Banking and International Trade, Vidyavahini Prakashan
9. Seth M.L., Money, Banking, International Trade Public Finance, Lakshmi Narayan Agrawal, Agra.



MAJOR - MANDATORY – 3

(Credit –2)

ECONOMICS SUSTAINABLE DEVELOPMENT

Learning Objectives of the Course:

This course aims at providing the basic concept and role of Sustainable development in the economic development. This course will help students to know about the aspects, strategy and approaches of Sustainable development. This course also imparts the functioning of the various organisations with their role in economic development.

Outcomes of the Course:

After completion of this course, students will be able to:

1. Understand Economics of Sustainable Development
2. Understand the various aspects of Sustainable Development.
3. Understand the availability of natural resources and its importance in the economic development.
4. Understand the strategy and approaches of sustainable development.

Course Content

Unit I: Economics of Sustainable Development

Meaning, Definition, Brief Historical background of Sustainable Development, Features and Principles of Sustainable Development, Sustainable Development Goals (SDGs), targets and indicators. Significance and Challenges of Sustainable Development, Sustainability as a key driver of Innovation, Introduction to National and Global Reporting Standards. Progress of Sustainable Development Goals in India.

Unit II: Sustainable Development Aspect

Introduction to Sustainability Development, Economic Aspects- Meaning, Ways of Achieving Economic Sustainability, Socio Political Aspects – Meaning, Ways of Achieving Socio Political Sustainability, Ecological (Environmental) Aspects – Meaning, Ways of Achieving Ecological Sustainability.

Books for References:

1. Sustainable Economic Development & Environment Raj Kumar Sen Kartik C. Roy Atlantic Publishers & Distributors Pvt Ltd
2. Sustainability Management Deb Prasanna Choudhary Zorba Books
3. Sustainable Development & Environment Snigdha Tripathi Ankit Publication
4. Concepts & Approaches for Sustainability Management Khai Ern Lee Springer International Publishing
5. Martin Ossewaarde, "Introduction to Sustainable Development", SAGE Publications Pvt Ltd First Edition
6. Theory & Practice with Case Studies (CSR, Sustainability, Ethics & Governance) Dr. Mark Anthony Camilleri Springer International Publishing
7. Resource Management, Sustainable Development and Governance Baleshwar Thakur Rajiv Thakur Srikumar Chattopadhyay Springer International Publishing

Electives (Choose Any One)

1. INDIAN PUBLIC FINANCE

Learning Objectives of the Course:

The basic objective of the course is to understand conceptual frame work of public economics which are used in public policies and annual budgeting. The course will impart the knowledge about various sources of the government income and expenditure, income distribution, different development policies, Public Debt and Centre and State relationship

Outcomes of the Course:

Upon successful completion of this course, students will be able to:

1. Understand the role and functions of the Government in the various economic perspectives and rationales behind various public sector activities, theory of public choice, various economic issues related to allocation of resources and solutions to complex economic problems.
2. Various theories, sources of the public revenue with its impact and different theories related to public expenditure, role of public expenditure to achieve economic stability and social cost benefit analysis.
3. Concept of public debt, its types and sources. Debt management and redemption along with the impact on economy.
4. Formulation and execution of the Budget, various techniques and trends of the budgeting, types of the budget and will take appropriate economic judgment. Role and impact of fiscal policy. Economic issues related to the fiscal imbalance. Importance of the finance commissions.

Course Contents

Unit 1: Introduction to Public Finance

Public Finance- Origin of Pubic Finance, Meaning, Scope, Distribution between Private and Public Finance, Basic Economic Systems and role of Public Sector, Public Goods, Social Goods, Merit Goods and Mixed Goods- meaning & characteristics. The principle of maximum social advantage – Musgrave's views – Mrs. Hicks optima of public policy – Externalities and public goods.

Unit 2: Public Choice Theory

Public Choice Theory developed by J. Buchanan, Advantages of Public Choice Theory, Private and public mechanism for allocating resources; Problems for allocating resources; problems of preference revelation and aggregation of preferences; Voting systems; Arrow impossibility theorem; An economic theory of democracy; Politico-eco-bureaucracy; Directly Unproductive Profit (DUP) seeking activities- Rent seeking and tariff seeking. Welfare Consequences of DUP.

Unit 3: Principles of Taxation and Public Expenditure

Principles of Taxation, traditional and Modern Approaches, Benefit approach – ability to Pay Approach, Laffer Curve - Taxable capacity, Colin Clark and Musgrave's view, classification of Public Expenditure and Effects of Public Expenditure.

Rise in public expenditure, theories of public expenditure, Classification of Taxation, Effects of Taxation, Incidence and shifting of Taxation.

Unit 4: Government Budget, Fiscal Federalism and Public Debt

Concept of budget and theories of budget, classification of budgets, various types of budget and budgeting concepts, Current year budget analysis.

The Concept of Fiscal federalism, division of power and functions, division of resources, working of Indian fiscal federalism, Finance Commissions of India, Review of current Finance Commission.

Pubic Debt - Meaning, Classification, Management & redemption.

Books for References:

1. Atkinson, A.B. and J.E. Stiglitz (1980): Lectures on Public Economics, Tata McGraw Hill, New York.
2. Auerbach, A.J. and M. Feldstein (eds.) (1985): Handbook of Public Economics. Vol.1, North Holland, Amsterdam.
3. Bhargava, P.K. (1984): Some Aspects of Indian Public Finances, Uppal Publishing House, New Delhi
4. Lekhi, R. K. (2016), Public Finance, Kalyani Publication, New Delhi
5. Bhatia, H.L. (2000): Public Finance, Vikas Publishing House Pvt. Ltd. Delhi.
6. Chelliah, Raja J. (1997), Towards Sustainable Growth, Oxford University Press, New Delhi.
7. Gandhi, V.P. (1970): Some Aspects of India's Tax Structure, Vora and Company, Bombay.
8. Mundle, S. (1999), Public Finance Policy: Issues for India, Oxford University Press, New Delhi.
9. Richard A. Musgrave (1989), Public Finance in Theory and Practice McGraw Hill Book Company, New York.
10. Indian Finance Commission Reports.

2. INDIAN ECONOMY – ISSUE & POLICIES

Learning Objectives of the course:

a. To acquaint with the students in the context of federal structure of Indian Economy
b. To develop insight among the students to understand economic environment in India with 'Global to Local Context.
c. To equip the student to analyze economic policy implications of Centre & state

Outcomes of the Course:

i. Students develop skills in formulating of suggestion for measures on current economic situations.
ii. They will be able to derive suggestions on the searching of remedies under different situation for national level.
d. Students will develop understanding to learn the institutional arrangements in society to overcome asymmetric information and develop skill in designing incentive mechanisms.
e. It will make to understand students to the basic process of income generation and distribution as well as their sources. It will also enable to know national share of each category of citizens.
f. It will also help in knowing dynamics of capital market.
g. students will be taken to the philosophical level of equity and justice.

Course Content

Unit I: Overview of Indian Economy and development strategy

State of Indian economy of since Independence – Development strategy and planning up to eighties. Effect of control and obstacles in economic growth, Economic Policy of 1991 - Objectives, Features and Impacts – major aspects of transformation and recent developments in Indian Economy

Unit II: Population and Socio-Economic Development in India

Population as a factor of economic development – Age and Sex composition, quality of population-Demographic Dividend – Problem of unemployment, Poverty and Inequality and measures to solve these problems – changing nature of labour markets- recent trends– women labour and child labour, Problem of Rural-Urban Disparities in Health, Education, and Employment.

Unit III Sectoral Analysis of Indian Economy –

A) **Primary Sector** – Trends in contribution of primary sector in India's National Income and employment generations – Agricultural inputs and productivity-diversification of agriculture- agricultural marketing, prices, credit and subsidies.

B) **Secondary Sector** – Trends in Industry and Trade in India – Their Contribution in National income of India – Industrial Policy in post-liberalization periods – Strategy of Industrial development for large industries and MSME- Problems of public sector industries – Disinvestment policy

C) **Tertiary Sector** – Importance of service sector in India – Performance of service sector in post-liberalization period – service sector led growth and its sustainability

Unit IV: Current Economic Issues in India

Reforms in Capital Market – Inflow of FDI and FII and their magnitude and influences on domestic economy – financial sector reforms – recent changes in direction and composition of foreign Trade of India. Problem of Environmental degradation.

Books for References:

1. Bardhan, P., "The Political Economy of Development of India", OUP.
2. Brahmananda, P.R. and Panchmukhi, V.R., "The Development Process of Indian Economy", Himalaya.
3. Basu, Kaushik (Ed), "India's Emerging Economy" OUP.
4. Datt, R. and Sundaram, K.P.M.: Indian Economy, S. Chand.
5. Jalan, Bimal (Ed), "The Indian Economy – Problems and Prospects", Viking.
6. Kapila, Uma (Ed), "India's Economic Reforms", Academic Foundation.
7. Kapila, U.: Indian Economy since Independence, Academic Foundation
8. Sen, A. and Drese, J., "Economic Development and Social Opportunities", OUP.
9. Wadhwa, C. (Ed), "Some Problems of India's Economic Policy", Tata McGraw Hill.
10. Fonseca, A.J. (Ed), "Challenge of Poverty in India", Vikas.
11. Rao, V.K.R.V., "India's National Income, 1950-1980", Sage.
12. Joshi, Vijay and Little, IMD, "India's Economic Reforms 1991-2001", Oxford University Press
13. Ahluwalia. I.J. and I.M.D Little (Eds) (1999), India's Economic Reforms and Development, Oxford University Press, New Delhi.
14. Bardhan, P.K. (1999), The Political Economy of Development in India, Oxford University press, New Delhi.
15. Bawa, R.S. and P.S. Raikhy, (1997), Structural Changes in Indian Economy, Guru Nanak Dev University press, Amritsar.
16. Chakravarty, S. (1987), Development planning: The Indian Experience, Oxford University press,
17. Datt.R. (2001), Second Generation Economic Reforms in India, Deep and Deep publications.
18. Ruddar Datt and K.P.M. Sundaram, (2008), Indian Economy, Sultan Chand and Co, New Delhi

3. ECONOMICS OF ENVIRONMENT

Learning Objectives of the course:

It examines the elements of environmental economics. Topics include the environmental problems of Industrial and Agricultural development, use of Natural resources and its sustainability. To provide simple yet rigorous frameworks to understand real environment problems facing by the world and individual countries. To understand policies being implemented by the government to improve the green and clean environment level. To understand the forces for and against the agglomeration of economic activities. To provides basic understanding about Mechanism for environment regulation and Environment protection laws in India. Also, to develop their analytical and critical thinking skills to judge the appropriateness of Sustainable development policy options.

To prepare students for more advanced studies in Environmental economics.

Outcomes of the Course:

Upon successful completion of this course, students will be able to:

1. On completion of the course students would be able to realize the importance and influence of environment on the economy including the quality of manpower. Arouse their feelings to make cleaner environment so as to achieve harmonious development.
2. Understand that environmental problem is not the problem of a single country or region but a global problem and issue.
3. Demonstrate the scientific management of waste materials; realize the role and importance of individuals to keep the environment clean.
4. Explain linkages between Economic development, Population and Environment, Poverty and the Environment.
5. Acquire quantitative skills by working with the mathematical models that show how to allocate environmental goods optimally.

Course Contents

Unit 1: Elements of Environmental Economics

Meaning, Subject matter, Nature and Scope of Environmental Economics; Economic Development and the Environment, Population and Environmental Linkages. Economy, Ecology and Environmental Interaction- Ayrees Kneese's Material Balance Model. Leontief's Environmental extended Input-Output Model. Environmental Quality as public goods, Market Failure.

Unit 2: Environmental Problems of Industrial and Agricultural Development:

Environmental Problems of Industrial development: Water Pollution, Air Pollution, Noise Pollution, Special Economic Zones and Environmental Issues, Green Marketing, Environmental Auditing.

Environmental Problems of Agricultural development- Salinity, water logging, desertification of land, Excess use of water, fertilizers and pesticides, Approaches to Sustainable Agriculture Management.

Unit 3: Economics of Natural Resource Management and Sustainable Development

Economics of Renewable Resources; Resource Scarcity as Limits to Growth; Pricing of Resources; Energy and Economic Development.

Mechanism for environment regulation in India; Environmental laws and their Implementation-Policy instruments for controlling water and air pollution-Forestry policy.

Unit 4: Environmental Problems and Environmental Policy in India:
Rural and Urban environmental problems – Population and the Environment, Poverty and the Environment, Housing and Slums and the Environment, Rural Sanitation Scheme, Trade and environment, issues of Climate Change, Environmental Policy in India- Environment protection laws in India.
Central Pollution Control Board, State and Local Bodies and Environment protection.

Books Recommended:

1. Jhingan M.L. and Sharma, Environmental Economics, Vrinda Publication, New Delhi
2. Ali, S. A. (1979), Resources for Future Economic Growth, Vikas Publishing House, New Delhi.
3. Baumol, W.J. and W.E. Oates (1988), The Theory of Environmental Policy (2nd edition), Cambridge University Press, Cambridge.
4. Bhattacharya, R.N. (Ed) (2001), Environmental Economics; An Indian Perspective, Oxford University Press, New Delhi.
5. Chopra, K. (1998), Valuation of Bio-diversity within Protected Areas: Alternative Approach and a case study, Institute of Economic Growth, Delhi.
6. Chopra, K., Kadekodi G.K. and M.N. Murthy: The Management of Common Property Resources, SAGE, New Delhi.
7. Garge, M. R. (Ed.) (1996), Environmental Pollution and Protection, Deep and Deep Publications, New Delhi.
8. Hanley, N., J.F. Shogern and B. White (1997), Environmental Economics in Theory and Practice, Macmillan.
9. Kolstad C.D.(1999), Environmental Economics, Oxford University Press, New Delhi.
10. Lodha, S. L. (Ed.) (1991), Economics of Environment, RBSA Publishers, Jaipur.
11. Markandeya, A. and M. N. Murty (2000), Cleaning up the Ganges: Cost-Benefit Analysis of Ganga Action Plan, Oxford University Press, New Delhi.
12. Mehta, S.S Mundle and U. Sankar: Controlling pollution: Incentives and Regulation, SAGE, New Delhi – 1995
13. Murthy, M.N, A. James and S. Misra: The Economics of Water pollution in India: Oxford University Press, New Delhi, 1995
14. Pearce, D.W. and R. Turner (1991), Economic of Natural Resource Use and Environment, John Hopkins University Press, Baltimore.
15. Rajlaxmi & Brinda (1994) Environomics, Allied Publishers Limited, Madras
16. Rathore, M. S. (Ed.) (1996), Environmental and Development, Rawat Publications Jaipur.
17. Sankar, U. (Ed), (2001, Environmental Economics, Oxford, University Press, New Delhi.
18. Singh, G. N. (Ed.) (1991), Environmental Economics, Mittal Publications, New Delhi
19. Singh, Katar and Anil Shishodia; Environmental Economics; Theory and Applications, Sage Publications, New Delhi, 2007.
20. Tripathy, S.M. and Shumaker Panda, Fundamentals of Environmental Studies, Vrinda Publications, Delhi.
21. World Bank: World Development Report, 1992: Environment and Development Oxford University Press, New Delhi

RTM Nagpur University, Nagpur

New Syllabus as per NEP – 2020

Implementation from the Academic Session 2023-24

Post Graduate Syllabus in Economics

M.A (Part-II) Fourth Semester Examination

(Under Choice Based Credit System/CBCS)

SESSION - 2024-25

MAJOR - MANDATORY – 1

(Credit – 4)

ECONOMICS OF DEVELOPMENT AND GROWTH–II

Learning Objectives of the course:

The learning objectives of this course are to introduce students to the domestic and international measures of economic development, problem of poverty and Inequality and critical evaluation of economic Planning with Indian perspective. Also, to develop analytical and critical thinking skills and use it to judge the appropriateness of policy options Develops research skills including: data collection; interpretation by way of analytical commentary; demonstrated ability to support analysis through empirical evidence and draw critical conclusions and develop presentation skills.

Outcomes of the Course:

Upon completion of this course, students should be able to:

1. Acquire a basic understanding of the concepts, issues and domestic & international measures of economic development.
2. Acquire skills and technique to measure economic development
3. Apply an analytical framework to understand the problems of Urbanization and Migration.
4. Acquire skills in conducting research related to international aspects of development through IMF, WTO and Foreign Investment.

Course Contents

Unit 1: Measures for Economic Development

Capital formation and Economic Development, Role of Agriculture and Industry in economic Development, Human Capital formation and economic Development, Institutional Structure and economic Development, Poverty and income inequality in developing countries, Problem of Unemployment.

Unit 2: Important Aspects of Economic Development

Entrepreneurship and Economic Development, Role of State and Economic Development Foreign Trade and Foreign Capital and Economic Development, Commercial policy and Economic Development

Foreign Direct Investment and Economic Development, Role of Multinational Corporations and Economic Development, Sustainable Development Goals (SDGs)

Unit 3: Urbanization and Development

Causes and effects of Urbanization, Harris-Todaro Model of Rural- Urban Migration, Migration and development, Policies for urban informal sector, women in the informal sector, The microfinance revolution, rural- urban in equality in development

Unit 4: International Aspect of Development

Foreign Investment and developing countries, Nature of Private foreign Investment, their merits and demerits. Role of IMF and IBRD, Impact of WTO on Indian Economy, TRIPS and TRIMS, Asian Development Bank.

Books Recommended -

1. Todaro, Michael P. and Stephen C. Smith, Economic Development, 8e. Delhi: Pearson Education, 2003.
2. Misra, S. K. and Puri, Growth and Development, Mumbai: Himalaya Publishers, 2005.
3. Thirlwall, A.P. Growth and Development 8e. New York: Palgrave McMillan, 2005.
4. Meier, Gerald M. and James E. Rauch, Leading issues in Economic Development, 8e. New Delhi: Oxford University Press.
5. Jhingan M.L. (2015) The Economics of Development and Planning. Vrinda Publication (P) Ltd, New Delhi

MAJOR - MANDATORY – 2

(Credit – 4)

INTERNATIONAL TRADE AND INVESTMENT

Learning Objectives of the Course:

The course provides insights into theoretical structure as well as trade policies related international economics. The main objective of the course is to develop conceptual framework about various restrictions and its impact. The course will also impart the knowledge about the economic integration and various international organizations. This will also help to understand balance of payment and determination of the exchange rate. To know the importance of the foreign capital.

Outcomes of the Course:

Upon successful completion of this course, students will be able to:

1. Need and importance of trade restriction. Optimum rate of the restrictions.
2. Different economic integrations and regional trading arrangements.
3. Role of foreign trade in economic development and Composition and Direction of India's foreign trade.
4. Importance of the foreign capital to any country and will be able to take the decision about the foreign investments.

Course Contents

Unit 1: Trade Restrictions:

Free Trade vs. protection. Tariffs: Classification, and effects of tariff- The Partial Equilibrium & General Equilibrium Analysis of a Tariff. The Optimum Tariff. The Stolper Samuelson Theorem on effect of tariff. Non-Tariff Trade Barriers: import quotas, voluntary export restraints, exchange control, subsidies and countervailing measures and commodity agreements. State Trading; International Cartels; Dumping.

Unit 2: Economic Integration

Economic Integration: meaning and types. Static and Dynamic effects of a customs union and free trade areas, Regional Trading Arrangements – SAFTA, NAFTA, EFTA, ASEAN, European Union. Recent Development in Economic Integration

Unit 3: India's Foreign Trade

Value of Exports and Imports, Composition of Exports and Imports, Export Promotion Policy, Recent Export- Import Policy, Direction of Foreign Trade and Recent Changes.

Unit 4: Important Aspects of Foreign Trade

International Debt Problem, Measures to solve debt Crisis, G-20 and India, BRICS and India, Foreign Direct Investment, Multinational Corporations, Bilateral, Multilateral, Free and Preferential Trade Agreements.

Books Recommended:

1. Jhingan M.L., International Trade &Finance, 2014, Vrinda Publication, New Delhi.
2. Cherunilum Francis (2008), International Economics, Tata McGraw Hill.
3. Mithani D.M., International Economics, Himalaya Publishing house, Nagpur.
4. Salvatore Dominick (2002), International Economics, (Latest edition), John Wiley and Sons, Singapore
5. Feenstra Robert C. (2004), International Trade: Theory and Evidence, Princeton, University Press, Princeton.

MAJOR - MANDATORY – 3

(Credit – 4)

URBAN AND RURAL ECONOMY

Learning Objectives of the Course:

The course provides insights into status, issues and problems of the Urban and Rural Economy. The main objective of the course is to develop problem solving innovative ideas using available resources. The course will also impart the knowledge about the concentration of various development opportunities. This will also help to understand role of agriculture and various government initiatives for the development of Urban and Rural Economy.

Outcomes of the Course:

Upon successful completion of this course, students will be able to:

1. Need, indicators and importance of urbanization.
2. To know the status of urbanization and government initiatives in India.
3. To know the status and indicators of rural development in India.
4. Able to understand the available resources and agriculture related issues in India

Course Contents

Unit -1: Introduction of Urban Economy

Definition and Scope of Urban Economics- the process of Urbanization-Definition of Urban Area-Causes of urbanization- models of Urban Development and Planning, The Urban Economy and Development strategy, the Economics of Urban Growth, Models of Urban Growth, The Frontiers of Urban Growth- The Economics of Intra-urban Location Decisions, Residential and Industrial Locations, Semi Urban areas, special township features of urbanization in developing countries.

Unit -2: Urbanization in India

Urbanization in India-Growth of Urban Population-Causes, Urban Development Policy in India, Policies and Programmes, Under the Plans Jawaharlal Nehru National Urban Renewal Mission (JNNURM) Growth of Smart cities in India, Drinking Water, Sanitation Health, Education, Housing and Transportation.

Unit - 3: Introduction to Rural Economy

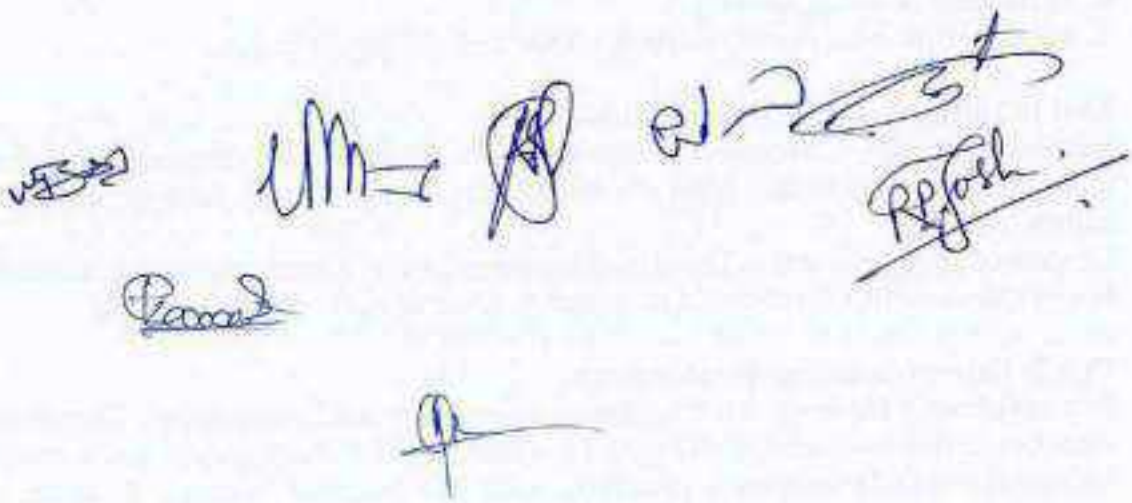
Concept and Nature of Rural Economy- Characteristic of Rural economy, factors affecting rural economy. Place of Agriculture in rural Economy, Basic needs of rural economy housing, health, education, training drinking water supply, electricity, sanitation, rural roads, transport and communication, rural stabilization, utilization of local human and natural resources.

Unit- 4: Rural Economy and Agriculture

Rural Production systems and Resources, Natural Resources and Sustainable Rural Economy, Agricultural Planning and Reform, Role of agriculture and allied activities in Rural Economy Agricultural and Food Problems – Food Security, Problems of Agricultural Prices and Agricultural Marketing. Government measures undertaken for agricultural development.

Books for References

1. O'Sullivan, A. (2002) Urban Economics, McGraw-Hill Irwin.
2. Fred Durr, The Urban Economy (London, Index Educational Publishers) 1971.
3. Hartwick, John M. (2015) Urban Economics, Routledge; 1st edition.
4. Black, Duncan and Henderson, Vernon (1999), A Theory of Urban Growth, Journal of Political Economy, 1999, vol. 107, no. 2, The University of Chicago. 12. Handbook of Urban Statistics 2019, Ministry of Housing and Urban Affairs, Government of India
5. Datt & Sundharam, Indian Economy S Chand & Co., New Delhi, 68th New Delhi, 2013
6. India Rural Development Report 2012-13, Orient Black swan Pvt. Ltd, New Delhi, 2013.
7. Deogirikar, A. B. W.T.O and Indian Economy, Jaipur: Shri Niwas Publications, 2004
8. Acharya, S.S.& Agricultural Marketing in India N.L. Agarwal New Delhi: Oxford & IBH ltd.,2004.
9. Khanna, Sulbha & Rural Development Strategies and Planning Upna Diwan New Delhi: Sonali Publications, 2003.
10. Prasad, B.K. Rural Development Concept Approach and Strategy New Delhi: Sarup and Sons, 2003.



Electives (Choose Any One)

1. ENTREPRENEURIAL DEVELOPMENT

Learning Objectives of the Course:

The learning objectives of this course are to introduce students to the domestic and international measures of economic development, problem of poverty and Inequality and critical evaluation of economic Planning with Indian perspective. Also to develop analytical and critical thinking skills and use them to judge the appropriateness of policy options Develops research skills including: data collection; interpretation by way of analytical commentary; demonstrated ability to support analysis through empirical evidence and draw critical conclusions and develop presentation skills.

Course Outcomes:

1. Acquire a basic understanding of the concepts, issues and domestic & international measures of economic development.
2. Acquire skills and technique of application of Input-Output analysis and Linear Programming in Planning and real worlds various economic issues.
3. Apply an analytical framework to understand the problems of Poverty& Inequality and policy options.
4. Assessment of Indian planning.
5. Acquire skills in conducting research related to development issues.

Unit 1: The Concept of Entrepreneurship

Entrepreneurship - Meaning & concept, Characteristics of entrepreneurs, nature & importance of entrepreneurs, types of entrepreneurs, entrepreneurial process. Entrepreneurial culture

Concept of entrepreneurship, Theories of entrepreneurship, factors responsible for emergence of entrepreneurship, Classification of entrepreneurs, barriers to entrepreneurship

Unit 2: Entrepreneurship Development:

Entrepreneurship Environment: Significance of entrepreneurial environment. Classification of entrepreneurship environment- Political, Economic, social, technological, legal & cultural.

Entrepreneurship Development: meaning, need, ED programs, strategy & issues of ED programs

Entrepreneurship Training: importance, objectives, methods, benefits

Institutions for ED: Management Development Institute, NIESBUD, EDII, STEPS, EDPs of SIDBI, role of commercial banks, B-schools

Unit 3: Project management:

Concept of Project: Meaning, classification of projects, Project cycle

Project identification: Searching for business ideas, identifying project, importance of project identification

Project formulation: Steps involved, stages, project evaluation. Problems for entrepreneurs in project formulation

Project Feasibility prospects - project objectives, design, assessment of technical, economic, financial and marketing aspects. Project profitability projections, Format of report

Unit 4: Project Finance & marketing:

Sources of finance: equity, debt & leasing- meaning, advantage & disadvantages. Capital structure, venture capital.

Credit facilities - types of credit available, role & types of institutions supporting finance to entrepreneurs

Marketing: concept, marketing mix, market segmentation, market positioning.

Marketing channels: concept, importance, types of distribution channels, factors influencing channel choice & channel decision

E-commerce: types, opportunities in India, barriers to growth, future of e-commerce

Books Recommended:

1. Vasant Desai, The Dynamic of Entrepreneurial development & management, Himalaya Publishing house.
2. Hans Schlemmer and Arthur H. Kniloff: Entrepreneurship and small business, Prentice Management, John Wiley.
3. James R. Cook and Harpet: The Startup Entrepreneur, 1986.
4. John E. Tropman and Gersh Morristar: Entrepreneurial system for the 1990s, Greenwood Press.
5. Sharma R.A.: Entrepreneurial change in Indian Industries, Sterling, Delhi.

2. ENERGY AND INFRASTRUCTURE ECONOMICS

Learning Objectives of the Course:

To know fundamental concepts and issues of energy and Infrastructure Economics.
To make understand various dimensions of the energy, physical and social infrastructure.
To analyse nature of energy markets, social infrastructure and their supply-demand.
To examine pricing of energy and Infrastructure resources; and analyse global market.

Course Outcomes:

i. Students will understand role and importance of energy in the economic development.
ii. After completion of the content, students will analyse the demand and supply of energy, pricing policy and energy policy of the government.
iii. Able to understand the relationship between infrastructure and economic development.
iv. Students will understand the status of physical and social

Course Content

UNIT 1: Introduction to Energy Economics

Meaning and Importance of Energy Economics, Types of Energy resources and commodities, Role of energy and infrastructure in economic development, renewable vs non-renewable energy, energy demand, supply and prices, energy exploration, production, transportation, Conversion Factors and Aggregation of Energy Flow. Energy Resources and Energy Commodities; Properties of Energy Resources and Energy Commodities; Energy, economy and environment interactions, role of energy in development.

UNIT 2: Demand, Supply and Production of Energy

Demand for and supply of Energy, Trends and Pattern of Energy Production, Production of Renewable and non-renewable energy, Different types of Energy Market, Social, Economic and Environmental Effects of Energy Production; Marketing and Pricing of Energy.

Energy Policy, Energy taxes and subsidies: principles of optimal indirect taxation, equity considerations, issues related to numerical determination of a burden, Tax and subsidy structure in Indian Context, Energy pricing in Indian Context (Coal, Gas and Electricity), Different Energy Markets.

UNIT 3: Infrastructure and Economic Development

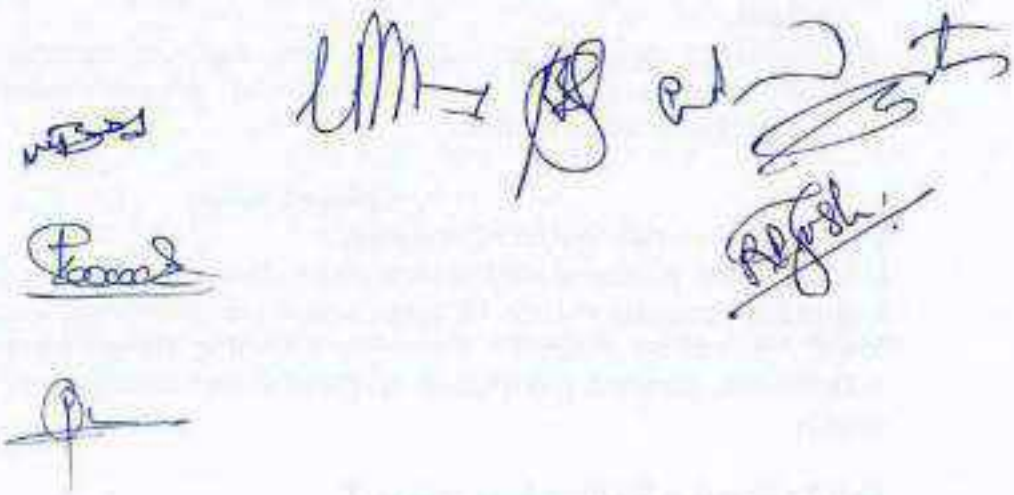
Meaning and Definition of Infrastructure–Types of Infrastructure–Economic and Social Infrastructure–Approaches to Infrastructure–Traditional and Modern Approaches – Infrastructure and Economic Development

UNIT 4: Social and Physical Infrastructures

Infrastructure as a public good, social and physical infrastructure (Transportation and Communication), public utilities, cross subsidization; transportation economics, pricing principles. Public vs private sector financing in infrastructure; Communication infrastructure

Books for References-

1. R Sampson Aronofsky, J.A Rao. ...Energy Policy, North Holland, Amsterdam.
2. R. K Pachauri (ed)... Energy Policy for India, McMillan India New Delhi.
3. MA Crew. Public Utility Economics. McMillan London.
4. Crow, M.A. and R.D. Kleindorfer, 1979, Public Utility Economics, Macmillan, London.
5. Nelson, J.R., 1964, Marginal Cost Pricing in Practice, Prentice Hall, England-Cliffs.
6. Philips, A and O.F. Williamson (Eds), 1967, Prices: Issues in Theory, Practice and Public Policy, University of Pennsylvania Press, Philadelphia.
7. Kneafsey, J.T., 1975, Transportation Economic Analysis, Lexington Books, Toronto.
8. Aronofsky, J.A and M. Shakum, Eds, 1978, Energy Policy, North Holland, Amsterdam.
9. Mavrakis, MS. Ed., 1974, Energy Demand Conservation and Institution Problems, Macmillan, London.
10. Nordhavs, W.P., Ed., 1974, International studies of the demand for energy, North Holland, Amsterdam.
11. Pachauri, R.K., Ed., 1989, Energy Policy for India, Macmillan Co. of India, Delhi.
12. Turvey, R and D. Anderson, 1977, Electricity Economics, John Hopkins, Baltimore



3. WELFARE ECONOMICS

Learning Objectives of the Course:

It Demonstrate an active understanding of economic theory as it relates to natural resource and environmental economics: It studies concepts of Pareto optimality, efficiency, and equity. Demonstrate a basic knowledge of the role of markets and market failure with regards to the allocation of natural resources. Gain a basic understanding of the effects and relative merits of public environmental policy efforts, including cap-and-trade schemes, Pigouvian taxes, regulation, and public ownership and/or management. To apply the marginal social benefit and marginal social cost principle; to examine the ways in which externalities, public goods and monopolies create market failures; to understand the arguments for and against government intervention to study the effectiveness of government policies.

Course Outcomes:

1. Welfare Economics will be useful to explain the foundation of economic policy, the design and the efficiency of different policy instruments, welfare consequences of economic policy, and the process of policy-making.
2. Understand the arguments for and against government intervention in an otherwise competitive market and effectiveness of government policies such as subsidies, taxes, quantity controls, transfer programs and public provision of goods and services;
3. Examine the ways in which externalities, public goods and monopolies create market failures.
4. Choose and apply relevant welfare economic analytical methods to empirical cases. Also analyse the pros and cons, costs and benefits of economic measures and changes from the perspective of social welfare.

Course Content

Unit 1: Pre-Paretian Welfare Economics

Definition and nature of welfare economics, Pigouvian Welfare Economics, Benthamite approach to aggregate welfare, Optimum resource allocation and welfare maximization Marshallian welfare economics, Consumer 's Surplus; Measurement of Consumer 's Surplus —Difficulties involved, Criticism; Principle of Compensating Variation; Hicks Consumer 's surplus.

Unit 2 : Paretian Welfare Economics – I

Pareto optimality- Optimum exchange conditions, The consumption optimum, the production optimum, Infinite number of non- Comparable optima vs unique social optima, Concept of contract curve; Compensation criteria: contribution of Barone, Kaldor and Hicks, Scitovsky double criteria

Unit 3: Paretian Welfare Economics - II

Concept of community indifference map, Samuelson utility possibility curve, Value judgment and welfare economics, Bergson's social welfare function, Arrow's impossibility theorem

Unit 4: Some later developments

Problems of non-market interdependence, Externalities of production and consumption External economies and diseconomies, Problems of public goods. Divergence between Private and social costs, Marginal cost pricing; Cost-benefit analysis;

Books Recommended:

1. Arrow K.J., Social Choice and Individual Values, Yale University Press, New Haven
2. Baumol W.J., Welfare Economics and the theory of the State, Longmans, London
3. Fieldman A. M. Welfare Economics and OScilaChice Theory, Martinus Neuhoff Boston
4. Myint H, Theories of Welfare economics, Longman
5. Nicolas B., Economic theory and the A Welfare State, Edward Elgar Publishing, UK
6. Quirk J and Sapasnik, Introduction to General Equilibrium Theory and Welfare Economics, McGraw Hill, New York

Four Year Bachelor of Science & BCA Examination

Scheme of Examination for Four Year Bachelor of Science (B.Sc.) & BCA Program from Academic Session 2023-24

As approved by all the Boards of Studies in the Faculty of Science & Technology in their meetings held on 20th May 2023

Placed before the Faculty of Science & Technology for consideration and approval in its meeting scheduled on 25th May 2023

Preamble:

The Academic Council of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur has adopted the Government Resolution No. NEP-2020/प्र.क्र.09/विशी-3/शिकाना dated 20th April 2023 issued by the Government of Maharashtra in its meeting held on 21st April 2023 in view of implementation of National Education Policy, 2020. The Faculty of Science & Technology, R T M Nagpur University has approved the following 'Teaching and Examination Scheme' for 'Four Year – Bachelor of Science (B.Sc.) Honours/Research Degree with Major and Minor' in its meeting held on 25th May 2023. The scheme is also approved by the Academic Council of the University in its meeting held on 5th June 2023. This notification is issued to facilitate the HEIs (Affiliated Colleges) and students for smooth conduct of admission process for the year 2023-24. Basic details required at the time of admission are provided in this notification and a detailed Direction/Regulation containing comprehensive provisions related to all aspects shall soon be issued by the University. Further, a list of 'Co-Curricular Courses (Annexure – VI) shall also be soon issued by the University.

1. **Details of Eligibility for B.Sc. & BCA Semester I Examination**

   a. The candidate should have passed 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education/CBSE/ICSE, with English at Higher or Lower level and any Modern Indian Language at higher or lower level together with any three science subjects comprised in the Faculty of Science or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed;

   OR

   b. 12th Standard Examination of Maharashtra State Board of Secondary and Higher Secondary and offering Education in Vocational/Bi-focal Stream with one language only with any three science subjects comprised in the faculty of Science OR any other examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed by Minimum Competency Vocational Courses (MCVC).

   OR

   c. Any other Equivalent Examination of any State in (10+2) pattern with any three science subjects comprised in the Faculty of Science or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

   d. For admission to the B.Sc. programs in i) Computer Science ii) Information Technology, iii) Data Science iv) Electronics and v) Bachelor in Computer Applications (BCA), the candidate should have passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with English and other Modern Indian Languages together with mathematics or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

2. Duration of the Program, Student Progression Path and Provisions for Multiple Entry and Exit

Duration of the **B.Sc. & BCA** Program shall be FOUR years with the provision for multiple exits as mentioned here:

Multiple Exit:

Students will have the flexibility to enter a program in odd semesters and exit a program after the successful completion of even semester as per their future career needs:

a. A student can exit the program after successful completion of semesters I & II having earned requisite number of credits as mentioned in the scheme of examination and additional 'NSQF* Course or Internship' with 4 credits. Such a student shall be eligible for the award of 'Certificate in Science' by the University.
OR a student can continue the program in 2nd year.

b. A student can exit the program after successful completion of semesters I, II, III, & IV having earned requisite number of credits as mentioned in the scheme of examination and additional 'NSQF* Course or Internship' with 4 credits. Such a student shall be eligible for the award of 'Diploma in Science' by the University.
OR a student can continue the program in 3rd year.

c. A student can exit the program after successful completion of semesters I, II, III, IV, V & VI having earned requisite number of credits as mentioned in the scheme of examination. Such a student shall be eligible for the award of 'Three Year Bachelor of Science' degree by the University.
OR a student can continue the program in 4th year for either HONOURS or RESEARCH degree.

d. A student, on successful completion of all the 8 semesters and having earned requisite number of credits as mentioned in the scheme of examination shall be eligible for the award of either 'Bachelor of Science (Honours) Degree with Major and Minor' OR 'Bachelor of Science (Research) Degree with Major and Minor'.

Table 2: Eligibility for Award of Certificate/Diploma/Degree/Honours or Research Degree

Levels	Qualification Title	Additional Credits to be Earned	Credit Earned	Sem.	Year
4.5	UG Certificate in Science *OR* Continue with Major	4 (NSQF* Course or Internship)	44	2	1
5.0	UG Diploma in Science with Major & Minor *OR* Continue with Major	4 (NSQF* Course or Internship)	88	4	2
5.5	Three Year Bachelor Degree in Science with Major & Minor *OR* Continue with Major & Minor	Not Required	132	6	3
6.0	Bachelor Degree in Science (Honors/Research) with Major and Minor	Not Required	172	8	4

***NSQF:** National Skill Qualification Framework or the skill courses prescribed by the RTMNU.*

3. Re-entry or Lateral Entry

a. Students, opting for exit at any level, will have the option to re-enter the programme from where they had left off, in the same or in a different higher education institution within THREE years of exit and complete the degree programme within the stipulated maximum period of SEVEN years from the date of admission to first year.

b. Re-entry at various levels for lateral entrants in academic programmes shall be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.

c. Lateral entry into the programme of study leading to the UG Diploma / Three Year UG Degree / Four Year Bachelor's Degree with Honours/Research will be based on the validation of prior learning outcomes achieved and subject to availability of seats based on intake capacity.

4. Types of Courses

A student admitted to this program is required to undergo and successfully complete the following types of courses as mentioned in the scheme of examination:

Table 1: Types of Courses and Choice for Selection

SN	Course Type	Choice for Selection
1.	Major (Core) Subject	A student is required to select her/his 'MAJOR' subject from amongst the choices provided in this scheme of examination before filling the examination form for 1st Semester. Change of major subject shall not be permitted after the examination form is submitted. Major subject comprises of Mandatory and Elective Course.
2.	Minor Subject	A student is required to select her/his 'MINOR' subject from amongst the choices provided in this scheme of examination or any other degree program offered by the university in any other faculty before filling the examination form for 3rd Semester. Change of minor subject shall not be permitted after the examination form for 3rd Semester is submitted.
3.	Open Elective Course (OE)	A student is required to select an 'OPEN ELECTIVE' from the 'Open Elective Basket' of any program offered by the university in any faculty before filling the examination form for the semester concerned. Such an 'OPEN ELECTIVE' cannot be selected from the subjects chosen by a student as 'Major' and 'Minor' subjects. A student is allowed to earn credits for 'OPEN ELECTIVE' by successfully completing online courses of equivalent credits from SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
4.	Vocational Skill Course (VSC)	A student is required to successfully complete the 'VOCATIONAL SKILL COURSE' as mentioned in this scheme of examination. This course must be a course corresponding to the 'MAJOR' and/or MINOR subject selected by a student. A student is allowed to earn credits for 'VOCATIONAL SKILL COURSE' by successfully completing online courses of equivalent credits from SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University provided they are approved by the competent authority of RTM Nagpur University. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
5.	Skill Enhancement Course (SEC)	A student is required to select a 'SKILL ENHANCEMENT COURSE' from the basket provided by the university for this purpose. A separate notification and guidelines in this regard shall be displayed by the university on its website. A student is allowed to earn credits for 'SKILL ENHANCEMENT COURSE' by successfully completing online courses of equivalent credits from

		SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University provided they are approved by the competent authority of RTM Nagpur University or the courses from Sector Skill Council. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
6.	Ability Enhancement Course (AEC)	A student is required to undergo and successfully complete the 'ABILITY ENHANCEMENT COURSE' as mentioned in this scheme of examination.
7.	Indian Knowledge System Course (IKS)	A student is required to undergo and successfully complete the 'INDIAN KNOWLEDGE SYSTEM COURSE' as mentioned in this scheme of examination.
8.	Value Education Course (VEC)	A student is required to undergo and successfully complete the 'VALUE EDUCATION COURSE' as mentioned in this scheme of examination.
9.	Co-Curricular Course (CC)	A student is required to select a 'Co-Curricular Course' as mentioned in this scheme of examination. This course must be completed at the Higher Education Institute (HEI) where the student has taken admission and transfer of credit is not permissible for this type of course.
10.	Field Project (FP) / On the Job Training (OJT) /Community Engagement Project (CEP) / Research Project (RP)	A student is required to undergo and successfully complete this course as mentioned in the scheme of examination under the guidance of supervisor/mentor assigned by the HEI. This course must be corresponding to the 'MAJOR.' This course must be completed at the HEI where the student has taken admission and transfer of credit is not permissible for this type of course.

5. Availability of 'Major' and 'Intake Capacity'

All HEIs affiliated to the University for offering B. Sc. Program in the Faculty of Science and Technology shall adhere to the following:

Table 3: List of MAJOR Subjects

Affiliated Program	**Sanctioned Intake**	**'Major' to be offered**	**Code of 'Major'**
B. Sc. (Group A)	As approved by the University	Chemistry	CH
		Environmental Science	ES
		Textile Science	TS
		Fashion Design	FD
B. Sc. (Group B)	As approved by the University	Physics	PH
		Zoology	ZO
		Biochemistry	BC
		Cosmetic Tech.	CT
B. Sc. (Group C)	As approved by the University	Mathematics	MT
		Botany	BO
		Home Science	HS
		Forensic Science	FS
		Interior Design	HD
B. Sc. (Group D)	As approved by the University	Statistics	ST
		Microbiology	MI
		Biotechnology	BT
		Geology	GE
		Electronics	EN

B. Sc. (Group E)	As approved by the University	Computer Science	CS
		Data Science	DS
		Information Technology	IT
		Bachelor of Computer Application	CA
		App. Electronics & Software Technology	ET

NOTES:

- Table 3 above has five groups accommodating all the Major programs. A student is required to select one Major program (subject) from any Basket.
- A student is required to select one Minor from any basket except the basket from which she/he has selected the Major program (subject).
- Total intake capacity for the program as approved by the university shall remain the same and be divided amongst the 'Major' subjects allowed for that program.
- The HEI may offer a particular 'Major' subject based on the availability of teachers and students.
- The HEI is not expected to force any student to opt for a particular subject where a choice is provided in the scheme of examination.
- Subject code given in the table may change, however the change if any will be notified.

6. Minor Subjects:

All HEIs affiliated to the University for offering B. Sc. Program may offer all/any of the subjects given in Table 3 (column 3) as 'MINOR' subject/s as mentioned in this scheme of examination. It is mandatory for the students to choose only one Minor subject which obviously will be other than the Major subject she/he has already chosen. Once the Minor subject is chosen, it is mandatory for a student to pursue all the courses from the basket of that Minor only.

7. All HEIs affiliated to the University offering B. Sc. Program are required to display the list of 'Major' and 'Minor' subjects offered on the Notice Board as well as on the website of HEI to make students aware about the availability of subjects. Moreover, HEIs are expected to define and display the 'Standard Operating Procedure' for their faculty members and students to facilitate the process of selecting 'Major' and 'Minor' subjects.

8. In pursuance with the National Education Policy 2020 and a Government Resolution No. NEP-2020/प्र.क्र.09/विशी-3/शिकाना dated 20th April 2023 issued by the Government of Maharashtra, the credit framework for B. Sc. Program is given in **Annexure - I.**

9. Teaching and Examination Schemes:

Teaching and Examination Schemes (of eight semesters) and Syllabus of Semester I & II for all B.Sc. subjects and BCA is appended in **Annexure - II**.

10. Credit Specifications:

a. Theory/Tutorial Courses**:** One hour/credit/week (a minimum of 15 hours of teaching per credit is required in a semester.
b. Laboratory/Performance Based Courses: A minimum of 30 hours in laboratory or Performance Based activities is required in a semester. Performance based activities include Studio activities, Workshop based activities, internship, Apprenticeship, Field based learning, community engagement learning, etc.
c. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.

11. GRADE Conversion Table and Computation of SGPA & CGPA

Table 4: Grade Conversion Table (Theory)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 - 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	C	5.00 - < 5.50	50 - < 55	Average
7	P	4.00 - < 5.00	40 - < 50	Pass
8	F	Below 4	Below 40	Fail
9	AB	0	-	Absent

Table 5: Grade Conversion Table (Practical)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 - 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	P	5.00 - < 5.50	50 - < 55	Pass
7	F	Below 5	Below 50	Fail
8	AB	0	-	Absent

Computation of SGPA & CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \Sigma(Ci \times Gi) / \Sigma Ci$$

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \Sigma(Ci \times Si) / \Sigma Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. CGPA to Percentage (%) conversion formula:

$$Percentage\ (\%) = (CGPA) * 10$$

Note: Illustration for Computation of SGPA & CGPA is given on last page

12. General Guidelines:

a. Students opting Major in the subjects Computer Application, Computer Science, Information Technology and Data Science will not be eligible to take Minor Courses offered by any of these four Major subjects. For Example, a student is opting Computer Application as Major, will not be eligible to take the Minor courses from the Minor baskets of Computer Science, Information Technology and Data Science subjects.

b. A student will be eligible to the fourth year of four year with Research Degree only when she/he scores minimum 7.5 CGPA or 75% in three-year degree.

c. For non-credit courses 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

d. The baskets of Elective & Vocational Skill Courses are related to the Major, are given at the end of scheme.

e. The baskets of Open Elective Courses, Skill Enhancement Courses, Minor Courses and Co-curricular Courses being common will be available at the end (after the scheme of all Major subjects) in the form of Annexures.

f. SEE (Semester End Examination) for Theory as well as Practical examinations as mentioned in the scheme shall be conducted by the University for all EVEN semesters and by colleges on behalf of the University for all ODD Semesters.

g. In case, a student is opting out any of the course (subject to conditions of this scheme) and bringing credits from any other institutes/online courses outside the scheme, the marks/grades obtained by student shall be certified by the Principal and be submitted to the university as CIE (Continuous Internal Examination) marks.

13. Assessment

- The final total assessment of examinees is made in terms of Continuous Internal Assessment (CIE) and Session End Examination (SEE) for each course/subject taken together.
- For each course mentioned in Annexures – II, III, IV and V, the examination shall be conducted at college level (Odd semesters examinations) and RTM Nagpur University level (Even semester examinations)
- For each course mentioned in annexure - VI, the examination shall be conducted at the college level according to the evaluation system prescribed in annexure – VI.

Table 6: CIE Assessment Plan

1a	Attendance of the student during a particular semester	05 Marks
1b	An assignment (min. two) based on curriculum to be assessed by the teacher concerned	05 Marks
1c	Subject wise class test (min. two) or activities conducted by the teacher concerned with proper rubrics.	10 Marks
	Continuous Internal Evaluation (CIE) marks/course	**20**

- In case of Courses having more than 20 marks for CIE, a scheme of evaluation is appended with the detailed syllabus of the course.
- Expected classroom activities shall consist of the following: (a) Group Discussion (b) Seminars (c) Power Point Presentations (d) Elocution (e) Debate (f) Role Play (g) Case Studies (h) Educational Games. The teacher is expected to undertake a minimum of four of the aforesaid activity.
- The CIE marks will be communicated to the University at the end of each semester, but before the semester end examinations / as instructed by the university. These marks will be considered for the declaration of the results.
- The record of internal marks, evaluation & results should be maintained for a min. period of three year by the respective institute/college for verification by the competent authority.

14. Standard of Passing

The scope of the course, percentage of passing in Theory and Project and Internal Assessment will be governed as per following rules:

(i) In order to pass the Bachelor of Science (B.Sc.) 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th Semester Examinations, an examinee shall obtain not less than 40 % (Grade 4) marks in each theory course/paper, taking CIE & SEE together. Whereas, for practical/performance-based examination an examinee shall obtain not less than 50 % (Grade 5) marks in each practical, taking CIE & SEE together.

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

15. Abbreviations Used:

CIE: Continuous Internal Evaluation SEE: Semester End Examination

OE: Generic/Open Electives, VSEC: Vocational Skills & Skill Enhancement Courses, VSC: Vocational Skill Courses, SEC: Skill Enhancement Courses, AEC: Ability Enhancement Courses, IKS: Indian Knowledge Systems, VEC: Value Education Courses, OJT: On Job Training (Internship/Apprenticeship), FP: Field Project, CEP: Community Engagement & Service, CC: Co-curricular Courses, RM: Research Methodology, RP: Research Project

16. Provision for Transfer of Credits

The B.Sc. program offered under this direction provides enhanced academic flexibility to students in terms of selecting the courses they want to learn. A student can opt for any course from any statutory/recognized University or a MOOC from SWAYAM/NPTEL in lieu of a course mentioned in this scheme of examination as 'Open Elective', 'Vocational Skill Course' and 'Skill Enhancement Course'. The mechanism for transfer of credits earned through these courses to be adhered is mentioned here:

1. Every student is mandatorily required to create an ID on Academic Bank of Credits (ABC) and shall submits her/his ID to the college.
2. Any Course mentioned in this scheme of examination under 'Open Elective', 'Vocational Skill Course', and 'Skill Enhancement Course' may be opted by a student for taking a MOOC from SWAYAM/NPTEL learning platform.
3. A student cannot opt any other course than the courses under course category mentioned in point no. 2 mentioned above.
4. If a student is willing to opt any such course, he/she will have to mention this while submitting the examination form to the University for respective semester.
5. A certificate of completion of such an ODL/Online course shall be submitted by the student to the University through college before end term evaluation.
6. Such a certificate shall mandatorily have the number of credits, duration of the course and grades/marks obtained by the student and shall preferably have a QR code for verification.
7. The college shall submit the grades and marks obtained by the student to the University along with CIE marks for the concerned examination.
8. If a student has opted for an ODL/Online course in a particular semester and failed to submit the certificate within prescribed time, the student will be marked as 'Absent' for a particular course in that examination. Such a student will be required to fill in the examination form for the next attempt and submit the passing certificate in order to get his/her corrected result.
9. A separate guideline 'Transfer of Credits' issued by the University will be applicable to the students of B. Sc. Program from the date of its issuance.

Annexure – I: Credit Structure given by Govt. of Maharashtra as per GR dated 20/04/2023
Annexure – II: Scheme of teaching & examination of all Major programs
Annexure – III: Basket of Minor Courses of all programs
Annexure – IV: Basket of Open Electives (OE)
Annexure – V: Basket of Skill Enhancement Courses (SEC)
Annexure – VI: Basket of Co-curricular courses (CC)

NOTE: This scheme of teaching and examination for Bachelor of Science program shall be effective from the academic session 2023-24 and a comprehensive direction for other regulations in this connection shall be soon issued by the University.

Illustration for Computation of SGPA & CGPA

i) Illustration for SGPA

COURSE	CREDIT	GRADE LETTER	GRADE POINT	CREDIT POINT (Credit * Grade)
Course 1	3	A	8	3 * 8 = 24
Course 2	4	B+	7	4 * 7 = 28
Course 3	3	B	6	3 * 6 = 18
Course 4	3	O	10	3 * 10 = 30
Course 5	3	C	5	3 * 5 = 15
Course 6	4	B	6	4 * 6 = 24
	20			139

SGPA (Si) = Σ(Ci x Gi) / ΣCi

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Thus, SGPA = 139 / 20 = 6.95

ii) Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Credit : 20 SGPA : 6.9	Credit : 22 SGPA : 7.8	Credit : 25 SGPA : 5.6	Credit : 26 SGPA : 6.0	Credit : 26 SGPA : 6.3	Credit : 25 SGPA : 8.0

CGPA = Σ(Ci x Si) / Σ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

$$\text{Thus, CGPA} = \frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144} = 6.73$$

Annexure - I

Credit distribution structure for three/ four-year Honors/Research Degree Program with Multiple Entry and Exit options (GoM GR dated 20/04/2023)

Level	Sem.	Major		Minor	OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC,RP	Cum. Cr./Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	6	-	-	2 + 2	VSC: 2, SEC: 2	AEC: 2, VEC: 2, IKS: 2	CC: 2	22	**UG Certificate 44**
	II	6	-	-	2 + 2	VSC: 2, SEC: 2	AEC: 2, VEC:2 IKS: 2	CC: 2	22	
	Cum Cr.	12	-	-	8	4 + 4 = 8	4 + 4+ 4 = 12	4	44	
Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor										
5.0	III	6		6	2	VSC:2,	AEC:2	FP:2 CC:2	22	**UG Diploma 88**
	IV	6		6	2	SEC:2	AEC:2	CEP: 2 CC:2	22	
	Cum Cr.	24		12	12	12	16	12	88	
Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor										
5.5	V	9	4	6	-	VSC: 2	-	CEP: 1	22	**UG Degree 132**
	VI	9	4	3	-	VSC: 2	-	OJT :4	22	
	Cum Cr.	42	8	21	12	16	16	17	132	
Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor										
6.0	VII	12	4	RM:4	-	-	-	-	20	**UG Honours Degree 172**
	VIII	12	4	-	-	-	-	OJT: 4	20	
	Cum Cr.	66	16	25	12	16	16	21	172	
Four Year UG Honours Degree in Major and Minor with 160-176 credits										
6.0	VII	9	4	RM:4	-	-	-	RP: 3	20	**UG Research Degree 172**
	VIII	9	4	-	-	-	-	RP: 7	20	
	Cum Cr.	60	16	25	12	16	16	27	172	
Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits										

Annexure - II

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Botany

Submitted by
Board of Studies,
Bachelor of Botany

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Botany- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-1** Microorganisms-Viruses, Prokaryotes, Algae and Fungi	BBO1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-1** Microorganisms-Viruses, Prokaryotes, Algae and Fungi	BBO1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-2** Cryptogams-Bryophyta, Palaeobotany & Pteridophyta	BBO1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-2** Cryptogams-Bryophyta, Palaeobotany & Pteridophyta	BBO1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Identification of Angio spermic plants	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-3** Spermatophyte-Gymnosperm & Angiosperm Morphology	BBO2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-3** Spermatophyte-Gymnosperm & Angiosperm Morphology	BBO2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-4** Cell Biology & Genetics (Mendelism)	BBO2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-4** Cell Biology & Genetics (Mendelism)	BBO2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Horticulture	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-5** Algae, Fungi, Lichen &Plant Pathology	BBO3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-5** Algae, Fungi, Lichen &Plant Pathology	BBO3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-6** Fossil Angiosperms &Angiosperm Taxonomy	BBO3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-6** Fossil Angiosperms &Angiosperm Taxonomy	BBO3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-7** Genetics, Plant breeding, Biostatistics & Evolution	BBO4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-7** Genetics, Plant breeding, Biostatistics & Evolution	BBO4P07			2	1	-	-	-	-	25	25	25
3	DSC	**Botany-8** Plant Development, Anatomy& Embryology	BBO4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-8** Plant Development, Anatomy& Embryology	BBO4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4P06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-V (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	**Botany-9** Biochemistry & Plant Physiology	BBO5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-9** Biochemistry & Plant Physiology	BBO5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-10** Economic botany, Ethnobotany & Phytogeography.	BBO5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-10** Economic botany, Ethnobotany & Phytogeography.	BBO5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-11** Medicinal Plants: Cultivation and Practices	BBO5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-11** Medicinal Plants: Cultivation and Practices	BBO5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective **1Botany 12** (Pharmacognosy and Phytochemistry / Forestry)	BBO5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective **1Botany 12** (Pharmacognosy and Phytochemistry / Forestry)	BBO5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-13** Ecology & Laboratory Instrumentation	BBO6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-13** Ecology & Laboratory Instrumentation	BBO6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-14** Biotechnology& Molecular Biology	BBO6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-14** Biotechnology& Molecular Biology	BBO6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-15** Seed Technology & Plant Nursery	BBO6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-15** Seed Technology & Plant Nursery	BBO6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	**Elective-2 Botany 16** Molecular biology & Bioinformatics / LaboratoryTechniques	BBO6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	**Elective-2 Botany 16** Molecular biology & Bioinformatics / LaboratoryTechniques	BBO6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Botany - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-18** Bryophytes and Pteridophytes	BBO7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-18** Bryophytes and Pteridophytes	BBO7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-** 19 Palaeobotany and Gymnosperms	BBO7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-** 19 Palaeobotany and Gymnosperms	BBO7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	**Botany-20** Cytology and Genetics	BBO7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	**Botany-20** Cytology and Genetics	BBO7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 **Botany 21** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 **Botany 21** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BBO7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BBO7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-23** Plant Physiology and Biochemistry.	BBO8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-23** Plant Physiology and Biochemistry.	BBO8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-24** Plant Development and Reproductive Biology	BBO8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-24** Plant Development and Reproductive Biology	BBO8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-25** Cell and Molecular Biology-I	BBO8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-25** Cell and Molecular Biology-I	BBO8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	**Botany-26** Angiosperms-I and Ethnobotany	BBO8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	**Botany-26** Angiosperms-I and Ethnobotany	BBO8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 **Botany-27** (Biodiversity and Environment / Plant Biochemistry)	BBO8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 **Botany-27** (Biodiversity and Environment / Plant Biochemistry)	BBO8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-** 18 Palaeobotany and Gymnosperms	BBO7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-** 18 Palaeobotany and Gymnosperms	BBO7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-19** Cytology and Genetics	BBO7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-19** Cytology and Genetics	BBO7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 **Botany 20** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 **Botany 20** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBO7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBO7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Botany- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	**Botany-22** Plant Physiology and Biochemistry Ethnobotany.	BBO8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-22** Plant Physiology and Biochemistry Ethnobotany.	BBO8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-23** Plant Development, Reproductive Biology and Angiosperms-I	BBO8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-23** Plant Development, Reproductive Biology and Angiosperms-I	BBO8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-24** Cell and Molecular Biology-I	BBO8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-24** Cell and Molecular Biology-I	BBO8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 **Botany-25** (Biodiversity and Environment / Plant Biochemistry)	BBO8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 **Botany-25** (Biodiversity and Environment / Plant Biochemistry)	BBO8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Botany)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Identification of Angiospermic plants	Botany	**BVS1P01**
II	**VSC**	Horticulture	Botany	**BVS2P03**
III	**VSC**	Plant pathology and Disease management	Botany	**BVS3P05**
V	**VSC**	Plant propagation and tissue culture	Botany	**BVS5P07**
VI	**VSC**			**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Botany)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Pharmacognosy and Phytochemistry B. Forestry	BBO5T12
VI	Elective 2	A. Molecular biology & Bioinformatics B. LaboratoryTechniques	BBO6T16
VII (Honors)	Elective 3	A. Plant Identification & Herbarium Technique B. Ethnobotany	BBO7T21
VIII (Honors)	Elective 4	A. Biodiversity and Environment B. Plant Biochemistry	BBO8T27
VII (Research)	Elective 3	A. Plant Identification & Herbarium Technique B. Ethnobotany	BBO7T20R
VIII (Research)	Elective 4	A. Biodiversity and Environment B. Plant Biochemistry	BBO7T25R

Model Question Paper Format

Time:-3Hrs. Max.Marks:80

Note:-1.All questions are compulsory.
2. Each question carries equal marks.

Q. 1. Write on:-

(A) Unit-I 8Marks
(B) Unit-I 8Marks

OR

Write Short Notes on:-

(C) Unit-I 4Marks
(D) Unit-I 4Marks
(E) Unit-I 4Marks
(F) Unit-I 4Marks

Q. 2. Write on:-

(A) Unit-II 8Marks
(B) Unit-II 8Marks

OR

Write Short Notes on:-

(A) Unit-II 4Marks
(B) Unit-II 4Marks
(C) Unit-II 4Marks
(D) Unit-II 4Marks

Q. 3. Write on:-

(A) Unit-III 8Marks
(B) Unit-III 8Marks

OR

Write Short Notes on:-

(A) Unit-III 4Marks
(B) Unit-III 4Marks
(C) Unit-III 4Marks
(D) Unit-III 4Marks

Q. 4. Write on:-

(A) Unit-IV 8Marks
(B) Unit-IV 8Marks

OR

Write Short Notes on:-

(A) Unit-IV 4Marks
(B) Unit-IV 4Marks
(C) Unit-IV 4Marks
(D) Unit-IV 4Marks

Q. 5. Write in Three to Four Lines Diagrams are not necessary.

(A) Unit-I 2Marks
(B) Unit-I 2Marks
(C) Unit-II 2Marks
(D) Unit-II 2Marks
(E) Unit-III 2Marks
(F) Unit-III 2Marks
(G) Unit-IV 2Marks
(H) Unit-IV 2Marks

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

B.Sc. BOTANY (Honours/Research)

(Courses effective from Academic Year 2023-24)

SYLLABUS OF COURSES TO BE OFFERED

Major Courses (Discipline Specific Core), Minor Courses, Elective Courses (Discipline Specific Elective), Generic Elective (GE)/Open Elective (OE)

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Major/Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Major/Core course. Department/Subject Specific Core (DSC) is a single discipline course of study or specific subject course of study, which should be pursued by a student as a mandatory requirement of his /her program of study.

2. Minor Course: A course offered in a discipline/subject be treated as minor by another discipline/subject. Students are expected to gain in depth multi-/interdisciplinary understanding through theoretical and practical experiences, as well as an adequate knowledge base through the choice of minor subject and discipline. The student choosing to discipline specific core (DSC) have to choose minors from faculty/discipline unrelated to the major but something that complements the major.

3. Elective Course: A course which can be chosen from a pool of courses, and which is very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope, or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course. There shall be a pool /basket of DSEs from which a student has to choose a course of study.

4. Generic Elective (GE) or Open Elective (OE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. Generic or open electives shall be a pool / basket of courses which is meant to provide multidisciplinary or interdisciplinary education to students.

5. Vocational Skill Course: Vocational Skill Courses enable people to work that requires technical knowledge along with artistic or practical skills. These courses do not focus on theoretical knowledge, instead, they are primarily designed to provide job centred training for very specific fields.

6. Ability Enhancement Courses (AEC): AEC courses are the courses based upon the content that leads to knowledge enhancement through various area of study. They are Language and Literature, Environmental Science and Sustainable Development courses which will be mandatory for all disciplines. Combination of courses on English, Indian language (Marathi /Hindi/ Sanskrit or other regional languages if offered in that college) and Environment studies can be taken as an example on AEC courses.

7. Professional Ethics, Value Education and Life Skills Courses (EVLSC): Value education courses are common pool of courses offered by different faculties/disciplines and are aimed at personality building embedding ethical, cultural and constitutional values promoting critical thinking and scientific temperament. Value based education is expected to accomplish the development of humanistic, ethical, constitutional and universal human values (UHV) of truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values and life skills. Lessons in service and participation in community service programs could also be included as an integral part of the holistic education. Courses on life skills should beadded to increase the employability as well as self-esteem of the students.

8. Co-curricular Courses on Sports, Fine/Applied/Visual Arts and Cultural Activities: Students have to take some courses under co-curricular courses as a part of four-year multidisciplinary degree program.

9. Internship, apprenticeship, Field Projects and Community Engagement Projects: A student may undertake minimum of 4-6 weeks of Project Work either at University Research Centers or at any preapproved external Research Institutions/CSIR Laboratories.

The field-based learning / project should attempt to provide opportunities for students to understand the different socio-economic contexts. It should aim at giving students exposure to development related issues in rural and urban settings. This component will include participation in activities related to National Service Scheme (NSS), national Cadet Corps (NCC), adult education/literacy initiatives and mentoring school students. A minimum of 4-6weeks of summer work, either on university campus in activities related to preservation of environment/ biodiversity or community-based work in the neighbour community (through NSS unit) or field level work with a recognized NGO or regional case studies program at villages may be undertaken as a part of field projects

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

B.Sc. BOTANY (Honours/Research)

(Courses effective from Academic Year 2023-24)

SYLLABUS

Semester I

B. Sc. Semester-I Discipline Specific Core Course (DSC-I)- BOTANY Paper-I (BBO1T01) Microorganisms-Viruses, Prokaryotes, Algae and Fungi			
DSC-I Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
1. Introduction to microorganisms. 2. Classification of microorganisms (Outline) –Carl Woese's- Domain system (1990). 3. Brief account of Bacteria- Archaebacteria, Mycoplasma, Actinomycetes 4. **Viruses-** General account, structure& multiplication of –T4 Phage (Lytic, Lysogenic) 5. **Bacteria**: General characteristics, cell structure and economic importance. 6. **Cyanobacteria** : *Nostoc* (Morphology, Reproduction and importance in Agriculture)			7 Hrs
Unit-II			
1. General characteristics and Economic importance's of Algae. 2. **Classification of algae**: Lee (2008) up to phylum with examples 3. **Morphology and reproduction of the following**: *Oedogonium, Chara* and *Ectocarpus,*			8 Hrs
Unit-III			
1. **Fungi** General characteristics and Economic importance. 2. **Classification outline:** Alexopolous and Mims, 1996 3. **Life cycle** of *Albugo*, *Rhizopus* and *Agaricus*. 4. **Mycorrhiza:** ectomycorrhiza and endomycorrhiza.			7 Hrs
Unit-IV			
1. **Lichens:** General account, Types of lichens, Internal Structure, Reproduction and Economic importance. 2. **Plant Pathology:** Casual organism, Symptoms, transmission and control measures of Plant diseases- Citrus canker, Red Rot of Sugar cane, Little leaf of Brinjal and Leaf Curl of Papaya.			8 Hrs

DSC-I Practical	Hours: 2 Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Viruses from models / photographs (TMV and T4 Bacteriophage).
2. Study of gram staining of the given Bacterial culture.
3. Study of ultrastructure of Bacteriophage from TEM photographs.
4. Study of vegetative and reproductive structure of Cyanobacteria: *Nostoc*, *temporary* preparations and from permanent slides.
5. Study of vegetative and reproductive structure of Algae: *Chara, Ectocarpus, and Oedogonium,* temporary preparations and from permanent slides.
6. Study of Fungal genera: *Albugo, Rhizopus, and Agaricus*.
7. Study of Lichen: Thallus structure, Types of lichens.
8. **Plant Pathology** Study of diseases caused by the following: Citrus canker, Red Rot of Sugar cane, Little leaf of Brinjal and Leaf Curl of Papaya.
9. **Mycorrhiza:** ectomycorrhiza and endomycorrhiza (Photographs).
10. Instruments of Micro biology laboratory.

Suggested activity:

Seminar, Quiz, debate, Assignments, collection of diseased plant parts –studying symptoms and identification of pathogen, collection and study of Algae available in local area, Field work, Study Projects, Models etc. are Part of Curriculum for all units in all papers

B.Sc - SEMESTER –I BOTANY PRACTICAL

PAPER –I

Microorganisms-Viruses, Prokaryotes, Algae and Fungi

Time: 3hrs. **Max. Marks: 25**

1. Perform Gram staining of the given Bacterial culture **/** Identify giving reasons the given C**yanobacteria (A)**. **5 Marks**
2. Identify giving reasons the given **Algae (B)** **5 Marks**
3. Identify giving reasons the given Fungi **(C)** **5 Marks**
4. **Spotting:** **5 Marks**
   D. One of the instruments of Micro biology laboratory.
   E. Whole specimen or a permanent slide of Algae.
   F. Whole specimen or a permanent slide of Fungi.
   G. Whole specimen or a permanent slide of Plant disease studied.
   H. Whole specimen or a permanent slide of Lichens, Mycorrhiza.
5. Record and excursion report(submission is compulsory) **5 Marks**

Suggested readings

1. Barsanti, L. and Gualtieri, P. (2014). Algae: Anatomy, Biochemistry and Biotechnology, 2 nd Edition. CRC/ Taylor & Francis,
2. NY. Lee, R.E. (2018). Phycology, Fifth Edition. Cambridge University Press, Cambridge.
3. Marjorie, Kelly and Cowan, Heidi Smith. (2017). Microbiology: A Systems Approach. McGraw Hill New York, 5th edition.
4. Pandey, S.N and Trivedi, P.S. (2015). A text book of Botany Vol.I Vikas publishing House Pvt/ Ltd, New Delhi
5. Mehrotra, R.S. and K.R. Aneja. (1999). An Introduction to Mycology. New Age International Publisher.
6. Pelczar M.J., Chan E.C.S and Kreig N.R. (1997). Microbiology. Tata MacGraw Hill.
7. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGrawHill, Delhi, India.
8. Robert Edward Lee. (2018). Phycology. Cambridge University Press, U.K. 5th edition.
9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
10. Sharma, O. P. (2011). Algae. Tata McGraw Hill Education Private Limited, U.K. 1st edition.
11. Tortora, G.J., Funke, B.R., Case, C.L. (2011). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 13th edition

12. Aneja, K.R. (1993): Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
13. Bold H. C. and M. J. Wynne (1978): Introduction of Algae: Structure and Reproduction (Prentice Hall of India Pvt. Ltd.)
14. Sharma, P. D. [1991]: The Fungi (Rastogi & Co. Meerut)
15. Sharma, P.D. [1993] Microbiology and plant pathology (Rastogi & Co)
16. Smith, GM. [1971] Cryptogamic Botany, Vol 1 Algae and Fungi(TMI)
17. Smith, K. M. [1992]: Plant Viruses 6th Ed (university Book Stall New Delhi)
18. Sunder Rajan, S. (2001): Tools and Techniques of Microbiology, Anmol Publ New Delhi
19. Vasistha, B. R. (1990): Algae (S. Chand & Co. New Delhi)
20. Vasistha, B. R. (1990): Fungi (S. Chand & Co. New Delhi)
21. Woese CR, Fox GE (November 1977). "Phylogenetic structure of the prokaryotic domain: the primary kingdoms". Proceedings of the National Academy of Sciences of the United States of America. 74 (11): 5088 0. Bibcode:1977PNAS...74.5088W. doi:10.1073/pnas.74.11.5088. PMC 432104. PMID 270744
22. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
23. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
24. Alexopoulos C.J., Mims C.W. and Blackwell M. 2002. Introductory Mycology (4thed.). John Wiley and Sons (Asia), Singapore.
25. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
26. Gangulee H.C. and Kar A.K. 2011. College Botany (Vol. II).New Central Book Agency. Calcutta.
27. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
28. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall
29. Bergey's Manual of Systematic Bacteriology, 2nd ed., vol. 1-3, Springer Verlag, New York, NY.
30. Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd. Ramnagar, New Delhi.
31. Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
32. Sambamurty, A.V.S.S. (2006). A text book of Algae. I.K International Publishing House,Pvt. Ltd.
33. Dube, R.C. and D.K. Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.

B. Sc. Semester-I

Discipline Specific Core Course (DSC-II)- BOTANY Paper-II (BBO1T02)

Paleobotany, Bryophyta and Pteridophyta

DSC-II Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. Palaeobotany: Concept and Importance. Geological Time Scale. 2. Contributions of Birbal Sahni 3. Types of fossils: Impression, Compression, Petrifaction, Cast, Mold and Amber. 4. Fossil plants: *Glossopteris* (Leaf, Scutum).	7 Hrs
Unit-II	
1. Bryophytes – Bryophytes as amphibians of kingdom Plantae, General characteristics of Hepaticopsida, Anthocerotopsida and Bryopsida, alternation of generation and classification (Proskauer 1957) of Bryophytes. 2. Distribution, morphology, anatomy, reproductive structures and life-cycles of *Riccia* and *Funaria* 3. Economic Importance of Bryophytes.	8 Hrs
Unit-III	
1.Pteridophytes- General characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida 2.Classification (Smith 1955) and Economic importance 3.Alternation of generation in Pteridophytes (Homosporic and Heterosporic) 4.Stelar system in Pteridophytes	7 Hrs
Unit-IV	
1. Fossil Pteridophyte : Rhynia 2. Morphology, anatomy, reproductive structures and life-cycle in Selaginella, and Pteris 3. Heterospory and Seed habit.	8 Hrs
Note- 1. Developmental details not to be included. 2. Short Excursion tour/visit is expected to study Bryophytes and Pteridophytes or fossils in natural habitat.	

DSC-II Practical	Hours: Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Fossil types
2. Study of fossil plants- Rhynia, Glsossopteris.
3. Study of morphology, classification, reproductive structures and life-cycle of Riccia and Funaria
4. Study of morphology, classification, anatomy, reproductive structures and lifecycle of Selaginella, and Pteris

B.Sc - SEMESTER –I BOTANY PRACTICAL

PAPER –II

Palaeobotany, Bryophytes and Pteridophytes

Time: 3hrs. **Max. Marks: 25**

Q. 1) Identify & give characters of the given Bryophytic material [A] and make a temporary Mount 05

Q. 2) Identify & give characters of the given Pteridophytic material [B]and make temporary Mount. 05

Q. 3) Describe the given fossil Type [C] 05

Q. 4) Spotting: 05

D- Bryophyte

E- Pteridophyte (Morphology)

F- Pteridophyte (Reproductive)

G- *Glossopteris*

H- Types of Stele

Q. 5) Practical Record & Excursion Report 05

Suggested reading

1. Agashe SN 1995. Paleobotany- Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
2. Prasad KN 1999. An Introduction to Paleobotany. APH Publication.
3. Siddiqui KA 2002. Elements of Paleobotany. Kitab Mahal Allahabad.
4. Parihar NS 1995. Essential of Paleobotany. Central Book, Allahabad.
5. Gangulee HC, Kar AK and Santra SC 2018. College Botany Vol II. New central Book Agency Ltd London.
6. Singh V, Pande PC and Jain DK 2007. Diversity of Microbes and Cryptograms. Rastogi Publication.
7. Hait G, Bhattacharya K and Ghosh AK 2017. A Textbook of Botany Vol I. New central Book Agency Ltd London.
8. Bhattacharya K, Hait G, and Ghosh AK 2015. A Textbook of Botany Vol II. New central Book Agency Ltd London.
9. Rashid A 2016. An Introduction to Archegoniate Plants. Vikas Publishing House.
10. Thakur AK and Bassi SK 2007. Diversity of Microbes and Cryptograms. S. Chand Publication, New Delhi.
11. Rashid A 2018. An Introduction to Bryophyta. Vikas Publishing House.
12. Satish Kumar 2015. Diversity of Algae, Lichen and Bryophytes. Pragati Publication.
13. Sharma OP 2017. Bryophyta. Tata McGraw Hill Publishing Co. New Delhi.
14. Vashishtha BR 2016. Bryophyta. S. Chand Publication, New Delhi.

15. Parihar NS 1997. The biology and Morphology of Bryophytes. Central Book Depot, allahabad.
16. Smith GM 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata McGraw Hill Publishing, New Delhi.
17. Vanderpoorten A and Goffinet B 2009. Introduction to Bryophytes, Cambridge Unversity Press, Cambridge.
18. Sharma OP 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
19. Sharma OP 2012. Pteridophyta. Tata McGraw Hill Publishing Co. New Delhi.
20. Sporne KR 1970. The Morphology of Pteridophytes. Hutchinson University Library London.
21. Dhaka TS and Lalit Singh 2017. Elementary Pteridophyta. Pragati Prakashan.
22. Rashid A 2018. An Introduction to Pteridophyta. Vikas Publication House Pvt. Ltd.
23. Parihar NS 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
24. Parihar NS 1976. An Introduction to Pteridophytes, Central Book Depot, Allahabad.
25. Vashishtha BR 1992. Pteridophyta. S. Chand and Co. New Delhi.
26. Sundara Rajan 2000. Practical Manual of Pteridophyta. Anmol Publication Pvt. Ltd. New Delhi.
27. Santra SC 2015. Practical Botany Vol I NCBA London.

B. Sc. Semester-I

VSC Botany (BVS1P01)

Identification of Higher plants

VSC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I

1. Study of Morphological features of vegetative parts of plant. — 15 Hrs
   a) Morphology of different types of Roots and its Modifications with examples.
   b) Morphology of Stem and its Modifications with examples.
   c) Morphology of Leaf and its Modifications with locally available plants.
   d) Study of phyllotaxy and venation pattern and epidermal features of different leaves with locally available suitable examples.

Unit-II

2. Study of Morphological features of reproductive parts of plant. — 15 Hrs
   a) Study of Inflorescence- i) Cymose, 2) Racemose, 3) Special types
   b) Structure of typical flower and its variations.

Unit-III

3. Study of Morphological features of reproductive parts of plant. — 15 Hrs
   a) Study of family specific characteristics features of plants,
   b) Study of accessory whorls of flower-Calyx and Corolla with Modifications
   c) Study of essential whorls of flower – Androecium and Gynoecium with modifications.
   d) Study of fruits- Simple, aggregate and composite with suitable examples.

Unit-IV

4. Taxonomic description of various locally available different taxa representing various members of dicot and monocot groups (minimum 7 from Dicot and 3 from monocot) and preparation of Key (for any two families by using available Flora) — 15 Hrs
5. Identification of plant by –
   a) Flora (10 Plants).
   b) By using different online applications (Minimum two apps)
   c) Visit to different taxonomic digital data base.

B.Sc - SEMESTER –I BOTANY PRACTICAL

VSC Botany (BVS1P01)

Identification of Higher plants

Time: 5 Hrs **Total Marks: 50**

Q1. Describe the given plant material in technical language and identify the family.	10
Q2. Describe the morphology of different leaf	10
Q3. Prepare a family key of given plants	10
Q4. Identify the given plant species using Flora	05
Q5. Spotting 1. (Vegetative Morphology - 3) 2. (Types of Inflorescence - 2)	05
Q6. Viva-voce & Practical Record	10

Suggested Reading

1. Flora of British India By T. Cooke
2. Flora of Nagpur District By Dr. N. R. Ugemuge.
3. Practical Botany Vol. II, Bendre & Kumar
4. Flora of Maharashtra State By- Sharma, Karthikeyan, Singh.
5. Various other flora available from different websites.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, Motilal Banarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books.

Semester II

B. Sc. Semester-II Discipline Specific Core Course (DSC-3)- BOTANY Paper-3 (BBO2T03) Spermatophyte: Gymnosperms and Angiosperm Morphology			
DSC-III Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Gymosperms: 1. **Gymnosperms:** General characteristics, Classification (Stewart, 1982) and Economic Importance 2. **Fossil Gymnosperms:** *Cycadeoidea* (Morphology and Reproductive structure) 3. **Life cycle of:** *Cycas* (Morphology, Anatomy and Reproductive structures)			7 Hrs
Unit-II			
Vegetative Morphology: 1. **Root:** Tap root and adventitious root, modification of root for storage and respiration. 2. **Stem:** Branching (Monopodial and Sympodial), Modification of stem (Runner, Suckers Rhizome, Tuber, Bulb) 3. **Leaf:** Typical leaf, Types (Simple and Compound), Types of phyllotaxy, Venation, Modification of leaf (Tendril, Phyllode)			8 Hrs
Unit-III			
Reproductive Morphology: 1. **Inflorescence:** Definition, Racemose, Cymose and Special types. 2. **Flower:** Structure of Typical flower, insertion of floral whorls, Variation in thalamus (Androphore, Gynophore and Gynandrophore) 3. **Calyx and Corolla:** Cohesion, Forms of corolla and Aestivation. 4. **Androecium:** Parts, Cohesion, Adhesion and Fixation.			7 Hrs
Unit-IV			
Carpel and Fruit: 1. **Gynoecium:** Parts, Cohesion, Adhesion and Placentation. 2. **Fruit:** Definition, Pericarp, Types of fruits: Simple (Dehiscent, Schizocarpic, Dry Indehiscent, Fleshy Indehiscent); Aggregate (Etaerio) fruits, Composite Fruits			8 Hrs

(Sorosis and Syconus).	

DSC-III Practical	Hours: 2Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Gymnosperms*:* Fossil gymnosperm *Cycadeoidea and Cycas*
2. Study of different root modifications
3. Study of nature of branching and modification of stem
4. Study of leaf: Types (Simple & Compound), Phyllotaxy, Venation and Modifications.
5. Inflorescence: Types mentioned in theory.
6. Flower: Parts, calyx, corolla, androecium, gynoecium, Insertion of Floral whorls, variation in thalamus.
7. Fruits: Study of different types of fruits

B.Sc - SEMESTER –II BOTANY PRACTICAL

PAPER –III

Spermatophyte: Gymnosperms and Angiosperm Morphology

TIME: FIVE HOURS **MAX. MARKS: 25**

Q. 1: Identify the given **Gymnospermic** material **(A)**. Prepare temporary mount and write identifying characters. 05 M

Q. 2: Describe the given **leaf** material**(B)**. 05 M

Q. 3: Describe the given **flower(C)** 05 M

Q. 4: **Spotting**: 05 M

(D) Gymnosperm **(E)**Fossil gymnosperm **(F)**Modified root/Stem

(G) Inflorescence **(H)** Fruit

Q. 5: Practical Record and Excursion report. 05 M

Suggested Readings:

1. Bhatnagar, S. P. and Moitra A. (1996): Gymnosperms. New Age International Limited, New Delhi.
2. Bierhorst, D. W. [1971]: Morphology of Vascular Plants. Macmillon& Co. N. R.
3. Chamberlain, C. J. (1986) Gymnosperms-Structure and Evolution .CBS Publishers & Distributors.
4. Cronquist A. (1961) Introductory Botany . Harper and Brothers , Publishers, New York.
5. Datta A. C. [1971] A Class-book of Botany, Oxford University Press .
6. Galbraith D (1989) Understanding Biology.John Wiley & Sons Inc.
7. Gangulee H. C. and Kar A. K (1970) College Botany Vol. I & II, New Central Book Agency, Calcutta
8. Moore, R, Clark W. D, Vodopich D. S. (1998) Botany. Second Edition . WCB/McGraw-Hill,
9. Sambamurty A.V.S.S. (2013) A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd .
10. Saxena A. K. and Sarabhai R. P. (1962) A Textbook of Botany Vol. II.RatanPrakashanMandir, Agra.
11. Sharma, O. P. (2004). Gymnosperms.McMillan India Ltd.
12. Singh M. P, Sharma A K (2002) Textbook of Botany. Anmol Publications Pvt. Ltd.
13. Sporne, K. R. (1965): The Morphology of Gymnosperms. Hutchinson University Library Press,London.
14. Vashishtha, B. R. [1992]: Gymnosperm. S. Chand & Co. New Delhi.
15. Vashistha, P.C (1978) Botany for Degree Students- Gymnosperms Vol. V. S. Chand and Co. New Delhi.
16. Vashistha, P.C, Sinha A. K. and Kumar A (1976) Botany for Degree Students- Gymnosperms S. Chand Publishing.
17. Verma, V. (2010) Botany. Ane Books Pvt. Ltd.

B. Sc. Semester-II

Discipline Specific Core Course (DSC-4)- BOTANY Paper4 (BBO2T04) Cell Biology and Genetics			
DSC-III Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
1. Definition of cell, brief account of Schleiden and **Schwann** Cell theory. 2. Comparison of prokaryotic and eukaryotic cell 3. Ultra-structure of typical plant cell 4. Ultra-Structure and functions of: a. Cell wall b. Cell membrane (Fluid Mosaic model) c. Endoplasmic reticulum			7 Hrs
Unit-II			
Ultra- Structure and functions of: Continued d. Golgi complex e. Ribosomes f. Mitochondria g. Chloroplast h. Lysosome i. Vacuole j. Peroxisomes and Glyoxysomes			8 Hrs
Unit-III			
Ultra-Structure and functions of: Continued k. Nucleus 5. Morphology of typical eukaryotic chromosome 6. Karyotype and idiogram 7. Molecular organization of chromosome- **Nucleosome model** 8. Sex chromosomes in ***Melandrium album*** (XY-type)			7 Hrs
Unit-IV			
9. Cell cycle 10. Mitosis in plants 11. Meiosis in plants 12. Significance of Mitosis and Meiosis 13. Mendelism: Monohybrid and dihybrid cross, Laws of inheritance – Law of segregation and Law of independent assortment			8 Hrs

DSC-IV Practical	Hours: 2Hours/Week	Marks: 25+25=50	Credit: 1
1. To study the cell organelles with the help of photographs and slides. 2. To study the mitosis with suitable plant materials. 3. To study the meiosis with suitable plant materials. 4. To work out the Numerical problems based on monohybrid and dihybrid ratio. 5. To prove Mendel's law of segregation by applying Chi-square test with the help of coloured beads. 6. To prove Mendel's law of independent assortment by applying Chi-square test with the help of coloured beads. 7. To study the morphology of eukaryotic Chromosome. 8. To demonstrate monohybrid cross by using Pea plant.			
Note: **Botanical excursion and visits is compulsory**			

B.Sc - SEMESTER –II BOTANY PRACTICAL

PAPER –IV

Cell Biology and Genetics

TIME: FIVE HOURS **MAX. MARKS: 25**

Q. 1: To prepare semi permanent smear/squash of the given plant material (A), identify stage/ Stages of Cell division. 05 M

Q. 2: to prove Mendels law of inheritance by using colour beads (B) and apply chi square test 06 M

Q. 3: To work out numerical problem based on monohybrid/ dihybrid ratio. 04 M

Q. 4: **Spotting**: 05 M

(D)Cell organelle **(E)** Cell organelle

(F) Mitosis/ Meiosis

(G) Types of cell **(H)** Chromosome morphology

Q. 5: Practical Record and Excursion report. 05 M

Suggested reading:

1. The Science of Genetics, William Hexter; Henry t. Yost Jr, Printice-Hall of India Pvt. Ltd, New-Delhi; 1977.
2. Genetics 2nd Ed., Strickberger M.W.; Mac Millan Publising Co. Inc., New York, 1976.
3. Cell and Molecular Biology, E. De. Robertis and E.M. De. Robertis; 7th Ed. Saunders College/Holt Rinehart and Winston, Philadelphia, 1980.
4. Fundamental of Genetics, 6th Ed. B.D. Singh; MedTech Science Press, Scientific International Pvt. Ltd., New Delhi, 2023.
5. Cytology and Genetics, V.R. Dnyansagar; Tata Mc Graw Hill, 1986.
6. Genetics, C. Sarin; Tata Mc Graw Hill, 1985.
7. Principles of Genetics, Gardner E.J.; Simmons M.S. and D. Peter Snustad, Wiley India Pvt. Ltd., New Delhi, 2006.
8. Cell Biology, Gerald Karp; 7th Ed., Wiley India Pvt. Ltd., New Delhi, 2013.
9. Introduction to Cytogenetics, Ganesh Prasad, Kalyani Publishers, New-Delhi, 1998.
10. Cell Biology, C.B. Powar, Himalaya Publishing House, Mumbai, 2010.

B. Sc. Semester-II VSC Botany (BVS2P03) Horticulture			
VSEC Practical	**Hours: 4 Hours/Week**	**Marks: 50+50=100**	**Credit: 2**
Unit-I			
1. Visit to a garden/orchard/vegetable farm. 2. Identification of major fruit crops of our country. 3. Identification of major vegetable crops of our country. 4. Identification of major flower crops of our country.			15 Hrs.
Unit-II			
1. Identification of ornamental plants for avenues and lawn- grasses, hedges, edges plants of our country 2. Identification of indoor and outdoor foliage ornamentals, cacti-succulents and bulbous plants. • Understanding interior environments. • Plants for different light conditions. • Deciding the location of the indoor plant, managing colour, Using mirrors, Plants in baskets, Miniature gardens 3. Dealing with indoor plants- Potting Media, Container selection, managing plant nutrition, pruning indoor plants, Factors for growing indoor plants			15 Hrs.
Unit-III			
1. Propagation of horticultural crops through seeds 2. Propagation through asexual methods-cuttings, layering, runners, suckers, grafting, and budding. 3. Preparation of pot for planting, cleaning, media preparation and filling.			15 Hrs.
Unit-IV			
1. Identification of different fertilizers-NPK 2. Identification of organic manures-FYM, vermicompost, cakes, bone meal. 3. Preparation of model of a low-cost storage structure for horticultural produce			15 Hrs.

B.Sc. Semester-II BOTANY

PRACTICALEXAMINATION

VSEC-3 Botany (BVS2P03)

Subject: Horticulture

Time: 5 hrs.	**Max. Marks: 50**
Q.1. Identify Given five Fruit material and state its importance.	05
Q.2. Identify Given five Vegetable materials and state its importance.	05
Q.3. Identify given four flowers crops of our country.	10
Q.4. Describe various Potting Media, Container selection for indoor plants,	05
Q.5. Prepare a pot for planting by cleaning, media preparation and filling.	05
Q.6. Spotting:	10
Identify given 05 fertilizer samples and comment on it.	
Q.7. Viva-voce	05
Q.8. Practical Record and field visit report.	05

Suggested Reading

1. Fundamentals of Horticulture Dr. G. S. K. Swamy, Dr. J. Auxcilia
2. Principles of Horticulture Fifth edition C.R. Adams, K.M. Bamford and M.P. Early Butterworth-Heinemann is an imprint of Elsevier
3. Fundamentals of Horticulture A Laboratory Manual Dr. Divya Slathia, Dr. Amit Saurabh, Dr. Yogendra Singh & Dr. Shalini Singh Dr. Khem Singh Gill, Akal College of agriculture, Eternal University, Baru Sahib, Sirmour 173101, Himachal Pradesh, India.
4. Fundamentals of Horticulture (Practical Manual) S.K. Pandey, C.S. Pandey Department of Horticulture College of Agriculture Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur 482004 (MP)
5. Practical manual of Basic Agriculture CBSE First Edition

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Biochemistry)

Submitted by

Board of Studies,

Bachelor of Science (Biochemistry)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Biochemistry - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Biomolecules & Nutritional Biochemistry	BBC1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biomolecules & Nutritional Biochemistry	BBC1P01	-		2	1	-	-	-	-	25	25	25
3	DSC	Microbial Biochemistry	BBC1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Microbial Biochemistry	BBC1P02	-		2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Refer VSC Basket	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Human Physiology & Clinical Biochemistry	BBC2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Human Physiology & Clinical Biochemistry	BBC2P03			2	1	-	-	-	-	25	25	25
3	DSC	Techniques in Biochemistry	BBC2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Techniques in Biochemistry	BBC2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Microbial Culture Media	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Agriculture Biochemistry	BBC3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Agriculture Biochemistry	BBC3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Enzymes and Enzyme Technology	BBC3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Enzymes and Enzyme Technology	BBC3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Food Processing Techniques	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Prokaryotes	BBC4T07	2	-	-	2	3	80	20	40	-	--	
2	DSC	Molecular Biology-Prokaryotes	BBC4P07	-	-	2	1					25	25	25
3	DSC	Metabolism	BBC4T08	2	-	-	2	3	80	20	40	-	--	
4	DSC	Metabolism	BBC4P08	-	-	2	1					-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1					25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1					-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Eukaryotes	BBC5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Biology-Eukaryotes	BBC5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Biophysical Techniques	BBC5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Biophysical Techniques	BBC5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Cell Communication and Signalling	BBC5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cell Communication and Signalling	BBC5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Molecular Genetics or Forensic Biochemistry	BBC5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Molecular Genetics or Forensic Biochemistry	BBC5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genetic Engineering	BBC6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genetic Engineering	BBC6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Biochemistry of Diseases	BBC6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Biochemistry of Diseases	BBC6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Immunology	BBC6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Immunology	BBC6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics	BBC7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics	BBC7P17			2	1	-	-	-	-	25	25	25
3	DSC	Protein Biochemistry	BBC7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Biochemistry	BBC7P18			2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19			2	1	-	-	-	-	25	25	25
7	DSC	Neurobiochemistry	BBC7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Neurobiochemistry	BBC7P20			2	1	-	-	-	-	-	50	25
9	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BBC7T22	2	-	-	2	3	80	20	40			
12	RM	Research Methodology	BBC7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Toxicology and clinical research	BBC8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology and clinical research	BBC8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Environmental Biochemistry	BBC8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Environmental Biochemistry	BBC8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Secondary Metabolites and Its Applications	BBC8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Secondary Metabolites and Its Applications	BBC8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P27	-	-	2	1					25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics & Protein Biochemistry	BBC7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics & Protein Biochemistry	BBC7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Neurobiochemistry	BBC7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Neurobiochemistry	BBC7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBC7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBC7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8T22 R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8P22 R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T23 R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P23 R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Secondary Metabolites and Its Applications	BBC8T24 R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Secondary Metabolites and Its Applications	BBC8P24 R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T25 R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P25 R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits: 1. Three Year UG Degree Program: 132

2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Biochemistry)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Microbial Culture media	Biochemistry	**BVS1P01**
II	**VSC**	Food Processing Techniques	Biochemistry	**BVS2P03**
III	**VSC**	Protein Purification	Biochemistry	**BVS3P05**
V	**VSC**	Methods of DNA Analysis	Biochemistry	**BVS5P07**
VI	**VSC**	Data Retrieval & Analysis	Biochemistry	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Biochemistry)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Molecular Genetics B. Forensic Biochemistry	BBC5T12
VI	Elective 2	A. Immunodiagnostics B. Molecular sequencing Techniques	BBC6T16
VII (Honors)	Elective 3	A. Scientific communications and Data representations B. Obesity & Endocrine Disorders	BBC7T21
VIII (Honors)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC8T27
VII (Research)	Elective 3	A. Scientific communications and Data representations B. Model Systems for Research	BBC7T20R
VIII (Research)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC7T25R

B. Sc. Part I
SEMESTER: I, PAPER: I

(Biomolecules and Nutritional Biochemistry)

UNIT-I

Carbohydrates: Classification and Biological Functions of monosaccharides(glucose, fructose, Manose, galactose), disaccharides, oligosaccharides, polysaccharides : starch, cellulose, chitin, food sources, digestion and storage in body. Nutritional aspects of carbohydrates, types of dietary carbohydrates, role of non starch carbohydrates.

Lipids: Nomenclature, classification, saturated and unsaturated lipids, Triglycerides, Conjugated lipids, Saponification value, Iodine Number, Acid value and RM number, Nutritional aspects of lipids, dietary types of lipids, essential lipids, classification, food sources, function of fats.

UNIT-II

Amino acids, classification, peptide bond, polypeptides. Proteins, functions, structure: primary Secondary, Tertiary, quaternary, Forces stabilizing protein structure, denaturation.

Nutritional aspects of proteins, Proteins - composition, sources, essential & non-essential amino acids, quality of proteins, digestibility coefficient, net protein utilization, biological value, amino acid score, Protein deficiency. Protein Energy malnutrition

Nucleic acids: Bases, Nucleoside, Nucleotide, DNA, Watson-Crick Model, A,B and Z forms of DNA, RNA, types and functions of RNA

UNIT-III

Vitamins (water & fat soluble) - definition, classification & functions. Minerals - macro & micronutrients. - functions, sources. Bioavailability, and deficiency of Calcium, Iron, Iodine, Sodium & Potassium (in very brief).

Modern methods of improvement or nutritional quality of food, food fortification, enrichment and nutrient supplementations

UNIT-IV

Direct and indirect calorimetry, energy value of foods, Basal Metabolic Rate, Measurement of BMR, Factors affecting BMR, energy requirements of human being Malnutrition- meaning. factors contributing to malnutrition, over nutrition.

Effect of cooking & heat processing on the nutritive value of foods. Role of fibers in human nutrition, Water - as a nutrient, function, sources, requirement, water balance & effect of deficiency.

B. Sc. Part I
SEMESTER: I, PAPER: II
(MICROBIAL BIOCHEMISTRY)

UNIT I

A) **History of Microbiology**: Contribution of Louis Pasteur, Robert Koch and Edward Jenner

B) **Microscopy:** Principle, Ray diagram and Applications of Compound Microscope, Phase contrast.

C) **Structure of Bacteria**: i) General morphology of bacteria, shapes & sizes ii) Biomolecular composition of Slime layer & capsule iii) Cell wall structure and composition of Gm + ve & Gm -ve cells iv) General account of Flagella, Pili & Fimbriae v) Endospore: Detailed study of endospore structure & its formation.

UNIT II

A) **Bacterial Nutrition**: i) Basic nutritional requirements (nutrients as water, carbon, nitrogen, sulfur and vitamins etc.). ii) natural and synthetic media, nutritional classification of bacteria. Selective and Differential media.
B) **Bacterial Growth:** Growth rate and generation time, growth curve ii) Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), Ph etc.
C) **Isolation and Maintenance of Bacteria:** Pure cultures and cultural characteristics. I)Maintenance of pure culture. ii) Measurement of growth: - Total cell count and viable cell count method. ii)Biochemical characterization of bacteria

Unit III

A) **Terminologies:** Terminology Sterilization, disisinfectant, Antiseptic, Antimetabolite, Antibiotics, Microbiostatic, Microbicidal, Pasteurization and Sanitization.
B) **Biochemical basis of microbial control**: Factors influencing antimicrobial activity. Mechanism of cell injury
C) **Microbial control Methods**: Physical control methods and Chemical control methods.

Unit IV

A) Staining: Principle and technique of simple & differential staining, Gram staining, Endospore staining, Capsule staining, Negative staining.

B) **Introductory Medical Parasitology:** i) Classes of Pathogens (Bacteria, fungi, Protozoans, Helminths etc.), ii) Methods for diagnosis for parasitic infections iii) Pathogen induced disease: Malaria –(pathogen, lifecycle and stages of infection), Widal test

C) **Viruses:** General characteristics of viruses. Virus Structure. General characteristics of RNA and DNA Viruses. Bacteriophages, Lytic cycle & Lysogeny.

B. Sc. Part I Semester I PRACTICALS

[A] Biomolecules & Nutritional Biochemistry

1) Qualitative analysis of Carbohydrates.
2) Qualitative analysis of Proteins and Lipids.
3) Determination Saponification value of fats.
4) Determination of Acid value of fats.
5) Titrimetric estimation of calcium in food sample
6) Estimation of Vitamin C by DCPIP method.
7) Calculation Body Mass Index (BMI)
8) Determination of food adulterants.

[B] Microbial Biochemistry

1) Demonstration compound microscope, uses, & care of microbiological equipments.
2) Preparation of culture media: Nutrient agar slants and nutrient broth.
3) Sterilization of media and glassware by autoclaving.
4) Sterilization of heat labile compounds by filter sterilization.
5) Isolation of pure culture by streak plate and pour plate method.
6) Isolation of Bacteria on nutrient agar plate from water, air, skin, teeth samples etc.
7) Simple staining of Bacteria.
8) Differential staining: Gram staining and Endospore staining
9) Anaerobic culture of bacteria
10) Isolation of bacteriophage from sewage / other sources.

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS B.Sc. Semester I

1) Biochemistry – U. Satyanarayana, 6th Edition
2) Food Science, Chemistry and Experimental Foods: Dr.M.Swaminathan, The Bangalore Printing and Publishing Co. Ltd.
3) Fundamentals of Foods, Nutrition and Diet Therapy :S.R Mudambi and M.V. Rajgopal. New Age International Ltd
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) General Microbiology, Vol. I & II – Powar, Daginawala – Himalaya Publishing House.
9) General Microbiology – Stanier, Adelberg, Ingraham – The Macmillan Press – London.
10) Fundamental Principals of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
11) Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
12) Microbiology – Pelczar, Chan, Kreig –McGraw Hill Int. Edition.
13) Microbiology-An Introduction – Tortora, Funke, Case, Benjamin – Cummings Publ. Co.
14) Fundamental Virology (1995) – B. N. Fields, D. M. Knipe, P. M. Howley, R. M. Chanock, J. L. Meenick, T. P. Monath, Strans, Lippin Cott Raven.

VSC Basket Biochemistry (2 credit, 4 hour Practical) Semester 1

MICROBIAL CULTURE MEDIA (BVS1P01)

Course Objective: This course is designed to offer enhanced practical skills to students. After completion of this course student will have understand, learn and perform skills needed in a microbial laboratory/pathology laboratory.

1. Basic instrumentations in microbial culture.
2. Preparation and use of nutrient broth for microbial cultivation.
3. Preparation and use of nutrient agar for microbial cultivation.
4. Preparation of enriched media and cultivation of micro-organisms from water and soil.
5. Preparation and uses of alkaline peptone water enrichment media for cultivation of *Vibrio cholerae*.
6. Preparation and uses of Selenite F broth enrichment media for isolation of Salmonella from feces, urine, water, foods and other materials.
7. Preparation and use of differential media (Mac Conkey agar, Blood agar etc.) in microbial culture.
8. Preparation and use of transport media.
9. Preparation and use of storage media for microbial culture (Egg saline medium, chalk cooked meat broth etc.).
10. Isolation of salt sensitive E Coli using LB lennox broth.
11. Cultivation of aerobic and facultative anaerobic bacteria using Mueller Hinton Broth.

References:

1. American Society for Microbiology Commi. Manual of Methods for Pure Culture Study. 2nd edition. Sagwan Press publication.
2. Stuart Isaacs and Prof David Jennings. **Microbial Culture (Introduction to Biotechniques). Taylor and Francis.**

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Part I
SEMESTER: II, PAPER: I
(Human Physiology & Clinical Biochemistry)

UNIT I

A) Acid base balance concepts: i). Concepts of Acid Base reaction and hydrogen ion concentration. pH meter & pH buffer. Ii)Disorders: Acidosis, Alkalosis

B) Blood: Composition, Hemoglobin, plasma proteins, Mechanism of blood coagulation, Anemia (Sickle cell anemia)

C) Muscles and Neurons: Structure of striated muscle fiber. Sliding mechanism of muscle contraction, Structure of Neuron, conduction of impulse, Neuromuscular Junction

UNIT-II

A) Cardiac Profile: Blood pressure (BP), BP disorders: Hypotension and Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases.

B) Kidney: Structure of Nephron, Urine formation, GFR, analysis of urine, Renal Function Tests,

C) Liver Function Tests, Jaundice, Importance of alkaline phosphatase, SGOT,SGPT and bilirubin

UNIT-III

A) Endocrine glands & their hormones, Classification of hormones. Role of Hypothalamus & Pituitary in hormone secretion

B) Function of hormones: Thyroxine, parathormone, adrenaline, noradrenaline, cortisol, Basic mechanism of action of Peptide and Steroid hormones.

UNIT-IV

A) Examination of body fluids:Semen analysis, CSF (Cerebrospinal Fluid) and Stool Examination.

B) Diabetic Profile 1. Regulation of Blood Glucose, 2. Glucose tolerance test, 3. Glycosylated Hemoglobin, 4. Microalbuminuria etc. Role of insulin, glucagon in diabetes

B. Sc. Part I

SEMESTER: II, PAPER: II

(Techniques in Biochemistry)

UNIT – I:

Spectrophotometry:-Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiation, Concept of chromophores.
Beer's law – derivation & deviations, Extinction coefficient.
Instrumentation & applications of UV & Visible spectrophotometry.

UNIT-II

Chromatography:-Partition principle, partition coefficient, Paper Chromatography and thin layer chromatography,
Gel filtration: - Concept of distribution coefficient, Types of gels & glass beads, Applications Ion-Exchange chromatography: - Principle, Types of resins, Choice of buffers, Applications. Affinity chromatography: - Principle, Selection of ligand, Applications.

UNIT – III:

Electrophoresis: Migration of ions in electric field, Factors affecting electrophoretic mobility.
Paper electrophoresis: - Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis
Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications.

UNIT-IV:

Radioactive & stable isotopes: Pattern and rate of radioactive decay. Units of radioactivity. Isotopes commonly used in biochemical studies – 32P, 35S, 14C, 3H. Applications of isotopes in RIA, PET Scan etc.)

Centrifugation: Basic principles, RCF, Sedimentation coefficient, Svedberg constant, Types of centrifuge:- Desk top, High speed & Ultracentrifuges. Preparative centrifugation: - Differential & density gradient centrifugation, Isolation of cell components. Analytical centrifugation: - sedimentation velocity & sedimentation equilibrium methods.

B. Sc. Part I Semester II PRACTICALS

[A] Human Physiology & Clinical Biochemistry

1) Calculation of Normality, Molarity and preparation of Phosphate buffer.
2) Determination creatinine in urine by Jeff's method.
3) Determination serum bilirubin by Malloy and Evllyn method.
4) Estimation of blood urea by Nesslerization method.
5) Estimation of SGOT and SGPT activity.
6) Routine urine analysis.
7) Determination of alkaline phosphatase activity.
8)Determination of clotting time of blood by capillary tube method.
9) Estimation of glucose by Benedict quantitative method.
10)Measurement of blood pressure and blood group determination.

[B] Techniques in Biochemistry

1) Determination of absorption maxima of hemoglobin.
2) The validity of Beer's law for colorimetric estimation of creatinine.
3) Estimation of DNA by diphenylamine reaction.
4) Subcellular fractionation by centrifugation
5) Separation of amino acids by TLC.
6) Separation of amino acids by descending\ascending paper chromatography..
7) Determination of isoelectric pH of casein.
8) Estimation of proteins by Folin-Lowry's method.
9) Demonstration of Salting-Out of proteins by ammonium sulphate precipitation.
10) Agarose Gel electrophoresis of DNA

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS FOR SEMESTER II

1) Human Physiology, Vol. I & II, - C. C. Chatterjee – Medical Allied Agency – Calcutta.
2) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
3) TextBook of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
9) 2) A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ. 11
10) The Tools of Biochemistry – T. G. Cooper.
11) Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12) Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13) Enzyme Kinetics – Irwin H. Segal – Wiley Intersci. Publ.
14) Biologist's Physical Chemistry – T. G. Morris.
15) Chromatography – G. Abbott.
16) Methods in Experimental Biology – R. Ralph.
17) Physical biochemistry – vanHolde – Prentice Hall Inc.

VSC Basket Biochemistry (2 credit, 4-hour Practical) Semester 2

FOOD PROCESSING TECHNIQUES (BVS2P03)

Course Objectives: After completion of this course, the student should be able to:

- Understand methods of processing and analysis of important parameters related to food science.
- Perform proximate analysis to know components of food,
- Demonstrate various principle applied to food processing.
- Understand the importance of processing techniques.

SYLLABUS

1. Introduction to food laboratory practices,
2. Proximate analysis (protein, carbohydrate, fat) of food
3. Estimate the moisture content of food.
4. Determination of ash content in food.
5. Determination of fiber content.
6. Precipitation of casein protein from milk with vinegar and to test the effectiveness of casein as a bonding agent to make casein glue.
7. To demonstrate how changes in air pressure can affect food products and the principle behind applying a vacuum in meat processing.
8. Jelly preparation and effect of sugar content on the quality of Jelly.
9. Effect of Temperature on Taste
10. Estimation of microbial load in food materials by aerobic plate count
11. Estimation of protein by lowry's method
12. To study the osmotic dehydration of foods
13. Determination of rehydration ratio of dehydrated food
14. To detect the adulterants, present in the food.
15. Food preservation Techniques.

REFERENCES

1.Food – The Chemistry of Its Components by T P Coultate, Royal Society of Chemistry, 2016 6^{TH} , edition ,

2.Food Processing and Preservation by B. Sivasanker, Prentic Hall of India, 2014

3.Food Microbiology by W C Frazier and D C Westhoff, McGraw-Hill Book Company

4. Modern Food Microbiology by J M Jay, Springer US, Language:English, Author:James M. Jay, Martin J. Loessner, David A. Golden2005,

5.Food Processing: Principles and Applications by J Scott Smith and Y H Hui

6.Principles of Food Processing by Sathya Prakash Sinha

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Biotechnology)

Submitted by

Board of Studies,
Bachelor of Science (Biotechnology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Biotechnology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Introductory Microbial Biotechnology	BBT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Introductory Microbial Biotechnology	BBT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cellular Macromolecules	BBT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cellular Macromolecules	BBT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Basic Transformation Techniqus	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Techniques in Biotechnology	BBT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Techniques in Biotechnology	BBT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Enzyme Technology	BBT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Enzyme Technology	BBT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Dairy Technology	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology –I	BBT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Biology –I	BBT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Molecular Biology -II	BBT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Molecular Biology -II	BBT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Genetic Engineering	BBT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Genetic Engineering	BBT4907	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Microbial Genetics	BBT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Microbial Genetics	BBT4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Immunology	BBT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Immunology	BBT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Medical Biotechnology	BBT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Medical Biotechnology	BBT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Techniques for gene editing	BBT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Techniques for gene editing	BBT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BBT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BBT5P12	-	-	2	3	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Biotechnology	BBT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Biotechnology	BBT6P13			2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biotechnology	BBT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biotechnology	BBT6P14			2	1	-	-	-	-	-	50	25
5	DSC	Gene Transformation Techniques	BBT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Gene Transformation Techniques	BBT6P15			2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BBT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BBT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genomics	BBT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Proteomics	BBT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Proteomics	BBT7P18	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Bioinformatics-I	BBT7T19	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Bioinformatics-I	BBT7P19	-		2	1	-	-	-	-	25	25	25
5	DSC	Bioinformatics-II	BBT7T20	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinformatics-II	BBT7P20	-		2	1	-	-	-	-	-	50	25
7	DSE	Elective 3	BBT7T21	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BBT7P21	-		2	1	-	-	-	-	25	25	25
9	RM	Research Methodology	BBT7T22	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBT7P22	-		4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Diagnostics	BBT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Diagnostics	BBT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Agricultural Biotechnology	BBT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Agricultural Biotechnology	BBT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Systems Biology-I	BBT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Systems Biology-I	BBT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Systems Biology-II	BBT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Systems Biology-II	BBT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BBT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BBT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genomics	BBT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Proteomics	BBT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Proteomics	BBT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinformatics	BBT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinformatics	BBT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BBT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BBT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Molecular Diagnostics	BBT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Diagnostics	BBT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Agricultural Biotechnology	BBT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Agricultural Biotechnology	BBT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Systems Biology	BBT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Systems Biology	BBT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BBT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BBT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Biotechnology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Transformation Techniques	Biotechnology	**BVS1P01**
II	**VSC**	Dairy Technology	Biotechnology	**BVS2P03**
III	**VSC**	Polymerase Chain Reaction (PCR) in Diagnostics	Biotechnology	**BVS3P05**
V	**VSC**	Next Generation Sequencing	Biotechnology	**BVS5P07**
VI	**VSC**	Tools for Scientific Communication	Biotechnology	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Biotechnology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	**A.** Vaccinology **B.** Gene Therapy	BBT5T12
VI	Elective 2	**A.** Fermentation Technology **B**. Food Biotechnology	BBT6T16
VII (Honors)	Elective 3	**A.** Drug Discovery and Development **B.** Transcriptomics	BBT7T21
VIII (Honors)	Elective 4	**A.** Ethics in Biotechnology **B.** Nanobiotechnology	BBT8T27
VII (Research)	Elective 3	**A.** Drug Discovery and Development **B**. Transcriptomics	BBT7T20R
VIII (Research)	Elective 4	**A**. Ethics in Biotechnology **B**. Nanobiotechnology	BBT7T25R

'R' in the subject code indicates 'Research'.

BSc Biotechnology (Hons./Res)

Semester 1

Course Pre-requisite(s): *Basic Training in Chemical and Biological Concepts at the level of Higher Secondary.*

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Describe at conceptual level the microbial cell suitability for execution of biotechnological principles.

2. Diagrammatically demonstrate structure of various categories of microorganisms routinely utilized for biotechnological purposes.

3. Conceptualize handling of microbes for biotechnology applications.

4. Establish correlation of macromolecular organization and function at cellular level.

5. *Design basic strategy for associating changes in DNA with cellular functioning*.

6. Establish enzymatic correlation for execution of DNA manipulations

7. Select technical methods for analysis of manipulated Biomolecules

BSc Biotechnology (Basic / Hons.)

Semester 1

Title of the Courses:

Course 1 BBT1T01 : DSC-1 Introductory Microbial Biotechnology

Course 2 BBT1T02 : DSC-2 Macromolecular Foundations of Biotechnology

Course 3 BBT1P01: DSC-1P, Practical

Content of Course 1 (Course Code: BBT1T01)Theory DSC Introductory Microbial Biotechnology	30 Hrs

Unit – 1: Microorganisms: Concept and Importance	7 Hrs
Relevance of Microbiology in the field of Biotechnology; Landmark discoveries (Anton van Leuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming); Distinguishing features of prokaryotic and eukaryotic microorganisms General morphology of bacteria: Size, shapes and arrangement; Bacterial Cell Structure: Slime layer and capsule, Flagella and Fimbriae, Endospore: Endospore structure & its formation, Basis of resistance; Ribosomes, Cell inclusions (Gas vesicles, carboxysomes, magnetosomes, PHB granules, Glycogen bodies, metachromatic granules)	
Unit -2 : Bacterial Cultivation and Growth	7 hrs
Basic nutritional (Macro and micronutrients) and environmental (temperature, oxygen and pH) requirements of Bacteria; Types of culture medium: Liquid, semi-solid and solid media; Selective media, Enrichment media, Enriched media, differential media. Nutritional classification of bacteria (phototrophs, chemotrophs, autotrophs, heterotrophs, prototrophs, auxotrophs). Concept of Pure culture, maintenance of pure cultures. Replica plating for isolation of mutants, screening of mutants/recombinants (Lederberg experiment) Details of growth curve & its various phases. Concept of culturable and non-culturable bacteria (VBNC).	
Unit – 3: Technical foundations of Microbiology	8 hrs
Importance of Sterilization; Physical methods of control: Moist Heat (Boiling, Pasteurization, Fractional sterilization, Autoclave), Dry Heat (Incineration, Hot air Oven), Filtration (Diatomaceous filters, membrane filters, HEPA), Radiation (Ionizing radiation-gamma radiations, non-ionizing radiations-UV radiations); Chemical methods of control: Alcohols, phenol, halogens, heavy metal salts, quaternary ammonium compounds, Gaseous sterilization agents Compound Microscopy: Parts of Compound microscope, Numerical aperture & its importance, Resolving power, Importance of Oil immersion objective, Ray diagram of compound light microscope. Importance of electron microscopy. Staining: Nature of stains, Types of stains, Principle of simple & differential staining	
Unit – 4: Microbial Diversity & Viruses	8 hrs

Algae & Fungi: Characteristics & applications in Biotechnology; Archaebacteria: Characteristics, classification and applications in Biotechnology; Viruses: General characteristics, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, Brief idea of lytic cycle and lysogeny. Commercially important microbial products [curd formation, penicillin, alcohol (wine), vaccine, vinegar/ Spirulina.]	

Content of Course 2 : DSC-2 (Course Code: BBT1T02), Macromolecular Foundations of Biotechnology	**30 Hrs**
Unit – 1: Structural foundations of macromolecules-1	8 hrs
Carbohydrates: Definition, classification, monosaccharide structure and properties. Simple sugars as carbon sources Amino acids and proteins: Definition, structure, classification and properties of amino acids, classification of proteins on the basis of structure (Globular and Fibrous proteins).	
Unit – 2: Structural foundations of macromolecules-2	8 hrs
Lipids and Fats: Definition, classification, structure, properties and importance of lipids. Nucleic Acids: Definition, classification, structure of nucleotides, properties and importance of sequence of nucleic acids (DNA and RNA).	
Unit – 3: Macromolecular organization in Bacterial cell	7 Hrs
Carbohydrate, protein and lipid foundations of bacterial cell wall, comparison of Gram positive and negative cell walls. Macromolecular basis of differential staining techniques (Gram staining, Acid Fast, Endospore and Capsule staining). Phospholipid bilayer as bacterial cell membrane. Proteins as structural and functional cellular units (Cytoskeleton and Transport proteins (porins) and enzymes).	

Unit -4 : Nucleic acids-blueprint of life	7 hrs
Identifying deoxyribonucleic acid (DNA) as the "transforming principle" (Avery, MacLeod and McCarty's Experiment). Beadle and Tatum experiments on Neurospora connecting gene (DNA) to Protein function. DNA protein complexes as Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials (plasmid and episomes).	

Practical:

Practical 1 (BBT1P01)

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, vortex, magnetic stirrer etc).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Qualitative test for carbohydrates: Molisch Test, Benedict's test, Barfoed test, Osazone test
7. Qualitative test for proteins and amino acids: Biuret Test, Ninhydrin Test, Lead Acetate test, Xanthoproteic test
8. Qualitative test for lipids: Solubility test, Saponification test, Acrolein test, Hubl's iodine test, Bromine water test

Practical 2 (BBT1P02)

1. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
2. Demonstration of bacterial motility by hanging drop method.
3. Simple staining.
4. Differential staining - Gram staining.
5. Acid fast staining.
6. Structural staining - Flagella and Capsule.
7. Bacterial endospore staining.
8. Staining of reserved food materials.
9. Staining of fungi by Lactophenol cotton blue.
10. Negative staining.
11. Isolation of coliphage from sewage water

Text Books / References

1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J.

Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudburry, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9^{th} ed. Pearson Education Pte. Ltd., San Francisco. 958pp.
14. Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
15. Biochemistry – Lehninger – CBS Publishers.
16. Biochemistry – Stryer – W. H. Freeman & Co. – New York.
17. Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.

Vocational Skill Courses

SEMESTER – I

BASIC TRANSFORMATION TECHNIQUES

Course Code: BVS1P01 **Total Contact Hours:60**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Get an insight about the principles of bacterial/yeast cell transformation techniques.

CO2. Learn handling and development of genetically engineered organisms in the laboratory.

CO 3. Design strategies to screen genetically modified organisms.

CO 4. Work around the working principles behind various screening strategies

PRACTICALS

1. Bacterial Media preparation and Sterilisation principles for planning a transformation experiment- Eg. LB media preparation and Sterilisation
2. Handling bacterial pure cultures and subculturing- *E. coli* Dh5alpha
3. Pour plate versus Spread plate techniques for obtaining isolated bacterial colonies
4. Plasmid DNA isolation
5. Homogeneity analysis of isolated plasmid DNA by Agarose gel electrophoresis
6. Preparation of competent bacterial cells- $CaCl_2$ Method
7. Cryopreservation of competent cells
8. Transformation of competent bacterial cells with Plasmid DNA containing an antibiotic selection marker- Heat Shock Method
9. Selection of transformed cells using Pour plate/spread plate method
10. Comparison of any two transformation methods of the following to grade transformation efficiency of the methods: Heat Shock, PEG, Microwave, Electroporation, and Ultrasound method.
11. Blue-white screening of bacterial transformants
12. Culture of yeast cells in YPD medium
13. Preparation of competent yeast cells- Lithium Acetate method
14. Yeast transformation using either of the listed gene selection markers- His3, Leu2, Trp1 and Ura3 as selectable marker
15. Positive selection method for screening of yeast transformants-Auxotrophs
16. Negative selection method for screening of yeast transformants- Ura3

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.

2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.

3. Chang, Donald, ed. *Guide to electroporation and electrofusion*. Academic Press, 1991.

4. Gietz, R. Daniel, and Robin A. Woods. "Yeast transformation by the LiAc/SS Carrier DNA/PEG method." *Yeast Protocol* (2006): 107-120.

5. Das, Surajit, and Hirak Ranjan Dash. *Microbial biotechnology-A laboratory manual for bacterial systems*. Springer, 2014.

6. Gingold, Elliot B. "Bacterial transformation." *Nucleic Acids* (1984): 237-240.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.

B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.

C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.

B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.

C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

BSc Biotechnology (Basic / Hons.)

Semester 2

Title of the Courses:

Course 3 BBT2T03 : DSC-3 Technical Foundations of Biotechnology

Course 4 BBT2T04 : DSC-4 Enzyme Technology

Course 5: Practical DSC-3P, BBT2P02,

Content of Course 3: DSC-3T, (Course Code: BBT2T03), Technical Foundations of Biotechnology	**30 Hrs**
Unit – 1: Microbiological techniques	7 Hrs
Pure culture methods: Serial dilution and plating methods (pour, spread, streak); Enumeration methods: turbidity, cell counting, colony counting, maintenance and preservation of pure cultures; cultivation of anaerobic bacteria Bacterial identification techniques (Brief concept of Biochemical/ Automated/ Molecular identification methods). Importance of AMR, Mechanism of antimicrobial resistance, Concept of Quorum sensing and AMR screening methods (Antibiotic sensitivity assay method) Concept of MIC, MBC (Broth dilution method and microplate assay)	
Unit – 4: Spectroscopy	8 hrs
Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiations, Orbital theory, Concept of orbitals & their involvement in absorption of electromagnetic radiations, Concept of chromophores, Beer's law – derivation & deviations, Extinction coefficient. Instrumentation & applications of UV & Visible spectrophotometry	
Unit – 3: Chromatography and Centrifugation	7 hrs
Partition principle, partition coefficient, Nature of partition forces, Paper, Thin layer & Column chromatography (Column efficiency and concept of plates) Gel filtration, Ion-Exchange and Affinity chromatography: Principle and Applications. Brief idea of HPLC and its applications. Centrifugation: Basic principles, Mathematics & theory (RCF, Sedimentation coefficient, Svedberg constant) Types of centrifuge : Desk top, High speed & Ultracentrifuges.	
Unit -4: Electrophoresis	8 hrs

Migration of ions in electric field, Factors affecting electrophoretic mobility. Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications. SDS-PAGE and Agarose Gel Electrophoresis with Applications	

Content of Course 4: DSC-4T (Course Code: BBT2T04), Enzyme Technology	**30 Hrs**
Unit – 1: Proteins as Enzymes	8 Hrs
Protein structure in detail- Structural Organisation of proteins (Primary, Secondary, Tertiary and quaternary structure) Examples of secondary structure of proteins: - The alpha helix, beta pleated sheet structures. Tertiary structure of proteins: Forces that stabilize the structure, Concept of domains, Quaternary structure of proteins: Subunit interaction. Relevance of protein structural dynamics in enzyme activity.	
Unit -2 :	7 hrs
Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity, proof-reading mechanism), lock and key and induced fit models. Concept of allosteric enzymes	
Unit – 3: Introduction to Enzymes in Biotechnology	8 hrs
Restriction enzymes and their classification, exonucleases and endonucleases, ligases, polymerases, DNA modification enzymes (methylases, demethylases, phosphatases) and topoisomerases.	
Unit – 4: Modified Enzymes in Biotechnology	7 hrs

Concept of Immobilized enzymes, advantages and applications, methods of immobilization (Adsorption, covalent coupling, cross-linking, Entrapment/encapsulation) Concept of enzyme engineering- Imparting desired abilities to enzymes, Naturally occurring enzymes with novel properties eg. Taq Polymerase, its special properties, domain structure, mutants and applications	

Practical

Practical 1: (Course Code: BBT2P01) Analytical methods

1. Preparation of Solutions: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Separation of amino acids using paper chromatography
5. Colorimetric estimation of Reducing Sugar by DNS method
6. Colorimetric estimation of Proteins by Biuret and
7. Colorimetric estimation of Proteins by Lowry's method

Practical 2: (Course Code: BBT2P02) Microbiological methods

1. Bacterial DNA isolation
2. Agarose gel electrophoresis of DNA
3. DNA digestion using Restriction enzymes
4. Determination of bacterial growth by spectrophotometric method & calculation of generation time
5. Isolation of bacteria from air, water, soil
6. Isolation of Pure Culture (Streak Plate, Pour Plate methods)
7. Antibiotic Sensitivity assay

Text Books / References

1. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
2. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
3. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
4. The nature of enzymology – Foster – Croom Helm, London.
5. Fundamentals of enzymology – Price & Stevens – Oxford Science Publ.
6. Principals of enzymology for food science – J. R. Whitkar – M. Dekker Publs.
7. Enzymes – Dixon & Webb – Academic press.
8. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.

9. A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ.
10. The Tools of Biochemistry – T. G. Cooper.
11. Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12. Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13. Principles of Biochemistry – White, Handler, Smith – McGrew Hill Publ.
14. Biologist's Physical Chemistry – T. G. Morris.
15. Enzyme Technology – Chaplin, Buche – Cambridge Univ. Press.
16. Chromatography – G. Abbott.
17. Methods in Experimental Biology – R. Ralph.
18. Physical biochemistry – vanHolde – Prentice Hall Inc.
19. Physical Biochemistry – D. Friefelder – W. H. Freeman & Co.

Vocational Skill Courses

SEMESTER – II

DAIRY TECHNOLOGY

Course Code: BVS2P03 **Total Contact Hours:60**

Course Outcomes:

CO 1. This course will help students learn various methods of isolation, detection and identification of spoilage microorganisms in milk.
CO 2. Understand the application of principle of effect of temperature on spoilage of milk products.
CO 3. Develop technician level human resource for dairy industry.
CO 4. Develop young entrepreneurs for self-employment through dairy technology and associated activities.
CO 5. Impart knowledge and technical proficiency in processing of milk, testing and quality control of milk and milk products

PRACTICALS

1. Sampling of milk for physical and chemical examination
2. Determination of Titratable Acidity of Milk
3. Fat test by Gerber's method
4. Tests for Sanitation of Dairy Equipments (Rinse Solution and Swab Contact Methods)
5. Enumeration of total aerobic viable count in raw and pasteurized milk by serial dilution method
6. MBRT of milk samples
7. Resazurin Test
8. Determination of Efficiency of Pasteurization
9. Production of curd by using standard lactic culture and determining acidity.
10. Preparation of Shrikhand/Cheese
11. Preparation of Probiotic food (yoghurt)
12. Isolation of food borne bacteria and fungi from milk products.
13. Molecular identification of food borne bacteria from milk products
14. Effect of temperature on the spoilage of milk products.
15. Detection of Adulterants in milk
16. Detection of preservatives in milk

References:

- Food Microbiology by Frazier 5th ed
- Modern Food Microbiology by James Jay 6th ed
- Applied Dairy Microbiology by Martha & Steele
- Dairy India Year Book. 2007 & 2017. P.R. Gupta Publ., New Delhi.
- Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.

- Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
- Robinson (1986), Modern Dairy Technology, Vol.I, Advances in Milk Processing, Chapman and Hall India, Madras.
- Fernandes, R.2009 , Microbiology Hand book: Dairy Products. Royal Society of Chemistry, Revised ed., London
- Foster E.M (1957) Dairy Microbiology, Prentice Hall Inc, USA.
- Mani. A., A.M. Selvaraj, L.M. Narayanan, N.Arumugam, Microbiology (General and Applied), Saras Publication, A.R.P. Camp road, Periavilai, Kottar (PO), Nagercoil, Kanyakumari, Dist – 629 002.
- Pelczar.Reid and Chan, 1977 - Microbiology, Tata McGraw-Hill Publishing company Ltd., New Delhi.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Chemistry)

Submitted by

Board of Studies,

Bachelor of Science (Chemistry)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Chemistry - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)	BCH1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)	BCH1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Soap, detergent and disinfectant Technology	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Organic Chemistry-2 (Functional group chemistry)	BCH2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Organic Chemistry-2 (Functional group chemistry)	BCH2P03			2	1	-	-	-	-	25	25	25
3	DSC	Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)	BCH2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)	BCH2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Drug synthesis and analysis	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4T07	2	-	-	2	3	80	20	40			
2	DSC	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Organic Chemistry-3 (Nitrogen compounds, Heterocyclics and organometallics)	BCH4T08	2	-	-	2	3	80	20	40			
4	DSC	Organic Chemistry-3 (Nitrogen compounds, Heterocyclics and organometallics)	BCH4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Organic Chemistry-4 (NMR, Enolates and Natural products)	BCH5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Organic Chemistry-4 (NMR, Enolates and Natural products)	BCH5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Physical Chemistry-3 (Solid state, Surface Chemistry, Spectroscopy and Quantum mechanics)	BCH5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Physical Chemistry-3 (Solid state, Surface Chemistry, Spectroscopy and Quantum mechanics)	BCH5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Inorganic Chemistry-4 (Complexes and Organometallics)	BCH5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Inorganic Chemistry-4 (Complexes and Organometallics)	BCH5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCH5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCH5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Chemistry-4 (Electrochemistry, Quantum Chemistry and Characterization)	BCH6T13	2	-	-	2	3	80	20	40	-	-	-
	DSC	Physical Chemistry-4 (Electrochemistry, Quantum Chemistry and Characterization)	BCH6P13	-	-	2	1	-	-	-	-	25	25	25
2	DSC	Inorganic Chemistry-5 (Bioinorganic Chemistry)	BCH6T14	2	-	-	2	3	80	20	40	-	-	-
	DSC	Inorganic Chemistry-5 (Bioinorganic Chemistry)	BCH6P14	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Organic Chemistry-5 (Molecules of life)	BCH6T15	2	-	-	2	3	80	20	40	-	-	-
	DSC	Organic Chemistry-5 (Molecules of life)	BCH6P15	-	-	2	1	-	-	-	-	25	25	25
4	DSE	Elective 2	BCH6T16	3	-	-	3	3	120	30	60	-	-	-
	DSE	Elective 2	BCH6P16	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
6	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
7	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-1	BCH7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-1	BCH7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-1	BCH7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-1	BCH7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-1	BCH7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-1	BCH7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Analytical Chemistry-1	BCH7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Analytical Chemistry-1	BCH7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BCH7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCH7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCH7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCH7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-2	BCH8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-2	BCH8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-2	BCH8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-2	BCH8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-2	BCH8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-2	BCH8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Analytical Chemistry-2	BCH8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Analytical Chemistry-2	BCH8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BCH8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCH8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-1	BCH7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-1	BCH7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-1	BCH7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-1	BCH7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-1	BCH7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-1	BCH7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCH7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCH7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BCH7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCH7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Advanced Inorganic Chemistry-2	BCH8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-2	BCH8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-2	BCH8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-2	BCH8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-2	BCH8T24R	2	-		2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-2	BCH8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCH8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCH8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

R' in the subject code indicates 'Research'

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Chemistry)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Soap, detergent and disinfectant Technology	Chemistry	**BVS1P01**
II	**VSC**	Drug synthesis and analysis	Chemistry	**BVS2P03**
III	**VSC**	Soil sampling and analysis	Chemistry	**BVS3P05**
V	**VSC**	Vocational IT skills	Chemistry	**BVS5P07**
VI	**VSC**	Oil and Fats technology	Chemistry	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Chemistry)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Basic Analytical Chemistry	BCH5T12
		B. Industrial Chemistry	
VI	Elective 2	A. Instrumental Methods of Analysis	BCH6T16
		B. Chemistry of dyes and drugs	
VII (Honors)	Elective 3	A. Environmental Chemistry	BCH7T21
		B. Chemistry of natural products	
VIII (Honors)	Elective 4	A. Polymer Chemistry	BCH8T27
		B. Organometallic and bioinorganic Chemistry	
VII (Research)	Elective 3	A. Environmental Chemistry	BCH7T20R
		B. Natural product chemistry	
VIII (Research)	Elective 4	A. Polymer Chemistry	BCH7T25R
		B. Organometallic and bioinorganic Chemistry	

B.Sc. Chemistry (Honours/ Research)

A four-year eight semester degree program

1. Introduction to B.Sc. (Honours/ Research) Chemistry

The Choice Based Credit System (CBCS) provides an opportunity to a student to choose courses from the syllabus comprising Core, Elective, Generic and Skill-based vocational courses. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. The learning outcome based curriculum framework (LOCF) will provide students with a clear purpose to focus their learning efforts and enable them to make a well judged choice regarding the course they wish to study. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Programme Duration and Design: The B.Sc. (Hons/Res) Chemistry course is a eight semester course spread over four academic years. The teaching – learning process involves theory and practical classes and will be student-centred. Apart from the conventional chalk and talk method, power point presentations, audio–video tools, class discussions, simulations and virtual labs (wherever possible) will be used. Students will be encouraged to carry out short term projects and participate in industrial and institutional visits, seminars and workshops. Assessment will be based on continuous internal evaluation (CIE) and semester end examination (SEE). Each theory paper will be of 100 marks out of which 20% marks are for internal assessment while a practical paper will be of 50 marks comprising 50% internal assessment.

2. Learning Outcome-based Curriculum Framework in BSc (Hons/ Res) Chemistry

The Learning Outcomes-based Curriculum Framework (LOCF) for the B.Sc. (Hons/ Res) degree in Chemistry provides a broad structural framework that can accommodate the current curricular needs as well as gives sufficient flexibility to include changes in content that assume importance as the frontiers of science grow. The inherent flexibility in framework allows design of course basket in tune with individual preferences. The basic uniformity in core course design ensures smooth movement across universities in the country.

Nature and Extent: The B.Sc. (Hons/Res) Chemistry programme covers a wide range of basic and applied courses as well as courses of interdisciplinary nature.

Aims of the Programme: The core courses offered in the programme aim to build a strong conceptual chemical knowledge base in the student, the contents of electives and skill enhancement courses help them explore their fitness and suitability to pursue studies in these areas.

3. Programme Specific Outcomes (PSOs) in B.Sc. (Hons/Res) Chemistry

The B.Sc.(Hons/Res) programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

1. ***Knowledge: Width and depth*****:** Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.

2. ***Laboratory Skills: Quantitative, analytical and instrument based*:** A much valued learning outcome of this programme is the laboratory skills that students develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.
3. ***Communication*:** Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.
4. ***Capacity Enhancement*:** Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning process.
5. ***Portable Skills*:** Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after completion of chemistry honours programme. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and organizational skills. These are valued across work environments.

4. Structure of the Programme in B.Sc. (Hons/Res) Chemistry

The programme includes Core Courses and Elective Courses. The Discipline Specific Core (DSC) Courses are all compulsory courses. There are three types of Elective Courses – Discipline Specific Elective (DSE), Generic Elective (GE), Vocational/ Skill Enhancement Courses (VS). In addition there are Ability Enhancement Courses (AEC). Field based projects and research projects add to the skill component.

CORE PAPERS/ MINOR PAPERS
B.Sc. Semester – I
BCH1T01
Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)
Theory 2 credits + Practical 1 credit

Course Outcomes

By the end of the course, the students will be able to:

1. *Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic properties.*
2. *Draw the plausible structures and geometries of molecules using VSEPR theory.*
3. *Explain geometries and properties of molecules based on VBT.*
4. *Understand the concept of lattice energy using Born-Haber Cycle.*
5. *Rationalize the metallic properties based on various theories.*
6. *Elaborate structures and properties of common compounds formed by main group elements.*
7. *Identify acidic and basic radicals in simple inorganic salts.*

Unit-I: 7.5 h

(A) Atomic structure: Bohr model**,** Idea of de-Broglie matter Waves, Heisenberg's uncertainty principle. Schrodinger wave equation, significance of ψ and ψ^2, Quantum numbers, Concept of atomic orbital, Radial and angular wave functions and probability distribution curves for *1s, 2s, 2p, 3s, 3p* and *3d* orbitals, shapes of *s, p* and *d* orbitals, Aufbau principle, Bohr-Bury rule, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Principle of extra stability. Electronic Configuration of elements and ions.

(B) Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity-Definition, trends in periodic table. Factors affecting ionization potential. Pauling's, Mulliken's and Allred-Rochow scale of electronegativity. Effective nuclear charge and Slater's rule with some numericals.

Unit-II: 7.5 h

(A) Covalent Bond: Valency Bond Theory, Formation of Hydrogen molecule with potential energy diagram with all improvements, Limitations of VBT, Bond energy, bond length, Bond order, Bond angle. Various types of hybridization and shape of inorganic molecules [BeF_2, BCl_3, CH_4, NH_3, H_2O, PCl_5, SF_6 and IF_7].

VSEPR Theory: Rules/postulates and their applications to various common molecules and ions (NH_3, ClF_3, H_2O, SF_4, H_3O^+, NH_4^+, ICl_2^- etc)

(B) Ionic solids: Close packing in ionic solids [Square, Hexagonal, Cubic, BCC and FCC], Radius ratio rule and its limitations, Ionic structures with respect to NaCl and CsCl, Lattice energy and Born- Haber cycle. Solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rules.

Unit -III: 7.5 h

(A) s- block elements: Electronic configuration, atomic and ionic radii, Ionisation potential, Reducing properties and Metallic Properties. Diagonal Relationships (Li-Mg).

Metallic Bond – Free electron, Valence Bond and Band theory of metallic bond. Properties of conductors, insulators and semiconductors based on Band theory.

Hydrogen bonding - Classification and effect of Hydrogen bonding on viscosity, solubility, melting point and boiling point.

(B) p-block elements: Introduction to p-block elements, comparative study of groups 15, 16 and 17 with respect to atomic and ionic radii, ionisation potential, electron affinity, electronegativity, redox properties, oxidation state. Diagonal relationship (B-Si).

Unit- IV:7.5 h

Hydrides: Comparative study with respect to structure of NH_3, PH_3, AsH_3 and SbH_3. Structure and bonding of diborane, structure of borazine.

Allotropes of Carbon [Graphite, Diamond and Fullerene], **Carbides:** Classification and uses, **Silicates:** classification, **Nitrides of sulphur:** Structure of S_4N_4, **Fluorocarbon** and its uses.

Oxides of Phosphorus: Structure and bonding in P_2O_3 and P_2O_5.

Oxyacids of Phosphorous: Structures of H_3PO_2, H_3PO_3, H_3PO_4, $H_4P_2O_6$ and $H_4P_2O_7$

Peroxyacids of Sulphur: Preparation and structure of Caro's and Marshall's acids.

Interhalogens and Polyhalides: Preparation, properties and structure of Interhalogen compounds. Polyhalides- Classification, Structure of I_3^-, I_5^-, ICl_4^-.

Inorganic Chemistry Practical (1 credit)

A) Introduction to Chemistry Laboratory:

1. Safety rules in laboratory
2. Introduction to nomenclature of glassware and instruments
3. Demonstration of handling pipette, burette, volumetric flask and other common glassware.
4. Pipettable and non-pipettable liquids (aqueous, organic, volatile, viscous, carcinogenic etc)
5. Common mistakes in chemistry laboratory

B) Semimicro Qualitative Analysis: Qualitative analysis of inorganic salt mixture containing two acidic radicals of different group and two basic radicals of same groups.

Note: At least eight mixtures should be analyzed.

Reference books

1. Lee, J.D. (2010),Concise Inorganic Chemistry, Wiley India.
2. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education.
3. Douglas, B.E.; McDaniel, D.H.; Alexander, J.J.(1994),Concepts and Models of Inorganic Chemistry, John Wiley & Sons.
4. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010),Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
5. Wulfsberg, G (2002),Inorganic Chemistry, Viva Books Private Limited.
6. Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014),Inorganic Chemistry, 5th Edition, Pearson.
7. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989),Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.
8. Svehla, G. (1996), Vogel's Qualitative Inorganic Analysis, Prentice Hall.

B.Sc. Semester – I
BCH1T02
Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)
Theory 2 credits + Practical 1 credit

Course Outcomes

On completion of the course, the student will be able to:

1. *Understand and explain the different nature and behaviour of organic compounds based on fundamental concepts learnt.*
2. *Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.*
3. *Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.*
4. *Understand the fundamental concepts of stereochemistry.*
5. *Elaborate various properties of aliphatic and aromatic hydrocarbons.*
6. *Experimentally identify extra element and functional group in the given organic compound.*
7. *Synthesize various organic compounds making use of selective reagents.*

Unit – I: 7.5h

A) Structure and Bonding : Hybridization in case of Methane, Ethane, Ethylene and acetylene, Bond lengths, bond angles and bond energies. Inductive effect, Electromeric effect. Resonance effect. Hyperconjugation definition, examples and application of these effects. Hydrogen bonding in organic compounds (with reference to alcohol, phenols, amines, acids) and **c**onsequences.

B) Mechanism of Organic Reactions : Homolytic and heterolytic bond breaking examples and factors favouring the bond fission. Electrophiles and nucleophiles definition and example both neutral and charged. Types of organic reactions addition, substitution, elimination, rearrangement. Energy consideration. Reactive intermediates carbocations, carbanions, free radicals, carbenes, formation, geometry, stability and reactions given by these intermediates.

Unit - II: 7.5h

A) Stereochemistry of Organic Compounds : Concept of isomerism. Types of isomerism with suitable examples. Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic centre(lactic acid as example). Optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres (Tartaric acid) diastereomers, mesocompound. Resolution of enantiomers biological and chemical methods. Inversion retention and racemisation. Asymmetric synthesis. Relative and absolute configuration, sequence rules, D and L and R and S system of nomenclature.

B) Geometrical isomerism : *E* and *Z* system of nomenclature, geometric isomerism in alkenes with examples, maleic acid and fumaric acid, 2-butene.

Conformational isomerism : Conformational analysis of ethane, *n*-butane and substituted *n*-butane, conformations of Cyclohexane, axial and equatorial bonds. Newman's projection and sawhorse formulae. Difference between configuration and conformation.

Unit - III: 7.5h

A) Alkanes: IUPAC nomenclature of branched and unbranched alkanes. Alkyl group, Isomerism in alkanes. Methods of formation (Ethane)– Wurtz reaction, Kolbe reaction, decarboxylation of carboxylic acid. Physical properties and chemical reactions of alkanes-halogenation, nitration, sulphonation, isomerization, cyclization, aromatization, pyrolysis and cracking oxidation, L.P.G., Octane number. Mechanism of free radical halogenation of alkane.

B) Cycloalkanes : Nomenclature, methods of formation of cyclohexane from dihalides, benzene and cyclohexanone, chemical reactions of cyclohexane oxidation, aromatization, chlorination, Baeyer's strain theory and its limitations. Ring strain in small rings cyclopropane and cyclobutane. Theory of strainless rings.

C) Alkenes : Nomenclature of alkenes, methods of formation- dehydrogenation, dehydrohalogenation of alkyl halides, dehydration of alcohol dehalogenation of dihalides. Mechanism of dehydration of alcohol and dehydrohalogenation of Alkyl halides. Saytzeff rule, Hofmann elimination reaction. Chemical reactions of alkenes- hydroboration, oxidation $KMnO_4$, HIO_4, Epoxidation, Ozonolysis, Hydroxylation, Polymerization Substitution in allylic and vinylic position of alkenes. Industrial applications of ethylene and propylene. Markownikoff Rule and peroxide effect. Ionic Mechanism of addition of Br_2 to ethene and HBr to propene. Free radical mechanism of addition of HBr to propene. Stereochemistry of bromine and $KMnO_4$ addition to alkene.

Unit - IV: 7.5h

A) Dienes: Nomenclature and classification of dienes Methods of formation of 1, 3 - butadiene. 1,2 and 1,4 addition reactions of substituted 1,3-butadiene, Diels-Alder reaction.

B) Alkynes: Nomenclature, structure and bonding in Alkynes. Methods of formation of acetylene from - calcium carbide, dehydrohalogenation of dihalides Chemical reaction - hydroboration, oxidation metal ammonia reduction and polymerization. Oxyacetylene flame. Acidity of alkynes.

C) Aromatic Compounds and Aromaticity: Nomenclature of Benzene derivatives, structure of benzene, Molecular formula and Kekule structure. Resonance structure, MO picture, Huckel rule, aromatic ions (cyclopentadienyl anion and cycloheptatrienyl cation). Aromatic electrophillic substitution mechanism with energy profile diagram (eg. nitration and sulphonation).

Organic Chemistry Practical (1 credit)

A) Qualitative Analysis:
1. Element detection (N, S and halogens)
2. Identification of functional groups (-COOH, Phenolic –OH, -CHO, $-NH_2$, $-NO_2$, $-CONH_2$)
3. Melting and Boiling Points

B) Preparations and determination of yield (%) and melting points of products:
1. Hydrolysis : Preparation of Benzoic acid from Benzamide
2. Oxidation: Preparation of Benzoic acid from Benzaldehyde
3. Bromination of Phenol

Reference books

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1& 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Chandra, R. ; Singh, S.; Singh, A. (2019), Basic Organic Chemistry, Arcler Press.
4. Eliel, E. L.; Wilen, S. H.(1994),Stereochemistry of Organic Compounds; Wiley: London.
5. Singh, S.P.; Prakash, O.,(2017), Reaction Mechanism in organic chemistry, Laxmi
6. Mann, F. G.; Saunders, B. C. (2009), Practical Organic Chemistry, Pearson Education.
7. Ahluwalia, V.K.; Dhingra, S. (2004),Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
8. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012),Vogel's Textbook of Practical Organic Chemistry, Pearson.
9. Leonard, J.; Lygo, B.; Procter, G. Advanced Practical Organic Chemistry, CRC Press.

B.Sc. Semester – I

Vocational Skill Course (VSC)

BVS1P01: Soap, detergent and disinfectant Technology

Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *Gain an understanding of the history and influences behind modern soap creation processes and projected trends in the future of soap.*
2. *The analytical approach of this course is to enhance the reasoning and to understand the mechanical part of the industry.*
3. *Learn the most common formulations of soap products by exploring compositions and physical chemistry.*
4. *Understand the different aspects of industrial processes of Manufacturing disinfectants.*
5. *Optimise use of limited resources of harmful chemicals.*
6. *Suggest remedial measures for surfactant quality and threshold quantity improvement.*

List of Experiments

1. Brief History of Soap and Soap-Making Processes, Formulation and Marketing Challenges
2. Sustainable development in cleaning action of disinfectant technology and Innovations in advances and Mechatronic Solutions for Soap Manufacturing Technology from Saponification Systems.
3. Determination of the surface tension of given liquid in the presence of surfactant.
4. Determination of alkali content of soap.
5. Determination of pH of water samples and surfactant (Soap, detergent, Toiletries)
6. Estimation of hardness of water by titration with soap solution.
7. Determination of CMC of various soaps and detergents in market.
8. Comparison of cleansing actions of various commercial soaps and detergents.
9. Preparation of hand sanitizer.
10. Preparation of Soap, Detergents / Surfactants, Cleaners / Cleaning Powder.
11. Preparation of Laundry Care / fabric care / wash.
12. Preparation of Household and Industrial Detergent.
13. Preparation of Liquid Soaps/ Liquid Detergents / Acid Slurry.

Note: Minimum 10 experiments should be performed.

References

1. Ahluwalia,V.K. and Aggarwal,R. Comprehensive Practical Organic Chemistry, Preparation and Quantitative Analysis ,University Press, New Delhi.
2. Sharma, R.K., Sidhwani,I.T., Chaudhari,M.K. (2013),Green Chemistry Experiments: A monograph, I.K. International Publishing House Pvt Ltd. New Delhi.
3. Vermani, O. P.; Narula, A. K. (2004), Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
4. https://www.aocs.org/stay-informed/aocs-continuing-education-program/soap-fundamentals?SSO=True#brief-history-of-soap-and-soapmaking-processes
5. Bhatia, S. C. (2004), Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
6. Jain, P. C.; Jain, M. (2013), Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
7. Gopalan, R. Venkappayya, D.; Nagarajan, S. (2004), Engineering Chemistry, Vikas Publications. 5. Sharma, B. K. (1997), Engineering Chemistry, Goel Publishing House, Meerut.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Semester – II
BCH2T03
Organic Chemistry-2 (Functional group chemistry)
Theory 2 credits + Practical 1 credit

Course Outcomes

On completion of the course, the student will be able to:

1. *Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.*
2. *Use the synthetic chemistry learnt in this course to do functional group transformations.*
3. *To propose plausible mechanisms for various reactions.*
4. *Suggest synthesis routes for desired product from initial reactant.*
5. *Identify given organic compound by systematic chemical analysis.*
6. *Synthesize derivatives of given organic compound.*

Unit-I : 7.5h

Orientation : Activating (–OH, $–NH_2$) and deactivating (–Cl, $–NO_2$, –COOH) substituents, their orientation and directive influence on further electrophilic substitution, o/p ratio. Methods of formation and chemical reactions of alkyl benzene (Toluene) and biphenyl.

Alkyl halides : Nomenclature, classification, methods of formation, chemical reactions. Mechanism of nucleophilic substitution reactions of alkyl halides S_N1 and S_N2 with energy profile diagrams. Factors affecting S_N1 and S_N2 mechanisms.

Polyhalogen compounds : Chloroform and carbon tetrachloride – formation and chemical reactions.

Nuclear and side chain halogen derivatives of benzene: Halobenzene and benzyl halide preparation and reactions.

Unit-II: 7.5h

A) Alcohols : Classification and nomenclature,

Monohydric alcohols : Methods of formation by reduction of aldehydes, ketones using H_2/Ni, hydrolysis of alkyl halides, addition of Grignard reagent to aldehydes and ketones. Reactions of alcohol.

Dihydric alcohols : Methods of formation, chemical reactions of vicinal glycols, oxidative cleavage ($Pb(OAc)_4$ and HIO_4) and Pinacol – pinacolone rearrangement.

Trihydric alcohols : Methods of formation, chemical reactions of glycerol.

B) Phenols : Structure and bonding, Preparation of phenols from cumene, chlorobenzene (Dows and Raschig process) and diazonium salts. Physical properties and acidic character, Resonance stabilization of phenoxide ion, Reactions of phenols, Electrophilic aromatic substitution, acetylation and carboxylation, Claisen rearrangement, Gatterman synthesis reaction Mechanism of (i) Fries Rearrangement, (ii) Reimer-Tiemann reaction.

Unit-III: 7.5h

Aldehydes and ketones : Nomenclature and structure of the carbonyl group, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides and ketones from nitriles. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensation, Wittig reaction, Mannich reaction, oxidation of aldehydes (by $KMnO_4$, Tollen's reagent and Fehling solution), Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction with mechanism, MPV, Clemmensen, Wolf-Kishner, $LiAlH_4$ and $NaBH_4$ reductions,

Unit-IV: 7.5h

A) Carboxylic Acids : Nomenclature, structure and bonding, Physical properties, acidity of carboxylic acids, effect of substituents on acid strengths preparation of carboxylic acids(from G.R. and cyanides), Reactions of carboxylic acids, Hell-Volhard-Zelinsky reactions. Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids (crotonic acid and cinnamic acid).

Dicarboxylic acids : Methods of formation and effect of heat and dehydrating agents. (Succinic acid, Phthalic acid).

B) Carboxylic acid derivatives : Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, Chemical reactions, Mechanism of esterification and hydrolysis (acidic and basic).

Organic Chemistry Practical (1 credit)

Complete analysis of simple organic compound involving following steps:

1. Preliminary examination
2. Detection of elements
3. Detection of functional group
4. Determination of melting point/ boiling point.
5. Preparation of derivative and its melting point/ boiling point.
6. Performance of specific test, if any.

Note: At least eight compounds should be analyzed.

Reference books

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Janice Smith, Organic Chemistry, 7th Edition, McGraw Hill with solution manual
4. Bruice, P. Y. Organic Chemistry, 6th Edition, Pearson Education with solution manual
5. Francis A. Carey, Robert M. Giuliano Organic Chemistry, 8th Edition McGraw Hill with solution manual
6. Marc Loudon, Jim Parise 7th Edition, W. H. Freeman with solution manual
7. David Klein Organic Chemistry, John Wiley & Sons Inc with solution manual
8. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I. K. International.
9. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
10. Chandra, R. ; Singh, S.; Singh, A. (2019), Organic reactions and their nomenclature, Arcler Press.
11. Mann, F. G.; Saunders, B. C. (2009),Practical Organic Chemistry, Pearson Education.
12. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012),Vogel's Textbook of Practical Organic Chemistry, Pearson.
13. Ahluwalia, V.K.; Aggarwal, R.(2004),Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press.

B.Sc. Semester – II
BCH2T04
Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)
Theory 2 credits + Practical 1 credit

Course Outcomes

By the end of the course, students will be able to:

1. *Solve fundamental mathematical function based problems in chemistry.*
2. *Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties.*
3. *Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions.*
4. *Evaluate thermodynamics of various physical and chemical processes.*
5. *Analyse and explain properties of ideal gas, real gas and liquids.*
6. *Evaluate thermodynamic constants through calorimetric studies.*
7. *Use various properties of liquids for determination of their concentration and composition.*

Unit-I : 7.5h

Mathematical concepts and Introduction to Thermodynamics

(A) Mathematical concepts for Chemists: Logarithmic relations, Curve sketching, Linear graphs calculation of slopes, Differentiation of functions like kx, e^x, x^n, sin x, log x, etc., Maxima and Minima, Partial differentiation, Integration of useful/relevant functions, Permutations and combinations (introductory), Factorials, Concept of units with reference to C.G.S. and S.I. units, Inter-conversion of units.

(B) Introduction to Thermodynamics: Definitions of some common thermodynamic terms: system, surrounding, etc. Types of system (closed, open and isolated), Homogeneous and heterogeneous systems, intensive and extensive properties, thermodynamic processes (isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible) State function and path functions and their differentiation, concept of heat and work.

Unit-II: 7.5h

Fundamentals of Thermodynamics and Thermochemistry

(A) Statements of first law of thermodynamics, definition of internal energy and enthalpy, heat capacity, heat capacity at constant volume and at constant pressure, Joule-Thomson experiment, Joule-Thomson coefficient and inversion temperature, calculations of w, q , E and H for expansion of gases for isothermal and adiabatic conditions for reversible process.

(B)Thermochemistry : Standard states, standard enthalpy of formation, enthalpy of combustion, enthalpy of solution, enthalpy of dilution, enthalpy of neutralization, enthalpy of ionization, Hess's law of constant heat of summation and its applications, Heat of reaction, relation between heat of reaction at constant volume and constant pressure. Average bond energy, bond dissociation energy and its calculations from thermochemical data. Numerical problems.

Unit- III: 7.5h

Gaseous State

(A) Postulates of kinetic theory of gases, derivation of kinetic gas equation, deduction of various gas laws from kinetic gas equation (Boyle's law, Charle's law, Avogadro's law, Grahams law, Daltons law. Qualitative discussion of the Maxwell- Boltzmann distribution of molecular velocities. Effect of temperature on molecular velocities. Different types of molecular velocities (most probable, R.M.S. and average and expressions for them), their inter relationships. Definitions of collision diameter, collision number, mean free path.

(B) Ideal gas and real gases, behavior of real gases, deviations from ideal behavior, explanation of the terms - Compressibility factors and Boyle temperature. Causes of deviation from ideal behaviors. Vander Waal's equation of state, explanation of behaviour of real gases on the basis of van der Waal equation. Andrew's

experiment on critical phenomenon of CO_2. Continuity of states. The isotherms of Van der Waals equation, Relation between critical constants and Van der Waals constants. Reduced equation of state and law of corresponding states. Numerical problems.

Unit- IV: 7.5h

Liquid State

(A) Intermolecular forces, structure of liquids (a qualitative description), structural differences between solids, liquids and gases, liquid crystals, Classification, structure of Nematic and Cholesteric phases, Thermography, liquid crystal display and seven segment cell.

(B) Properties of liquid :

i) Surface tension : Explanation, methods of determination, Capillary rise method and drop number method, Parachor value and its application.

ii) Viscosity : Explanation, coefficient of viscosity, Effect of temperature on Viscosity, relative viscosity, specific viscosity and intrinsic viscosity and reduced viscosity. Method of determination by Ostwald viscometer.

iii) Refractive index : specific refraction, molar refractions and chemical constitution. Method of determination by Abbe's Refractometer. Numerical problems.

Physical Chemistry Practical (1 credit)

1. To determine the heat of solution of potassium nitrate calorimetrically
2. To determine heat of ionization of acetic acid calorimetrically.
3. To determine solubility of benzoic acid at different temperatures and hence to determine heat of solution of benzoic acid.
4. Determination of relative viscosity of unknown liquid by Ostwald viscometer.
5. To determine the percentage composition of given binary mixture (Ethanol-water) by viscosity method.
6. Determination of surface tension of a given liquid by drop number method (Stalagmometer method)
7. To compare cleansing power of two samples of detergent.
8. To determine parachor value of $-CH_2$ group by surface tension method.
9. To determine refractive index, specific and molar refraction of given liquid by Abbe's refractometer.

Note: At least eight experiments should be performed.

Reference books

1. Peter, A.; Paula, J. de. (2011), Physical Chemistry, 9th Edition, Oxford University Press.
2. Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.
3. Kapoor, K.L.(2015), A Textbook of Physical Chemistry, Vol 2, 6th Edition, McGraw Hill Education.
4. Kapoor, K.L.(2013), A Textbook of Physical Chemistry, Vol 3, 3rd Edition, McGraw Hill Education.
5. McQuarrie, D. A.; Simon, J. D. (2004),Molecular Thermodynamics, Viva Books Pvt. Ltd. Levine, I.N.(2010),Physical Chemistry, Tata Mc Graw Hill.
6. Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A.; Will, S.(2011),Commonly asked Questions in Thermodynamics. CRC Press.
7. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015),Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.
8. Kapoor, K.L. (2019),A Textbook of Physical Chemistry, Vol.7, 1st Edition, McGraw Hill Education.
9. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P.(2003),Experiments in Physical Chemistry, 8th Edition, McGraw-Hill, New York.

B.Sc. Semester – II
Vocational Skill Course (VSC)
BVS2P03: Drug synthesis and analysis
Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *A foundational understanding of the principles and concepts of medicinal chemistry, including drug design and development.*
2. *Gaining practical experience in common laboratory techniques used in medicinal chemistry, such as synthesis and purification.*
3. *Ability to design and perform experiments to test the effectiveness of potential drug candidates, including assays.*
4. *Develop an understanding of the Physico-Chemical properties of drugs through fundamentals of volumetric analytical skills.*

List of Experiments

(A) Synthesis of pharmaceuticals

- 1. Paracetamol from p-nitro phenol
- 2. Benzocaine from p-nitro benzoic acid
- 3. Acetanilide from aniline
- 4. Diphenylhydantoin from Benzoin.
- 5. Diclofenac sodium from aniline.
- 6. Aspirin from Salicylic acid.
- 7. Methyl Salicylate from Salicylic Acid.

(B) Estimation of pharmaceuticals

- 1. Estimation of vitamin B_{12} in commercial tablet.
- 2. Estimation of vitamin C in commercial tablet.
- 3. Estimation of alkali in antacid tablet.
- 4. Estimation of paracetamol in commercial tablet.
- 5. Estimation of aspirin in commercial tablet.
- 6. Estimation of Ibuprofen.
- 7. Estimation of Fe in hematinic tablet.

Note: Minimum 10 experiments should be performed.

References:

1. Patrick, G. (2017), Introduction to Medicinal Chemistry, Oxford University Press.
2. Singh H.; Kapoor V.K. (1996), Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan.
3. Foye, W.O.; Lemke, T. L.; William, D.A. (1995),Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd.
4. Kjonaas, R.A.; Williams, P.E.; Counce, D.A.; Crawley, L.R. Synthesis of Ibuprofen. J. Chem. Educ., 2011, 88 (6), pp 825–828 DOI: 10.1021/ed100892p.
5. Marsh, D.G.; Jacobs, D.L.; Veening, H. Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry. J. Chem. Educ., 1973, 50 (9), p 626. DOI: 10.1021/ed050p626
6. Kar, Ashutosh (2005),Textbook of Medicinal Chemistry, New Age International.
7. Eric Marsault and Mark L. Peterson (2017), Practical Medicinal Chemistry with Macrocycles, Wiley.
8. D. Sriram and P. Yogeswari (2010), Medicinal Chemistry, Pearson.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Computer Science)

Submitted by

Board of Studies,
Bachelor of Science (Computer Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Computer Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in 'C'	BCS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in 'C'	BCS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computer Fundamentals	BCS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computer Fundamentals	BCS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using 'C ++'	BCS2T03	2	-	-	2	3	80	20	40	-	-	-
	DSC	Object Oriented Programming using 'C ++'	BCS2P03	-	-	2	1					25	25	25
2	DSC	Operating Systems	BCS2T04	2	-	-	2	3	80	20	40	-	-	-
	DSC	Operating Systems	BCS2P04	-	-	2	1	-	-	-	-	-	50	25
3	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
4	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
5	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
6	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
7	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
8	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
9	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
10	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structures	BCS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structures	BCS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linux Operating System	BCS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linux Operating System	BCS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Java Programming	BCS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Java Programming	BCS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BCS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BCS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced JAVA Programming	BCS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced JAVA Programming	BCS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BCS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BCS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Communication and Networks	BCS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Communication and Networks	BCS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cyber Security	BCS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cyber Security	BCS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	SQL and PL/SQL	BCS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQL and PL/SQL	BCS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Python Programming	BCS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Python Programming	BCS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BCS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BCS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BCS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BCS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BCS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BCS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Neural Network	BCS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Neural Network	BCS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Data Mining	BCS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Data Mining	BCS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BCS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cloud Computing	BCS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Machine Learning	BCS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Machine Learning	BCS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	R-Programming	BCS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	R-Programming	BCS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Computer Graphics	BCS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Computer Graphics	BCS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BCS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BCS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BCS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BCS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BCS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Neural Network	BCS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Neural Network	BCS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BCS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Cloud Computing	BCS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Machine Learning	BCS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Machine Learning	BCS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	R-Programming	BCS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	R-Programming	BCS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCS8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Computer Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Computer Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Web Technology	BCS5T12
		B. E-Commerce	
VI	Elective 2	A. ASP.NET	BCS6T16
		B. Embedded System	
VII (Honors)	Elective 3	A. Discrete Mathematics	BCS7T21
		B. Digital Electronics and Microprocessor	
VIII (Honors)	Elective 4	A. Computer Architecture and Organization	BCS8T27
		B. PHP	
VII (Research)	Elective 3	A. Data Mining	BCS7T20R
		B. Soft Computing	
VIII (Research)	Elective 4	A. Digital Image Processing	BCS7T25R
		B. Internet of Things	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Computer Science - Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students analyze the requirements for system programming and exposes students for information systems

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for the study of modern methods of information processing and its applications.

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students who wish to go on to further studies in computer science and related subjects.

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Computer Science - Major)
SC-DSC (Paper I)
BCS1T01

PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.

File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B.Sc. Sem-I (Computer Science - Major)
SC- DSC (Paper II)
BCS1T02

COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **Output Devices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, **Topologies**: Linear, Circular, Tree and Mesh. **Types of Networks**: LAN, WAN, MAN.**Networking Devices**: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture**:** Peer-to-Peer, Client/Server
Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

B.Sc. Sem-I (Computer Science)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem -II (Computer Science - Major)

SC- DSC (Paper I)
BCS2T03

OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.

Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**

Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.

Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.Sc. Sem -II (Computer Science - Major)

SC- DSC (Paper II)
BCS2T04

OPERATING SYSTEMS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.

Expected Course Outcome:

1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. **Process Management**: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels **CPU Scheduling**: Schedulers, Scheduling Methodology, CPU Scheduling Algorithms: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison: Deterministic Modelling, Queuing analysis, Simulators. **Deadlock and Starvation:** Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNITIII

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, Segmentation with paging, Protection.

UNIT IV

I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking. **Protection Mechanisms**: Cryptography, Digital Signature, User Authentication.

Books

1. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2. Operating System Concept - Silbershaz (Addision Education)
3. Operating Systems - H. M. Deitel - Addision Wesley.
4. Operating Systems- John J. Donoven.
5. Operating System - A. S. Godbole (TMH)
6. Modern Operating Systems - Tanenbaum (Pearson Education)
7. Operating System - Peterson.

B.Sc. Sem-II (Computer Science)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones,

Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :
https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design
Reference Book :
Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister.
https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Computer Application

Submitted by

Board of Studies,

Bachelor of Computer Application

FYUGP-Scheme I-VIII Semester
Bachelor of Computer Application (Honors/Research)
(Computer Application-Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

BCA Sem-I (Computer Application-Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in 'C'	BCA1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in 'C'	BCA1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computer Fundamentals	BCA1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computer Fundamentals	BCA1P02	-	-	2	1	-	-	-	-	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

BCA Sem-II (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using "C ++"	BCA2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Object Oriented Programming using "C ++"	BCA2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Operating Systems and Linux	BCA2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Operating Systems and Linux	BCA2P04	-	-	2	1	-	-	-	-	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCA Sem-III (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structures	BCA3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structures	BCA3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Java Programming	BCA3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Java Programming	BCA3P06	-	-	2	1	-	-	-	-	25	25	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

BCA Sem-IV (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Java Programming	BCA4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Java Programming	BCA4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BCA4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BCA4P08			2	1	-	-	-	-	25	25	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCA Sem-V (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Python Programming	BCA5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BCA5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BCA5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BCA5P10	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Communication and Networks	BCA5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Communication and Networks	BCA5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCA5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCA5P12	-	-	2	1	-	-	-	-	25	25	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

BCA Sem-VI (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cyber Security	BCA6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cyber Security	BCA6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	SQL and PL/SQL	BCA6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQL and PL/SQL	BCA6P14	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Android Programming	BCA6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Android Programming	BCA6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BCA6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BCA6P16	-	-	2	1	-	-	-	-	25	25	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

BCA Sem-VII (Honors) (Computer Application - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Compiler Construction	BCA7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Compiler Construction	BCA7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	E-Commerce	BCA7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	E-Commerce	BCA7P18	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Mining	BCA7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Mining	BCA7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Software Testing	BCA7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Software Testing	BCA7P20	-	-	2	1	-	-	-	-	25	25	25
9	DSE	Elective 3	BCA7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCA7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCA7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCA7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

BCA Sem-VIII (Honors) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cloud Computing	BCA8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCA8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Blockchain Technology	BCA8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Blockchain Technology	BCA8P24	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Cryptography	BCA8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cryptography	BCA8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Embedded System	BCA8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Embedded System	BCA8P26	-	-	2	1	-	-	-	-	25	25	25
9	DSE	Elective 4	BCA8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCA8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

BCA Sem-VII (Research) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Compiler Construction	BCA7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Compiler Construction	BCA7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	E-Commerce	BCA7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	E-Commerce	BCA7P18R	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Mining	BCA7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Mining	BCA7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCA7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCA7P20R	-	-	2	1	-	-	-	-	25	25	25
9	RM	Research Methodology	BCA7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCA7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

BCA Sem-VIII (Research) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Cloud Computing	BCA8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCA8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Blockchain Technology	BCA8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Blockchain Technology	BCA8P23R	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Cryptography	BCA8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cryptography	BCA8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCA8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCA8P25R	-	-	2	1	-	-	-	-	25	25	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

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Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Computer Application)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Computer Application)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. ASP.NET	BCA5T12
		B. Discrete Mathematical Structure	
VI	Elective 2	A. Web Technology	BCA6T16
		B. Statistical Methods	
VII (Honors)	Elective 3	A. Computer Graphics	BCA7T21
		B. Operation Research	
VIII (Honors)	Elective 4	A. Pattern Recognition	BCA8T27
		B. PHP	
VII (Research)	Elective 3	A. Soft Computing	BCA7T20R
		B. Machine Learning	
VIII (Research)	Elective 4	A. Cloud Computing	BCA7T25R
		B. Design and Analysis of Algorithm	

'R' in the subject code indicates 'Research'.

Bachelor of Computer Application (Honors/Research)
(Computer Application-Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

BCA Sem-I (Computer Application-Major)
SC-DSC (Paper I)
BCA1T01
PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

BCA Sem-I (Computer Application-Major)
SC- DSC (Paper II)
BCA1T02

COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory:RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **OutputDevices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN.Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's,wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server

Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr.Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

BCA Sem-I (Computer Application)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

BCA SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper I)
BCA2T03

OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:
1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:
After completion of this course, students will be able to:
1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.
Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**
Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.
Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper II)
BCA2T04

OPERATING SYSTEMS AND LINUX

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.
4. To understand structure of Linux OS and commands.

Course Outcome: After completion of this course, students will be able to:
1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison : Deterministic Modeling , Queuing analysis, Simulators. Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT III

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods

UNIT IV

Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories. Shell: Creating User Account, Shell Program, bash shell, Changing shell prompt. Commands: Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp, Managing users accounts, Changing Password, Creating group accounts.

Books:

1) Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2) Operating System Concept :Silbershaz (Addision Education)
3) Operating System :A.S.Godbole (TMH)
4) Modern Operating Systems :Tenenenbaum (Pearson Education)
5) SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]

BCA Sem-II (Computer Application)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender

2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister. https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Data Science)

Submitted by

Board of Studies,

Bachelor of Science (Data Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)
(Data Science - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear Algebra	BDS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear Algebra	BDS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Programming with 'C++'	BDS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Programming with 'C++'	BDS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structure	BDS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structure	BDS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Probability and Statistics	BDS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Probability and Statistics	BDS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	JAVA Programming	BDS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	JAVA Programming	BDS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics and Microprocessor	BDS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics and Microprocessor	BDS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Operating System and Linux	BDS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Operating System and Linux	BDS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BDS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BDS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	SQL and PL/SQL	BDS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	SQL and PL/SQL	BDS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Communication and Networks	BDS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Communication and Networks	BDS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Statistical Inference	BDS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Statistical Inference	BDS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BDS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BDS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Python Programming	BDS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BDS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Artificial Intelligence	BDS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Artificial Intelligence	BDS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Cyber Security	BDS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cyber Security	BDS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BDS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BDS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Machine Learning	BDS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Machine Learning	BDS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BDS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BDS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Graphics	BDS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Graphics	BDS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Operation Research	BDS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Operation Research	BDS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BDS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BDS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BDS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BDS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Java Programming	BDS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Java Programming	BDS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Time Series Analysis	BDS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Time Series Analysis	BDS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Soft Computing	BDS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Soft Computing	BDS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	R-Programming	BDS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	R-Programming	BDS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BDS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BDS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Machine Learning	BDS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Machine Learning	BDS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BDS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BDS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Graphics	BDS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Graphics	BDS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BDS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BDS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BDS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BDS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Advance Java Programming	BDS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Java Programming	BDS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Time Series Analysis	BDS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Time Series Analysis	BDS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Soft Computing	BDS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Soft Computing	BDS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BDS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BDS8P25R	-	-	2	1	-	-	-	-	-	50	25
5	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Data Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Inter disciplinary program in Science (Data Science)	**BVS1P01**
II	**VSC**	Computer Animation	Inter disciplinary program in Science (Data Science)	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Inter disciplinary program in Science (Data Science)	**BVS3P05**
V	**VSC**	Web Development using Java	Inter disciplinary program in Science (Data Science)	**BVS5P07**
VI	**VSC**	Shell Programming	Inter disciplinary program in Science (Data Science)	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Data Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Data Mining	BDS5T12
		B. Microcontroller and Embedded Systems	
VI	Elective 2	A. Business Analytics	BDS6T16
		B. Design and Analysis of Algorithm	
VII (Honors)	Elective 3	A. Big Data Analytics	BDS7T21
		B. Internet of Things	
VIII (Honors)	Elective 4	A. Social Media Analytics	BDS8T27
		B. Predictive Modelling Analysis	
VII (Research)	Elective 3	A. R-Programming	BDS7T20R
		B. Data Visualization	
VIII (Research)	Elective 4	A. Health Care Analytics	BDS7T25R
		B. Natural Language Processing	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Data Science - Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students to demonstrate proficiency with statistical analysis of data.

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for statistical analyses with professional statistical software

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students to apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to to prepare students to apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software. Provide opportunity for statistical analyses with professional statistical software
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Data Science –Major)
SC-DSC (Paper I)
BDS1T01

Linear Algebra

Credits : 2 **Duration :30 Hours**

Course Objectives:

1.To cover certain solution of system of linear equations, vector space and orthogonality concepts for analyzing problems that arise in physical science.
2. To analyze the problems connected Eigen value, Hermitian and Unitary linear transformations.
3. To solve QR and LU decomposition and to learn the applications of linear algebra in computer science.

Course Outcomes: At the end of the course the student should be able to

1. Observe the various types of matrix, determinant and its properties.
2. Understand the concepts of system of linear equations and solving by various methods.
3. Understand the concepts of vector space, subspace and basis.
4. Understand the concepts of orthogonality, Hermitian and unitary transformations.

Unit - I

Matrix and Basic properties of matrix & vectors:
Matrix, scalar multiplication, linear transformation, transpose, conjugate, rank, determinant, Inner and outer products, matrix multiplication rule and various algorithms, matrix inverse, square matrix, identity matrix, triangular matrix, idea about sparse and dense matrix, unit vectors, symmetric matrix, Hermitian, skew-Hermitian and unitary matrices.

Unit – II

Special matrices and Vector Space:
Matrix factorization concept/LU decomposition, Gaussian/Gauss-Jordan elimination, solving Ax=b linear system of equation, vector space, subspaces, basis, span, dimension of subspace, orthogonality, orthonormality, linear least square, Eigenvalues, eigenvectors, and diagonalization.

Unit - III

Linear Transformations:
Definition and example of linear transformation, Null space, range, rank and nullity of linear transformation, matrix representation of a linear transformation, dual space, dual basis, doubledual, composition of linear transformation and matrix multiplication.

Unit – IV

Numerical Techniques:
Diagonalizability, matrix Limits and Introduction to Markov Chains and the Caley- Hamilton Theorem,
Numerical Linear Algebra:

Regularization, Introduction to Principal ComponentAnalysis, Singular-Value Decomposition, Latent Semantic Analysis,
Case Studies:
Recommender Systems, Page Ranking.

Books:

1. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Linear Algebra and its Applications, David C. Lay, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. Introduction to Linear Algebra, S. Lang, 2nd Ed., Springer, 2005.
4. Linear Algebra and its Applications, Gilbert Strang, Thomson, 2007.
5. Introduction to Algebra, A.I. Kostrikin, Springer Verlag, 1984.
6. Theory and Problems of Matrix Operations, Richard Bronson, Tata McGraw Hill, 1989.

B.Sc. Sem-I (Data Science –Major)
SC-DSC (Paper II)
BDS1T02

PROGRAMMING USING 'C++'

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:
After completion of this course, students will be able to:
1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Introduction to Object Oriented Programming: Introduction, Characteristics of OOPs, Advantages of OOPs, Disadvantages of OOPs, **Data Types, Operators and Expressions:** Identifiers & Keywords, Data Types, C++ Operators, Type Conversion. **Input and Output Streams:** Comments, Declaration of Variables, Simple C++ Programs, Manipulator Functions, Input and Output (I/O) **Control Statements:** Conditional Expressions, Loop Statements, Nested Control Structures, Breaking Control Statements.

UNIT II

Function and Program Structures: Introduction, Defining a Function, Return Statement, Types of Functions, Actual & Formal Arguments, Local & Global Variables, Default Arguments, Structure of C++ Program, Order of the Function Declaration, Scope Rules, Storage Class Specifiers, Recursive Function **Arrays:** Introduction, Array Notation, Array Declaration, Array Initialization, Processing with Arrays, Character Array. **Pointers and Strings:** Introduction, Pointer Arithmetic, Pointers and Functions, Pointers and Arrays, Pointer and Strings.

Structures and Unions Introduction, Declaration of Structure, Processing with Structures, Initialization of Structures, Functions and Structures, Array of Structure, Pointer and Structure, Unions.

UNIT III

Classes and Objects: Introduction, Structures and Classes, Declaration of Class, Member Functions, Defining the Object of a Class, Accessing a Member of Class, Array of Class Objects, Pointer and Classes. **Special Member Function:** Introduction, Constructors, Destructors, Inline Member Functions, Static Class Members, Friend Function, This Pointer. **Single and Multiple Inheritance:** Introduction, Single Inheritance, Types of Base Classes, Type of Derivation, Multiple Inheritance, Member Access Control.

UNIT IV

Overloading Functions and Operators: Function Overloading, Operator Overloading, Overloading of Binary Operators, Overloading of Unary Operators. **Polymorphism and Virtual Functions:** Polymorphism, Virtual Functions, Pure Virtual Functions, Abstract Base Classes, Virtual Base Classes.

Books:

1. D. Ravichandran, Programming with C++, McGraw-Hill.
2. E. Balaguruswamy, Object Oriented Programming with C++, McGraw-Hill.
3. RohitKhurana, Object Oriented Programming with C++, Vikas Publishing House Pvt. Ltd.
4. Anirban Das, GoutamPanigrahi, Object Oriented Programming with C++, Vikash Publishing House Pvt. Ltd.
5. Herbert Schildt, The Complete Reference – C++, McGraw-Hill.

B.Sc. Sem-I (Data Science)

BVS1P01

OFFICE AUTOMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..
.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem-II (Data Science –Major)
SC-DSC (Paper I)
BDS2T03

DATA STRUCTURES

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To understand basic data structures arrays, records, linked structures, stacks, queues, trees, and graphs
2. To understand algorithms for arrays, records, linked structures, stacks, queues, trees, and graphs
3. To understand the computational efficiency of the principal algorithms for sorting and searching

Course Outcomes (COs): After completing this course satisfactorily, a student will be able to:
1.Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
2. Describe common applications for arrays, records, linked structures, stacks,queues, trees, and graphs
3.Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
4. Demonstrate different methods for traversing trees
5. Compare alternative implementations of data structures with respect to performance
6.Describe the concept of recursion, give examples of its use
7.Discuss the computational efficiency of the principal algorithms for sorting and searching

UNIT I

Linked List: Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.

UNIT II

Stacks: Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

UNIT III

Queue: Representation of Queues in Memory, Circular Queue, Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.**Sorting and Searching:** Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations. Hash Tables, Hashing Technique, Collision Resolution Technique.

UNIT IV

Trees: Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method
Graphs: Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs: BSF, DFS Method.

Reference Books

1. Classical Data Structures: D. Samanta, PHI, New Delhi.

2. Data Structure: SchaumLipschutz, Outline Series
3. Data structure Using C++: Y. Kanetkar
4. Data Structures Using C++: Tanenbaum
5. Data structures by Tremblay Sorenson
6. Data structures by Bhagatsingh Naps

B.Sc. Sem-II (Data Science –Major)
SC-DSC (Paper II)
BDS2T04
Probability and Statistics

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To analyse distributions and relationships of real-time data.
3. To apply estimation and testing methods to make inference and modeling techniques for decision making.

Course Outcomes : At the end of this course the students are expected to
1. Have an understanding of the probability concepts.
2. Analyze the problems connected with statistics.
3. Understand how to make the transition from a real problem to a probability model for that problem.
4. Expose students to practical applications.

Unit I
Descriptive Statistics
Statistics and Measures of Central Tendency:
Mean, Median, Mode, Weighted mean, Geometric Mean and Harmonic Mean Measures ofDispersion:Range, Mean Deviation, Standard Deviation, Quartile Deviation, Co-efficient of variationSkewness and Kurtosis :Absolute Measures of skewness, relative measures of skewness, Karl Pearson's co-efficient ofskewness, Bowley's Co-efficient of skewness and Kurtosis

Unit II
Correlation and Regression
Concept of correlation, Types of correlation, Karl Pearson's co-efficient of correlation, Probableerror, Interpretation of "r", Rank correlation method. Concept of regression, Lines of Regression,Co-efficient of Regression

Unit III
Probability
Definition of Probability—Classical and relative frequency approach to Probability. Richard VonMises, Cramer and Kolmogorov's approaches to Probability.Random Experiment, sample space, an event, mutually exclusive and exhaustive events.Axiomaticdefinition of probability.Conditional Probability, independence of events,

UNIT IV
Random Variable and its Probability distribution
Random variables, Types of random variable and its distribution.expectation of a random variableand its properties. Moments, Moment Generating Function and its properties.

Books
1. Business Management and Statistics,N G Das, J K Das, McGraw-Hill.
2. Statistical Methods, S.P.Gupta (2014), Sultan Chand & sons
3. Fundamentals of Mathematical Statistics, Gupta,S.C. and Kapoor, V.K.(2000): 10/e, Sultan

Chand and Sons.
4. Principals of mathematical Analysis, Walter Rudin, McGraw-Hill.
5. StatisticalTechniquesDr.Pramod Fating, Dr. Milind Gulhane, Dr. Vijay Badge, Dr.SarangJavkhedkar – Sir Sahitya Kendra, Nagpur
6. Business Mathematics and Statistics, Dr. S. R. Arora, Dr.Kavita Gupta, Business Mathematicsand Statistics, Taxmann.
7. Business Mathematics,Mrintunjay Kumar, Vikas Publishing House Pvt. Ltd.
8. Mathematics & Statistics, Ajay Goel, AlkaGoel, Taxmann.

B.Sc. Sem-II (Data Science)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**
Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging

with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister. https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Electronics)

Submitted by

Board of Studies,

Bachelor of Science (Electronics)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(ELECTRONICS - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Semiconductor Theory & Devices	BEN1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Semiconductor Theory & Devices	BEN1P01			2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BEN1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BEN1P02			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Basic Electronics Components & Instruments	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Network Analysis	BEN2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Network Analysis	BEN2P03			2	1	-	-	-	-	25	25	25
3	DSC	Programming in C	BEN2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Programming in C	BEN2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Arduino and applications	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Analog Electronic Circuits	BEN3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Analog Electronic Circuits	BEN3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Micro-controller 8051 Family	BEN3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Micro-controller 8051 Family	BEN3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear Integrated Circuits	BEN4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear Integrated Circuits	BEN4P07			2	1	-	-	-	-	25	25	25
3	DSC	Signals and Systems	BEN4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Signals and Systems	BEN4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Instrumentation system	BEN5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Instrumentation system	BEN5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Communication System	BEN5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Communication System	BEN5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Microcontrollers and Applications	BEN5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Microcontrollers and Applications	BEN5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1 A. Digital Design and VHDL B. Control System	BDS5T12 BDS5T13	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1 A. Digital Design and VHDL B. Control System	BDS5P12 BDS5P13	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Instrumentation	BEN6T14	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Instrumentation	BEN6P14	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Signal Processing	BEN6T15	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Signal Processing	BEN6P15	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bio-Medical Instrumentation	BEN6T16 BEN6T17	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bio-Medical Instrumentation	BEN6P16 BEN6P17	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2 A. Power Electronics B. Reliability of Electronic Equipment	BEN6T18 BEN6T19	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2 A. Power Electronics B. Reliability of Electronic Equipment	BEN6P18 BEN6P19	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Reconfigurable Electronics	BEN7T20	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Reconfigurable Electronics	BEN7P20	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Antenna and Advance Communication	BEN7T21	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Antenna and Advance Communication	BEN7P21	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Networks &Internet of Things	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Networks &Internet of Things	BEN7P22	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Automotive Electronics & Optoelectronics	BEN7T23	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Automotive Electronics & Optoelectronics	BEN7P23	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7P24 BEN7P25	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BEN7T22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mechatronics	BEN8T29	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mechatronics	BEN8P29	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nanoscience and Nanotechnology	BEN8T30	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nanoscience and Nanotechnology	BEN8P30	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Design of Electronics instruments	BEN8T31	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Design of Electronics instruments	BEN8P31	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Medical Imaging	BEN8T32	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Medical Imaging	BEN8P32	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8P33 BEN8P34	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Reconfigurable Electronics	BEN7T20	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Reconfigurable Electronics	BEN7P20	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Antenna and Advance Communication	BEN7T21	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Antenna and Advance Communication	BEN7P21	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Networks &Internet of Things	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Networks &Internet of Things	BEN7P22	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7P24 BEN7P25	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Mechatronics	BEN8T29	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mechatronics	BEN8P29	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nanoscience and Nanotechnology	BEN8T30	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nanoscience and Nanotechnology	BEN8P30	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Design of Electronics instruments	BEN8T31	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Design of Electronics instruments	BEN8P31	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8P33 BEN8P34	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Electronics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Electronics Components & Instruments	Electronics	**BVS1P01**
II	**VSC**	Arduino and applications	Electronics	**BVS2P03**
III	**VSC**	Simulation and Modelling of Electronic Circuits 2	Electronics	**BVS3P05**
V	**VSC**	Electronic Product Design and Entrepreneurship	Electronics	**BVS5P07**
VI	**VSC**	Manual Drafting and Design of Electronic Gadgets	Electronics	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Electronics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Digital Design and VHDL	BDS5T12
		B. Control System	BDS5T13
VI	Elective 2	A. Power Electronics	BEN6T18
		B. B. Reliability of Electronic Equipment	BEN6T19
VII (Honors)	Elective 3	A. Wearable Technology	BEN7T24
		B. Smart Sensors	BEN7T25
VIII (Honors)	Elective 4	A. Hardware design of AL& ML	BEN8T33
		B. Automation & Robotics	BEN8T34
VII (Research)	Elective 3	A. Wearable Technology	BEN7T24
		B. Smart Sensors	BEN7T25
VIII (Research)	Elective 4	A. Hardware design of AL& ML	BEN8T33
		B. Automation & Robotics	BEN8T34

Semester – 1; Paper – 1: Semiconductor Devices and Circuits

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of semiconductor components such as diode, BJT, FET and MOSFET.
2. Plot V-I characteristics of electronic components to observe its performance parameters.
3. Understand the simple applications of circuit made using these semiconductor components.
4. Analyse and solve circuits of electronic devices.

Unit 1: Diode and Circuits:

V-I Characteristics of P-N Junction Diode, load line concepts, DC Analysis and models of P-N Junction Diode, types of special diodes, Applications of PN junction diode ─ Rectifier, Clipper, Clamper; Zener Diode circuits ─ shunt regulator, DC power supply.

Unit 2: Transistor and Circuits

BJT Construction and working, Current Components in BJT, Input-Output and Transfer characteristics in CB, CC and CE configuration, Load line concept, Biasing techniques, Bias Stability, small signal model of BJT, Applications of BJT, BJT Logic inverter, TTL.

Unit 3: FET and MOSFET

FET, MOSFET – Classification, Construction, working, Volt-Ampere Characteristics, DC operating point, biasing the MOSFET; small signal model of the MOSFET, small signal analysis, Applications of MOSFET: Switch, Amplifier, Digital Logic Inverter, CMOS inverter.

Unit 4: Amplifier

Classification of amplifiers, distortions in amplifiers, Single-stage and multi-stage transistor amplifiers, low frequency and high frequency response, effect of emitter (or source) bypass capacitor on the frequency response of amplifier, High frequency model of the MOSFET, Miller's theorem.

Practical – 1 Student will have to perform at least 6 practical.

1. Study of VI Characteristics of Silicon and Germanium diode, LED, and Zener diode.
2. Study of Diode as clipper and clamper.
3. Construction and study of Zener diode regulated power supply
4. Study of characteristics of BJT in CE mode.
5. Study of characteristics of BJT in CB mode.
6. Study of characteristics of FET transfer and drain characteristics.
7. Study of characteristics of MOSFET (D and E Type) transfer and drain characteristics.
8. Study of BJT as switch and amplifier
9. Study of BJT as amplifier and find the gain of amplifier and plot its frequency response.
10. To calculate the total harmonic distortion in transistor amplifier

Books:

1. J. Millman and C. C. Halkias, Integrated Electronics: Tata McGraw Hill (2001).
2. David A. Bell, 5th Edition 2015, Electronic Devices and Circuits, Oxford University Press.
3. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company, 2000.
4. R. S. Sedha, A Textbook of Applied Electronics:, S. Chand Publications.
5. Bhargava and Gupta, Basic Electronics and linear circuits, TMH.
6. D.L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, TMH.
7. A. S. Sedra, K.C. Smith, A.N. Chandorkar, Learning Microelectronic circuits:, 2014

Semester – 1; Paper – 2: Digital Electronics

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand number systems conversions and apply the principles of Boolean algebra to manipulate, minimize and design logic circuits using logic gates.
2. Demonstrate knowledge of various combinational logic circuits like code converters, multiplexers, adders.
3. Demonstrate knowledge of sequential logic circuits elements like latches, flip-flops and use them in the design and analysis of counters, registers.
4. Demonstrate knowledge of design and analysis of complex combinational and simple finite state machine and similar circuits.

Unit 1: Number System and Gates

Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques.

Unit 2: Combinational Circuits

Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, ALU.

Unit 3: Sequential Circuits

Latches, Flip flop – S-R, JK, D, T and Master-Slave JK FF, counters, Shift registers.

Unit 4: K Map and its applications

K-Maps, application of k-maps in building combinational circuits. Finite state machines & their implementation.

Practical – 1 Student will have to perform at least 6 practical with TTL or CMOS logic ICs.

1. Study of logic gates.
2. Verification of NAND and NOR as universal gates.
3. Verification of De Morgan's theorem.
4. Study of comparator
5. Study of multiplexer and demultiplexer
6. Study of ALU
7. Study of SRFF, Clocked SRFF, DFF.
8. Study of JKFF and JKMSFF.
9. Study of binary up-down counter.
10. Study of shift register.
11. Use of K-Map to design and verify combinational logic circuit. (On Software)
12. Use of K-Map to design various counters using various flipflops. (On Software)

Books:

1. A. Anand Kumar, Fundamentals of digital circuits, Prentice-Hall of India
2. R.P. Jain, Modern digital Electronics, Tata McGraw Hill
3. Malvino, Digital Electronic Principles, PHI, 3rd Edition.
4. Venugopal, Digital Circuits and systems, Tata McGraw Hill.
5. R. J. Tocci, N. S. Widmer, Digital Systems: Principles & Applications
6. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia
7. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill

Semester – 1: VSC

Basic Electronic Components and Instruments (BVS1P01)

Course outcome:

At the end of this course students will have ability to

1. Identify various passive and active components
2. Make series and parallel combinations of components.
3. Design various types of simple linear power supply.
4. Demonstrate knowledge and use of various instrument used in electronics lab.

Syllabus

1. Components Identification: Resistor, Capacitor, Inductor, Transformer, Switches, Semiconductors, IC types and Packages.
2. Serial and parallel connection of Resistor, capacitor, and inductor.
3. Working with LED. Design of Zener regulated power supply. 3 terminal fixed and variable power supply. Voltmeter, ammeter.
4. Study and application of CRO, Function Generator, Multimeter.

Books:

1. Charles Platt, Make: Electronics, O'Reilly Publications
2. Paul Scherz, Practical Electronics for Invertors, McGraw-Hills Publications
3. J. M. Hughes, Practical Electronics, O'Reilly Publications
4. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Semester – 2; Paper – 1: Network Analysis

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Apply network theorems for the analysis of electrical circuits.
3. Apply Laplace Transform for steady state and transient analysis.

Unit 1: Node and Mesh Analysis:

Types of sources, source transformation and duality, KVL, KCL, Node and mesh analysis,

Unit 2: Network Theorems

Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer theorem, compensation and Tallegen's theorem (Proof not required)

Unit 3: Behaviors of L, C and R circuit

Time Domain and frequency domain analysis of LR, CR, Series and Parallel LCR circuit. Introduction to filters.

Unit 4: Laplace transform and its application to circuits

Review of Laplace Transform, Partial fractions, singularity functions, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, evaluation of initial conditions. Transformed network with initial conditions, waveform synthesis, and analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms.

Practical – 1 Student will have to perform at least 6 practical

1. Study of current source and voltage source.
2. Verification KVL and KCL
3. Verification Superposition position.
4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Maximum power transfer Theorem
7. Verification of reciprocity theorem.
8. Time domain and frequency domain analysis of LR circuit (on simulation software).
9. Time domain and frequency domain analysis of CR circuit (on simulation software).
10. Time domain and frequency domain analysis of series LCR circuit (on simulation software).
11. Time domain and frequency domain analysis of Parallel LCR circuit (on simulation software).

Books:

1. M. E. Van Valkenburg, Network Analysis, Prentice Hall, 2006.

2. D. Roy Choudhury, Networks and Systems, New Age International Publications, 1998.
3. Mahmood Nahvi, Joseph A. Edminister, Theory and Problems of Electric Circuits, Schaum Series
4. Mahadevan and Chitra, Electrical Circuit Analysis, PHI
5. John Bird, Electrical Circuit Theory and Technology, Newnes Publications.
6. Network analysis by G. K. Mittal
7. James W. Nilsson & Susan A Riedel, Electric Circuits, Prentice Halls.
8. Sudhakar, A., Shyammohan, S. P.; Circuits and Network; Tata McGraw-Hill New Delhi, 1994
9. C. K. Alexander and M. N. O. Sadiku, Electric Circuits, McGraw Hill Education, 2004.
10. K. V. V. Murthy and M. S. Kamath, Basic Circuit Analysis, Jaico Publishers, 1999.

Semester – 2; Paper – 2: Programming in C

Course Outcome:

At the end of this course students will demonstrate the ability to

1. To formulate simple algorithms and translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration, and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays to solve various matrix operation, searching, sorting and Pointers, Structures for the formulation of algorithm and Programs.

Unit 1: Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Pre-processor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

Unit 2: Arrays and Basic Algorithms Arrays

1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 3: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Quick sort or Merge sort.

Unit 4: Pointers and Structures

Structures, defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers.

Practical – 2 Student will have to perform at least 6 practical.

1. Multiplication, square, cube table or any other table.
2. Bubble, Insertion, and selection Sorting algorithm
3. Finding roots of quadratic equation
4. Finding out the impedance table and frequency response table of RL or RC or LCR circuit.
5. Find out the table of phase angle of LR or CR or LCR circuit for different frequencies.
6. 1D and 2D array
7. Use of functions, parameter passing in function, call by value, call by reference.
8. Finding factorial, Fibonacci series.
9. Quick sort or merge sort.
10. Application of pointer.

Books

1. Let us C Y Kanetkar
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill
3. C in depth Shrivastava BPB publication
4. Programming in ANSI C Balgurusamy Tata McGraw Hill
5. Programming with C Byron Gottfried Schaums outline series TMH

Semester – 2; VSC – 2:

Arduino and applications (BVS2P03)

Course Outcome:

At the end of this course students will demonstrate the ability to

1. Understand the architecture of a Arduino boards & comparison
2. Understand the operation and interfacing with peripheral devices.
3. Implement various applications

Syllabus :

1. Introductction to arduino, Pin configuratuion and architecture, Device and platform features, concept of digital and analog ports, familiarizing with Arduino interfacing boards, introduction to embedded C and arduino platform
2. Review of Basic concepts and Arduino I/O Functions : Arduino Data types, Variables and constants, Operators, Control Statements, Arrays, Functions Pins configured as INPUT and OUTPUT, PinMode() Function, digital write(), analogRead() Function, Arduino Interrupts
3. Arduino Sensors: Humidity sensor, temperature sensor, Water level sensor, PIR sensor, Ultrasonic sensor, Connecting switches,
4. Arduino Communication and Interfacing: parallel and serial communication, Display devices, rf module, wifi module, bluetooth module, GSM/GPRS interfacing

Books:

1. Arduino made simple by Ashwin pajankar
2. Arduino-based Embedded Systems by Rajesh singh, Anita Gehlot, Bhupendra Singh and Sushabhan Choudhary
3. https://www.arduino.cc/en/Tutorial/HomePage

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Environmental Science)

Submitted by

Board of Studies,
Bachelor of Science (Environmental Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)
(Environmental Science - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Environmental Science	BES1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Environmental Science	BES1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biology	BES1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biology	BES1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Environmental Chemistry and Instrumentation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Home Science/ Computer Application	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Environmental Science- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Environmental Pollution	BES2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Environmental Pollution	BES2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forest, Wildlife and Biodiversity and it's conservation	BES2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forest, Wildlife and Biodiversity and it's conservation	BES2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Operation and Maintenance of Water and Wastewater Treatment Plant	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Environmental Science - Major)

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SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Atmospheric Science, Meteorology and Climatology	BES3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Atmospheric Science, Meteorology and Climatology	BES3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Natural Resources and Management	BES3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Natural Resources and Management	BES3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Solid and Hazardous Waste Management	BES4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Solid and Hazardous Waste Management	BES4P07			2	1	-	-	-	-	25	25	25
3	DSC	Water and Waste water Quality Monitoring	BES4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Water and Waste water Quality Monitoring	BES4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Air and Noise Pollution Control Technology	BES5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Air and Noise Pollution Control Technology	BES5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Water and Wastewater Treatment Technology	BES5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Water and Wastewater Treatment Technology	BES5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC		BES5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC		BES5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BES5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BES5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Environmental Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Soil Pollution and Environmental Toxicology	BES6T13	2	-	-	2	3	80	20	40	-	-	-

2	DSC	Soil Pollution and Environmental Toxicology	BES6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Remote Sensing and Geographical Information System (GIS) and it's Application	BES6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Remote Sensing and Geographical Information System (GIS) and it's Application	BES6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	??????	BES6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BES6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BES6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	?????	BES7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	?????	BES7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BES7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BES7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BES7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BES7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Sustainable and Environmental Management System	BES8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Sustainable and Environmental Management System	BES8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Climate Change its consequences and Mitigation.	BES8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Climate Change its consequences and Mitigation.	BES8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	?????	BES8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	?????	BES8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BES8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BES8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honors Degree in Major and Minor with 160-176 Credits

B.Sc. Sem-VII (Research) (Environmental Science Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	????	BES7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BES7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BES7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BES7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BES7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme	
				(Th)	TU	P		Theory	Practical

								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Sustainable and Environmental Management System	BES8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Sustainable and Environmental Management System	BES8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Climate Change its consequences and Mitigation.	BES8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Climate Change its consequences and Mitigation.	BES8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	????	BES8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	????	BES8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BES8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BES8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: /Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Environmental Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Environmental Chemistry and Instrumentation	Environmental Science	**BVS1P01**

II	**VSC**	Operation and Maintenance of Water and Wastewater Treatment Plant	Environmental Science	**BVS2P03**
III	**VSC**	Sanitary Engineering	Environmental Science	**BVS3P05**
V	**VSC**	Watershed Management	Environmental Science	**BVS5P07**
VI	**VSC**	Organic Farming	Environmental Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Environmental Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Environmental and Society B. Urban Planning and Development	BES5T12
VI	Elective 2	A. Circular Economy B. Wetland Conservation and Management.	BES6T16
VII (Honors)	Elective 3	A. Green Technologies B. Eco-restoration and Development	BES7T21
VIII (Honors)	Elective 4	A. Industrial Waste Treatment Technology B. Environmental Entrepreneurship	BES8T27
VII (Research)	Elective 3	A. Green Technologies B. Eco-restoration and development	BES7T20R
VIII (Research)	Elective 4	A. Industrial Waste Treatment Technology B. Environmental Entrepreneurship	BES7T25R

R' in the subject code indicates 'Research'.

The examination shall comprise two theory papers of 3 hours duration of 80 marks.
Theory paper is divided into four units. Each Unit shall be covered in 7.5 hours

B.Sc Semester 1
Paper - I
Fundamentals of Environmental Science

Unit–I: Basics of Environmental Science

A) Introduction to Environmental Science: Definition, Types, Classification, Characteristics, Components and Principle of Environment, Multidisciplinary Nature of environmental science.

B) Components of Environment: Atmosphere- Definition, structure and composition. **Hydrosphere -** Definition, distribution of water, hydrological cycle and global water balance. **Lithosphere-** definition, internal structure of earth. Rocks –types and their formation. **Biosphere –** definition, boundaries of biosphere. **(7 Periods)**

Unit –II: Aquatic Chemistry

A) Physical parameters of water: Solvency, colour, temperature, turbidity, taste, conductivity, odour, viscosity, Transparency, Density, pH, Forms of precipitation.

B) Chemical parameters of water: Salinity, CO_2, O_2, Alkalinity, Acidity, Hardness, Chlorides, Dissolved oxygen. Principle and method of estimation, prescribed limit of potable water as per WHO guidelines. **(7 Periods)**

Unit –III: Soil Chemistry

A) **Soil:** Definition, Composition of soil, Type of soil, soil formation, soil profile, soil structure, soil organism.

B) Properties of Soil –Physical- soil density, Soil texture, soil colour, porosity, soil temperature, soil air, soil water. **Chemical –** soil components (Inorganic and organic), soil pH , soil humus, NPK in soil. **(8 Periods)**

Unit – IV: Environmental Education and Awareness

A) Environmental Education: Goals, objectives and principles of Environmental Education, Formal and Non-formal Education, Importance of Environmental Education.

B) Environmental Awareness: Environmental awareness programs , Celebration of Environmental Days, **Global environmental issues –** Acid rain ,Ozone depletion , Greenhouse effect , Global warming, El-Nino,La-Nino. **(8 Periods)**

Practical-I

1. Study of laboratory Instruments and Glasswares.
2. Water sampling for ground and surface water and its storage techniques.
3. Determination of odor and conductivity.

4. Estimation of Chloride in water sample by Argentometric method
5. Estimation of Alkalinity in water sample.
6. Estimation of Acidity in water sample.
7. Determination of pH in soil sample
8. Determination of moisture content of soil
9. Determination of bulk density of soil

Visit:

- Visit to water body to study Pond as an ecosystem.
- Visit to Nearby Forest to study the flora and fauna in its Natural Environment.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Books for Reference (Practical)

1. A Manual of Water and Wastewater Analysis: Dr D.S.Ramteke and Dr C.A.Moghe,Published by NEERI,Nagpur,1996.
2. Laboratory Manual of Environmental Chemistry: Dr Snita Hooda and Dr Sumanjeet Kaur,S.Chand and Co.Ltd.New Delhi.1997.
3. Physico-chemical Examination of Water Industrial Effluents: N.Manivaskaram, Pragti Prakashan, Meerut (U.P) 1996.
4. Chemical and Biological Methods of Water Pollution Studies: R.K.Trevedi and P.K.Goel, Enviro Media Publication.

Book for Reference:

1. Text Book of Environment: K M Agrawal, P.K.Sikdar, and S.C.Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C.Dash and P.C.Mishra, Mc'Millan Publication, Mumbai.

3. Environmental Science: S.C.Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K.Asthana, S.Chand Publication,New Delhi.
5. Environmental Chemistry: S.S.Dara, S.Chand Publication,New Delhi.
6. Environmental Chemistry: B.K.Sharma, Goel Publication,Meerut.
7. Environmental Chemistry: A.K.Dey,New Age International Publishers,2001.
8. Man and Environment: P.R.Trivedi and Gurdeep Raj,Akashdeep Publishing House,New Delhi.
9. Fundamentals Concepts in Environmental Studies: Dr.D.D.Mishra, S.Chand Publication,New Delhi.
10. Climatology: D.S.Lal,Sharda Pustak Bhavan,Allahabad,2003.
11. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U.Meshram,Allied Publishers, New Delhi.

B.Sc Semester 1
Paper II
ENVIRONMENTAL BIOLOGY

Unit -I : Ecology and Environmental factors

A) Ecology: Introduction of Ecology (Definition, sub-division branches and scope), application and significance of ecology to human being.

B) Abiotic factors: Temperature, light, fire, soil, Shelford law of tolerance, Liebig's law of minimum. **Biotic factor:** Mutualism, commensalism, parasitism, neutralism, predation, competition. **(7 Periods)**

Unit – II : Population and Community ecology

A) Population Ecology: Characteristics of population - Natality, Mortality, Population Density, Population dispersal, Population Fluctuation, Population dispersion, Population Growth Curves (S & J Shaped), Biotic potential, Environmental resistance

B) Community Ecology: Definition, characteristic of community, community structure, Ecological indicators, Ecotone and edge effect, Ecological Niche , Ecological succession. **(7 Periods)**

Unit -III : Ecosystem

A) Ecosystem: Components, structure and function of ecosystem; Major ecosystems (terrestrial and aquatic). Major biome of the world.

B) Food Chain: food chain and food webs; energy flow in ecosystem, ecological pyramids, pollutants and trophic level (Bio-magnification and Bio-accumulation) **(8 Periods)**

Unit- IV: Biogeochemical cycles

A) Biogeochemical Cycles: Hydrological, gaseous (carbon, oxygen, nitrogen) sedimentary cycle (phosphorus and sulphur).

B) Productivity: Definition and types, measurement of productivity (Light and dark bottle method) factors affecting primary productivity. **(8 Periods)**

Practical-II

1) To determine the primary productivity in a water body by Light and Dark bottle method.
2) To determine the chlorophyll content of the given plant material.
3) Determination of species diversity indices by Simpson and Shannon's Wiener index
4) To measure color and temperature of different water bodies.
5) Determination of turbidity of given water sample
6) Determination of pH of given water sample
7) Determination of carbon dioxide (CO_2) in polluted and unpolluted water bodies.
8) To study biotic and abiotic components of a pond and forest ecosystem.

9) Observation and monitoring of different inter-specific relationship from different local habitat.
10) Identification of ecological indicators

Visit:

- Visit to water body to study Pond as an ecosystem.
- Visit to Nearby Forest to study the flora and fauna in its Natural Environment.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08Marks
2.	Short experiment (Any two)	:	08Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Books for Reference (Practical)

1. A Manual of Water and Wastewater Analysis: Dr D.S.Ramteke and Dr C.A.Moghe,Published by NEERI,Nagpur,1996.
2. Laboratory Manual of Environmental Chemistry: Dr Snita Hooda and Dr Sumanjeet Kaur,S.Chand and Co.Ltd.New Delhi.1997.
3. Physico-chemical Examination of Water Industrial Effluents: N.Manivaskaram, Pragti Prakashan, Meerut (U.P) 1996.
4. Chemical and Biological Methods of Water Pollution Studies: R.K.Trevedi and P.K.Goel, Enviro Media Publication.

Books for Reference:

1) Environmental Biology:Biswarup Mukherjee,Tata McGraw-Hill Publishing Company Ltd,New Delhi,1996
2. Animal Ecology and Distribution of Animals:Veer Bala Rastogi, Rastogi Publication,Meerut (U.P).
3. Ecology and Environment: P.D.Sharma, Rastogi Publication,Meerut (U.P).
4. Fundamentals of Environmental Biology: S.Arora,Kalyani Publishers.
5. Plant Ecology and Soil Science:R.S.Shukla and P.S.Chandel, S.Chand Publication,New Delhi.

6. Animal Ecology and Environmental Biology: H.R Singh,Vishal Publication.
7. Environmental Biology:P.S.Verma and V.K.Agrawal, S.Chand Publication,New Delhi.
8. Environmental Biology:P.K.G.Nair,Himalaya Publication.
9. Environmental Biology:K.C.Agrawal,Agro Botanical Publisher,Bikaner,1994.

VSC (BVS1P01)

Environmental Chemistry and Instrumentation

Unit 1

A. Types pollutants in the environment and their sources, general classifications of pollutants and their chemical structures, properties, concept of toxicity, units of measurement; Impacts of pollutants on human health,
B. Errors in quantitative analysis, precision and accuracy in measurement, accuracy, selectivity, sensitivity, role of r^2, sample preparation procedure for water, air, soil samples.

Unit 2

A. Titrimetric and colorimetric procedures, pH meter, conductivity meter, Nephelometer/Turbidity, working and applications.
B. Potentiometry and Voltammetry: Theory, instrumentation and applications of Colorimetry and Voltammetry. Electro-chemical techniques: Types, principle and working. Beer- Lambert's law, Flame photometry.

Unit 3

A. Absorption Spectrophotometry**:** Principle, working and applications of variousinstruments like UV-Visible Spectrophotometer, Infra-red (IR) Spectrophotometer, Nuclear Magnetic Resonance (NMR), Atomic Absorption Spectrophotometer (AAS), Flame Photometer
B. Chromatography: Introduction, Definition, theory of chromatographic separation, stationary and mobile phases, classification of chromatographic separations, Rf value**.** Types of Chromatography- Gas Chromatography (GC). High Performance Liquid Chromatography (HPLC)

Unit 4

A. Interpretation of mass spectra, basic GC/MS instrumentation, ion detectors, quantification, liquid-liquid extraction, solid phase extraction, ultrasonic extraction, supercritical fluid extraction; sample clean-up methods, ICP-MS, basic principle and its applications

B. Basic principle of High Volume Sampler its components, anemometer, weather station, adsorbent tubes, and canisters, solvent and thermal desorption techniques; Basic principle and applications of Total Organic Cabon analyser, X-Ray Fluorescence, X-Ray Diffraction.

Reference Books

1. A Technical Manual for Water and Wastewater Analysis, Sunil P Pande and Dr. LeenaDeshpande, Himalaya Publishing house 2012
2. Instrumental Methods of Environmental Analysis: Karan Sareen, (Sarup and SonsPublishers, New Delhi), 2001
3. Instrumental Methods of Chemical Analysis: B. K. Sharma, Goel Publishing House,Meerut (1996).
4. Standard Methods for the Examination of Water and Waste Water: (APHA, AWWA &WPCF), 1985
5. Willard. H., Merritt, L., Dean, D.A. and Settle F.A., 'Instrumental Methods ofAnalysis',7th edition, Wordsworth, New York, 1998.
6. Galen. W. Ewing, 'Instrumental Methods of Chemical Analysis 5th edition,McGraw Hill,New York., 1995.
7. Roger Reeve, Introduction to Environmental Analysis, John Wiley & SonsLtd,2002
8. Fundamentals of Analytical chemistry, D.A. Skoog, D.M. West and F.J.Holler,
9. Harcourt Asia PTE. Ltd., 7th edition, New Delhi,2001.
10. Manual of Water and Wastewater Analysis by Dr. D.S. Ramteke, C.A. Moghe &R.Sarin,NEERI, Nagpur
11. Our Environment Pollution Control and Future Strategies by M.P. Mishra, S.Chand&Company Ltd. New Delhi, 2000.
12. Principals of Environmental Science by H.V. Jadhav, Himalaya Publishing House, NewDelhi, 1994

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

The examination shall comprise two theory papers of 3 hours duration of 80 marks. Theory paper is divided into four units. Each Unit shall be covered in 7.5 hours

B.Sc Semester-II
Paper - I
Basics of Environmental Pollution

Unit-I: Environmental Pollution:

A) **Environmental Pollution:** Definition, types, Classification of Pollutants- on the basis of physical properties and forms of their existence, Primary and secondary pollutants, degradable and non-degradable pollutants.

B) **Air Pollution:** Sources, Effects (Human health, vegetation and animals, Building material and structures), Indoor pollution, vehicular pollution, Bhopal gas tragedy, Air Quality Standards- NAAQS, AQI, Air pollution control measures.

(7.5 Periods)

Unit-II: Water Pollution:

A) **Water Pollution:** sources, effect of water pollution on flora and fauna, human beings and materials, Eutrophicaton, Heavy metal pollution- Minamata episode, water, pollution control measures, water quality indices.

B) **Thermal Pollution**: Causes, effects and control measures. **Marine Pollution:** sources, causes and mitigation of marine pollution. **(7.5 Periods)**

Unit-III-Soil and Solid Pollution:

A) **Soil Pollution:** Sources and types, soil pollutants- metals, inorganic ion and salts, organic substances, effects of soil pollution on soil health and productivity, effects of pesticides, soil pollution control measures,

B) **Solid Waste Pollution:** sources, Classification and characteristics of solid waste, segregation, collection and transportation and disposal of solid waste, Solid Waste management, **Biomedical Waste**: Categories of biomedical waste, types of container used for the disposal of biomedical waste, biomedical waste management.

(7.5 Periods)

Unit-IV: Noise and Radiation Pollution:

A) Noise Pollution: Sources and effects, Decibel scale, control measures of noise pollution. Ambient noise level of monitoring.

B) Radioactive Pollution: Types and sources of radiations, biological effects and control measures of radiations, E-waste (sources and its health effect), recycling and disposal methods. **(7.5 Periods)**

Practical-I

1. Determination of total solids in polluted water sample.
2. Determination of free chlorine in water sample.
3. Estimation of Hardness in water sample
4. Determination of Dissolved Oxygen (DO) in polluted water sample.
5. To estimate the amount of dust (particulate matter) deposition on the leaves of roadside plants.
6. To measure settealable particles by dust fall jar.
7. Determination of Total Organic Carbon (TOC) and % organic matter in the soil sample.
8. Determination of noise levels of residential, institutional and industrial area.
9. Determination of moisture content municipal solid waste,
10. To segregate domestic solid waste into bio-degradable and non bio-degradable components.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Book for Reference:

1.Text Book of Environment: K M Agrawal, P.K.Sikdar, and S.C.Deb, Mc'Millan Publication, Mumbai.
2.Man and Environment: M.C.Dash and P.C.Mishra, Mc'Millan Publication, Mumbai.
3.Environmental Science: S.C.Santra, New Central Book Pvt.Ltd, Kolkatta.
4.Environmental Problems and Solution: D.K.Asthana, S.Chand Publication,New Delhi.
5.A Text book of Environmental Chemistry and Pollution Control: S.S.Dara, S.Chand and Company Ltd,New Delhi.
6.Environmental Chemistry: B.K.Sharma, Goel Publication,Meerut.
10. Environmental Chemistry: A.K.Dey,New Age International Publishers,2001.
11. Man and Environment: P.R.Trivedi and Gurdeep Raj,Akashdeep Publishing House,New Delhi.

12. Fundamentals Concepts in Environmental Studies: Dr.D.D.Mishra, S.Chand Publication,New Delhi.
13. Environmental Pollution: Khitoliya,R.K**.** S.Chand Publication,New Delhi.
14. Air pollution and it's Control: Rao,M.N and Rao, H.V.N., Tata McGraw-Hill Publishing Company ,New Delhi.
15. Principles of Environmental Chemistry,3rd edition, J.E.Girard, Jones and Bartlett Learning Company, Burlington
16. The Science of Environmental Pollution,3rd edition, Frank.R.Spellman, CRC Press, Taylor and Francis Group.

B.Sc Semester II
Paper IV
Forest, Wildlife & Bio-diversity Conservation

Unit -I: Forest Conservation

A) Forest: Types of forest in India, Minor forest products, Significance of forest, Deforestation (causes, effects and control measures), forest fires.

B) Forest Conservation: Social forestry, National Forest Policy, Chipko Movenment, Afforestation, Forest Conservation Act,1988,Sustainable Forest Management (SFM), Joint Forest Management (JFM) **(7 Periods)**

Unit – II: Wildlife Conservation

A) **Wildlife:** Importance of wildlife, Rare, endangered, vulnerable and extinct species of wildlife, causes of wildlife depletion, wildlife management, man-animal conflicts,

B) Wildlife conservation: Necessity and mode of conservation of wildlife, Project Tiger, Wildlife Protection Act,1972, Role of IUCN, UNEP and WWF in wildlife conservation.

(7 Periods)

Unit -III: Biodiversity

A) Biodiversity: types, causes for the loss of biodiversity, preservation strategies for biodiversity, benefits of biodiversity, Hotspots of biodiversity, Measurement of biodiversity.

B) India as mega diversity nation, Biogeography zones of the country, Community Biodiversity Register (CBD), Biodiversity Act' 2002, Red Data Book. **(8 Periods)**

Unit- IV: Biodiversity Conservation

A) Biodiversity: Conservation: Approaches for Conservation of Biological Diversity, "In-situ' (Biosphere Reserves, National Park and Sanctuaries) conservation, "Ex-situ" conservation (Botanical and Zoological gardens, gene banks, seed and seedling bank).

B) Role of local communities and traditional knowledge in conservation; Biodiversity convention; International and national efforts to conserve biodiversity (CITES and WCU)

(8 Periods)

Practical-II

1. To determine the frequency of a species (plant) by Quadrate method.
2. To determine the density of a species (plant) by Quadrate method.
3. To determine the Abundance of a species (plant) by Quadrate method.
4. To study the water holding capacity of soil.
5. Identification of Zoo-planktons and Phyto-planktons.
6. Preparation of field report based on the survey of local flora (herbarium sheet).
7. To determine the Humidity by Psychrometer.
8. Identification of endangered species of flora and fauna
9. Preparation of Social Forestry Proposal
10. Study of adaptive features of hydrophytes and xerophytes.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Visit to Bio-Diversity Park.
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Book for Reference:

1. Biodiversity – Strategies for Conservation – Dadhich.L.K. and A.P.Sharma, APH publishing corporation. New Delhi, 2002
2. Global Biodiversity Conservation measures – Khan. T.I and Dhari. N Al-Ajmi, pointer Publishers, Jaipur (1999)
3. An Advanced Text book on Biodiversity – Principles and Practice – Krishnamurthy. K.V, Oxford and IBH publishing, New Delhi (2003)
4. A Text Book of Ecology and Environment-P.C.Joshi and Namita Joshi, Himalaya Publihng House, First Edition (2005)
5. Environment and Ecology-S.N.Pandey and S,P.Mishra, Ane Books Pvt. Ltd. (2011).
6. A Text of Environmental Studies- Shashi Chawla, McGraw Hill Education (India) Private Ltd, New Delhi.(2012)
7. Environment and Ecology-Majid Husain, Access Publishing(India) Private Ltd, New Delhi.(2014)

Vocational and Skilled Based Education (VSE) (Environmental Science)

VSE-2: OPERATION & MAINTENANCE OF WATER & WASTE WATER TREATMENT PLANTS

Unit -1 : Introduction to Water Treatment Plant (WTP) & Waste Water Treatment Plants (WWTP) :

Objectives of WTP and WWTP. Role & duties of WTP / WWTP operator and Plant Incharge. Various units involved in WTP & WWTP. Operation of Pumps, Blowers, Agitators, Flow meters, valves, gear box, motors, MCC Panel

Sludge generation & Sludge handling system - Filter Press, Decanter, Screw Press, Belt Press. Handlingof filtrate and cakes

Layout , Hydraulic Profile and Piping &Instrumentation diagram of water and waste water treatment plant. Importance of spare list. Capital cost & Operational cost. Power (HP/kw) calculation of running plant.

Unit – 2 : Operation & Maintenance of Water Treatment Plant :

Water scarcity – Indian scenario. Depleting water resources. Per capita water supply, water supply schemes, Importance of water treatment plant and reuse.

Operation & Maintenance of intake well, check well, jack well, rising main, cascade aeration, flocculation and sedimentation, filters, Mass Balancing Reservoirs , Ground Storage Reservoirs, Elevated Service Reservoirs.

Advanced Water Treatment Technologies and it's operation & maintenance. Membrane filtration technology – Low & high pressure membrane, advanced oxidation, ultraviolet treatment, water softening.desalination plants, packaged drinking water and mineral water plants. Statutory guidelines for drinking water, Demineralization – cation exchangematerials – removal of ion, manganese, odour, colour taste – fluoridation, reverse osmosis

Unit – 3 : Operation & Maintenance of Primary & Biological Waste Water Treatment Plant :

Unit operations involved in Primary & Biological Treatment. Discharge norms. Zero liquid discharge (ZLD), treatment schemebased on discharge norms. Operation &maintenance of mechanical and manual screen , vibro separator, oil skimmer, plate heat exchanger, primary clarifier, agitator, coagulation &flocculation, dissolved air floatation unit, clariflocculator, tube settler, gear box and motors.

Unit operation involved in Biological Treatment. Operation &maintenance of aerators, diffusers, blowers, pumps, secondary clarifier, lamella clarifier, aeration tank, anaerobic digesters – Media based, Upflow Anaerobic Sludge Blanket (UASB), Continuous Stirred Tank Reactors (CSTR).

Operation and maintenance of sludge dewatering units – Sludge thickener, filter press, decanters, screw press, belt press.

Unit -4 : Operation & Maintenance of Tertiary and Advanced Waste Water Treatment Plant:

Basics of advanced waste water treatment technologies – Dual Media Filters, Membrane Bio Reactor, HRSCC, Multi Effect Evaporators. Membrane based treatment technologies. Instrumentations and it's O & M – pressure gauge, hi and low Laval switch, DO meter, PH meter, flow meter, various types of valves. Cleaning of filters, backwashing.

Operation & Maintenance of Reverse Osmosis Plant, High Rate Solid Contact Clarifier (HRSCC), Membrane Bio Reactor (MBR), Moving Bed Biofilm Reactor (MBBR), Multi Effect Evaporators, Skid mounted STPs

Documentation, Interpretation and Commissioning: Preparation of operation and maintenance manual, record keeping, report preparation& documentation, Log-sheet, Routine analysis of various parameters. commissioning of waste water treatment plants. Preparation of quality assurance plan. Environment audit.

Reference Books:

1. Waste Water Engineering: Metcalf and Eddy, Tata McGraw Hill Publishing Company,New Delhi.
2. Waste Water Treatment for Pollution Control : Soli J. Arceivala (Tata Mc- GrewHill Publishing Company, New Delhi)
3. Water Supply and Sanitary Engineering : R. C. Rangwala and S. C. Rangwala (Charotal publishing house, Anand)
4. Waste Water Engineering By Parker R (2018).
5. Waste water treatments by S.S Jahagirdar, R.K Lad,V.S Rajamanya.
6. Water and Waste Water Systems – Poonam Ahluwalia
7. Waste Water Treatment : M. N. Rao, A. K. Datta (Oxford and IBH Publishing company, New Delhi)
8. Introduction to Environmental Engineering: Mackenzie L. Davis & David A. Cornwell, McGrew Hill Publishing Company, New Delhi.
9. Fundamentals of Water Treatment Unit Processes - Physical, Chemical, and Biological David Hendricks, CRC Press, ISBN: 978-1-4200-6191-8 (Hardback), 2011 Edition [DWH]
10. Industrial Waste Water Treatment by A.D Patwardhan
11. Water-Wastewater Engineering - Fair G.M., Geyer J.G and Okun.
12. Waste Water treatment and Water Management – Anamika Srivastava
13. Sewage Treatment & Disposal & Waste Water Engineering- P N Modi

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, VedangJyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of BhaskarAcharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Forensic Science

Submitted by

Board of Studies,

Bachelor of Forensic Science

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research) (Forensic Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital & Cyber Forensic	BFS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital & Cyber Forensic	BFS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	A. Soap, Detergent, and Disinfectant Technology B. Basic Techniques in Forensic Biology C. Optical Laboratory	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Forensic Science- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Chemistry	BFS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Chemistry	BFS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Physics	BFS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Physics	BFS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	A. Documentation of Crime Scene B. Basics Techniques of Microbial Forensics C. Python Programming	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Psychology	BFS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Psychology	BFS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS3P06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Forensic Science – Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Biology	BFS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Biology	BFS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Forensic Science	BFS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Science	BFS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4P06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-V (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Forensic Chemistry	BFS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Chemistry	BFS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Science	BFS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Science	BFS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1 (Digital & Cyber Forensic/ Forensic Physics/ Forensic Psychology)	BFS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1 (Digital & Cyber Forensic/ Forensic Physics/ Forensic Psychology)	BFS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	NSS/ NCC/ Yoga/ Sports/ Cultural/ Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital & Cyber Forensics	BFS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital & Cyber Forensics	BFS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2 (Forensic Chemistry/ Forensic Physics/ Forensic Psychology)	BFS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2 (Forensic Chemistry/ Forensic Physics/ Forensic Psychology)	BFS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Forensic Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Biology & Serology	BFS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Biology & Serology	BFS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Digital & Cyber Forensics	BFS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Digital & Cyber Forensics	BFS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 (Forensic Physics/ Forensic Psychology/Law)	BFS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 (Forensic Physics/ Forensic Psychology/Law)	BFS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BFS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BFS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Biology & Serology	BFS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Biology & Serology	BFS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Digital & Cyber Forensics	BFS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Digital & Cyber Forensics	BFS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 (Forensic Physics/ Forensic Psychology/Law)	BFS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 (Forensic Physics/ Forensic Psychology/Law)	BFS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology & Serology	BFS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology & Serology	BFS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Physics	BFS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Physics	BFS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 (Digital & Cyber Forensics/ Forensic Chemistry & Toxicology/ Forensic Psychology)	BFS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 (Digital & Cyber Forensics/ Forensic Chemistry & Toxicology/ Forensic Psychology)	BFS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BFS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BFS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Forensic Science	BFS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital & Cyber Forensics	BFS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital & Cyber Forensics	BFS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 (Forensic Physics/ Forensic Biology/ Forensic Psychology)	BFS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 (Forensic Physics/ Forensic Biology/ Forensic Psychology)	BFS8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Forensic Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	A. Soap, Detergent, and Disinfectant Technology B. Basic Techniques in Forensic Biology C. Optical Laboratory	Forensic Science	**BVS1P01**
II	**VSC**	A. Documentation of Crime Scene B. Basics Techniques of Microbial Forensics C. Python Programming	Forensic Science	**BVS2P03**
III	**VSC**	Crime Scene Investigation	Forensic Science	**BVS3P05**
V	**VSC**	A. Practical Aspects of Forensic Journalism B. Forensic Biology C. Forensic Psychology	Forensic Science	**BVS5P07**
VI	**VSC**	A. Statistics in Forensic Science B. Forensic Biology C. Forensic Psychology	Forensic Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Forensic Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Digital & Cyber Forensic B. Forensic Physics C. Forensic Psychology	BFS5T12
VI	Elective 2	A. Forensic Chemistry B. Forensic Physics C. Forensic Psychology	BFS6T16
VII (Honors)	Elective 3	A. Forensic Physics B. Forensic Psychology C. Law	BFS7T21
VIII (Honors)	Elective 4	A. Forensic Physics B. Forensic Psychology C. Law	BFS8T27
VII (Research)	Elective 3	A. Digital & Cyber Forensics B. Forensic Chemistry & Toxicology C. Forensic Psychology	BFS7T20R
VIII (Research)	Elective 4	A. Forensic Physics B. Forensic Biology C. Forensic Psychology	BFS7T25R

'R' in the subject code indicates 'Research'.

B.Sc. Sem-I (Forensic Science - Major)

DSC I (Forensic Science)

Paper (BFS1T01): Basics of Forensic Science

Course Outcomes: By the end of this Course, the learners will be able to:

1. Apply fundamental principles and laws of forensic science to analyze and interpret crime scene evidence.
2. Evaluate the historical development and contributions of forensic science, including key concepts and scientists' contributions.
3. Assess the setup, services, and functionalities of forensic science laboratories in India, including divisions and areas of specialization.
4. Apply crime scene investigation techniques, including crime scene classification, evidence preservation, collection, and documentation.
5. Understand the role and functions of investigation agencies in society, including their structure and modern techniques of interview and interrogation.

Unit I: **Introduction to Forensic Science and its Historical Development.**

Forensic Science: Definition, Nature, need and functions. Basic Principles and Laws of Forensic Science: Locard's Principle of Exchange, Law of Progressive Change, Law of Individuality, Law of Circumstantial Fact, Principle of Analysis, Law of Probability, and Law of Comparison. Corpus Delicti, Modus Operandi, Signature. Historical development in India and world, Specific contribution of scientists in the field of Forensic Science. Scope of Forensic Science in India and world.

Unit II: Development of Forensic Science

Educational setup of Forensic Science in India, Services and functionalities provided by various FSLs, Structure of the FSLs, Various divisions in the FSL – General Analytical and Instrumentation, Ballistics, Biology, Chemistry Documents, Physics, Psychology, Serology, Toxicology, Cyber Forensic, Tape Authentication and Speaker Identification (TASI), DNA division. Mobile Forensic Science Laboratories. Growth and development of Forensic Science Laboratories in India – Central and State level, GEQDs, Eminent scientists and Forensic Experts in India and their contributions to the field.

Unit III: **Crime Scene Investigation**

Types and classification of Crime Scene, Initial response, Securing the scene of crime, Various crime scene search methods, Various methods of preservation of crime scene: Photography, Sketching, Videography, Voice Recording, Notes taking. Collection methods and labelling, packing, and forwarding of evidences, documentation and chain of custody, Role of First Responding Officer and Investigating officer.

Unit IV: Investigation Agencies and Society

Structure, role and functions of CID, CBI, IB, RAW, NCRB, BPR&D, DFS, DFSS, and NICFS. Techniques of interview and interrogation and other modern techniques).

Practical (BFS1T01): Basics of Forensic Science

1. To conduct mock 'Crime Scene Investigation'.
2. To perform a crime scene survey of a given crime scene
3. Sketching of a Crime Scene using Triangulation method.
4. Sketching of a Crime Scene using Baseline method.
5. Preliminary examination of suspected bloodstains at the scene of crime.
6. Preliminary examination of suspected saliva stains.
7. Preliminary examination of suspected semen stains at the sexual assault crime scene.
8. To write forwarding letter for evidences encountered at murder crime scene.
9. To write forwarding letter for evidences encountered at hit and run crime scene.
10. To write forwarding letter for evidences encountered at sexual assault crime scene.

B.Sc. Sem-I (Forensic Science - Major)

DSC II (Digital and Cyber Forensic)

Paper (BFS1T02): Fundamentals of Computers

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the meaning and basic components of a Digital computer system
2. Understand the concepts and need of primary, secondary memory and different storage devices
3. Explain input devices and output devices.
4. Understand the role and functionalities of operating system, its various types.
5. Explain Network concept, LAN, WAN and MAN, Network devices, networking architecture etc.

Unit I: Components of Digital Computer

Basic Components of Digital Computers: Block Diagram**.**

CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.

Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology

Unit II: Various types of devices

Storage Devices: Hard Disk, Optical Disk, Pen Drive, SD Card, and Cloud as storage.

Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.

Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet, Plotters: Drum, Flat-Bed and Inkjet.

Unit III: Introduction to Operating System

Introduction of Operating System, Functions of OS, **Types of OS:** Single user, Multi-User, single tasking, multi-tasking, RTOS and Distributed, **Examples:** Windows, Linux, Unix, Dos, Mac and Android.

Unit IV: Network and Networking Systems

Network: Network terminology, **Topologies**: Linear, Circular, Tree and Mesh. **Types of Networks**: LAN, WAN and MAN, **Networking Devices**: Repeaters, Bridges, Routers and Gateway. Modem for Communication between PC's, Wi-Fi network, Bluetooth and Infrared devices, **Network Architecture:** Peer-to-Peer, Client/Server

Practical (BFS1T02): Fundamentals of Computers

1. Identify and explain the functions of each unit in the CPU, including the primary memory, ALU, and CU.
2. Investigate and compare storage devices such as hard disks, optical disks, pen drives, SD cards, and cloud storage.
3. Compare the usability and functionality of different input devices.
4. Set up and use output devices, including VDUs, laser printers, inkjet printers.
5. Explore different operating systems, including Windows, Linux, Unix, DOS, Mac, and Android.
6. Discuss the functions of an operating system, such as process management, memory management, file system management, and user interface.
7. Configure a LAN using appropriate networking devices, including repeaters, bridges, routers, and gateways.
8. Transfer files between computers on the LAN and demonstrate shared resources.
9. Set up small-scale networks using different topologies and analyze their advantages and limitations.
10. Set up a client/server network using appropriate networking devices and software.
11. Configure client and server systems and establish network communication.
12. Demonstrate the use of client/server architecture for file sharing and resource access.

B.Sc. Sem-I (Forensic Science - Major)

VSC (Forensic Chemistry)

VSC 1-A (BVS1P01): Soap, Detergent and Disinfectant Technology

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall historical information, understand sustainable development in disinfectant technology,
2. Apply mechatronic solutions for soap manufacturing, and apply their knowledge to create different products.
3. Analyze various determinations and comparisons, evaluate different aspects related to soaps and detergents, and
4. They will have practical skills in soap and detergent manufacturing processes and an understanding of the principles behind them.

List of Practical

1. Brief History of Soap and Soap-Making Processes, Formulation and Marketing Challenges
2. Sustainable development in cleaning action of disinfectant technology and Innovations
3. in advances and Mechatronic Solutions for Soap Manufacturing Technology from
4. Saponification Systems.
5. Determination of the surface tension of given liquid in the presence of surfactant.
6. Determination of alkali content of soap.
7. Determination of pH of water samples and surfactant (Soap, detergent, Toiletries)
8. Estimation of hardness of water by titration with soap solution.
9. Determination of CMC of various soaps and detergents in market.
10. Comparison of cleansing actions of various commercial soaps and detergents.
11. Preparation of hand sanitizer.
12. Preparation of Soap, Detergents / Surfactants, Cleaners / Cleaning Powder.
13. Preparation of Laundry Care / fabric care / wash.
14. Preparation of Household and Industrial Detergent.
15. Preparation of Liquid Soaps/ Liquid Detergents / Acid Slurry.

B.Sc. Sem-I (Forensic Science - Major)

VSEC (Forensic Biology)

VSC 1-B (BVS1P01): Basic Techniques in Forensic Biology

Course Outcome: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of Neubauer's chamber and its application in forensic biology, including the ability to accurately count and analyze cells or particles.
2. Implement general safety guidelines and identify potential hazards in a forensic biology laboratory, ensuring a safe working environment for oneself and others.
3. Explain the basic concepts of laboratory equipment and apparatus used in forensic biology, including glassware and common laboratory instruments, and their appropriate usage.
4. Prepare different types of solutions, including molar normal formal and molal solutions, and determine their concentrations accurately using appropriate techniques.
5. Perform pH measurements of solutions used in forensic biology, interpret the results, and understand the implications of pH in various forensic applications.

List of Practical:

1. Study of Neubauer's chamber and its utility in forensic biology.
2. General guidelines for safety in a forensic biology laboratory, possible laboratory hazards.
3. General concept of basic equipment and apparatus (Glassware and laboratory instruments).
4. Preparation of molar normal Formal and molal solution (lower and higher range).
5. Determination of pH of solutions used in forensic biology.
6. Preparation of various microbial basal media.
7. Preparation of percent solution.
8. Preparation of various types of graphs used in forensic biology.
9. Sterilization of glassware and basal media.
10. Microbial culturing from the soil sample.
11. Preparation of various staining reagents used in forensic biology.
12. Preparation of temporary slides.

B.Sc. Sem-I (Forensic Science - Major)

VSEC (Forensic Physics)

VSC 1-C (BVS1P01): Optical Laboratory

Course Outcome: By the end of this Course, the learners will be able to:

1. Analyze and interpret experimental results to determine parameters such as dispersive power of a prism, focal length of lenses, resolving power of gratings, and magnification of microscopes.
2. Apply appropriate measurement techniques, such as using a spectrometer or Newton's rings, to determine angles, radii, and other optical properties.
3. Understand the concepts like Brewster's law, wavelength determination using transmission grating, and the working principles of compound, stereo, and comparison microscopes.
4. Develop skills in experimental setup, data collection, and analysis, enhancing their ability to conduct precise optical measurements.

List of Practical:

1. Determination of Dispersive Power of a Prism
2. Determination of Angle of Prism using Spectrometer
3. Determination of Focal Length of Concave Lenses
4. Determination of Focal Length of Convex Lenses
5. Determination of Focal Length of Combination of Lenses
6. Determination of Wavelength of Light using Plane Transmission Grating
7. Determination of Resolving Power of Grating
8. Determination of Radius of Curvature of Plano-Convex Lens by Newton’s Rings
9. Study of Brewster’s Law
10. Determination of R.I. of Glass by using Brewster’s Law
11. Determination of Resolving Power of Microscope
12. Determination of Magnification of Microscope
13. Study of Compound Microscope
14. Study of Stereo Microscope
15. Study of Comparison Microscope

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem-II (Forensic Science - Major)

DSC I (Forensic Chemistry)

Paper (BFS2T03): Basics of Forensic Chemistry & Toxicology

Course Outcomes: By the end of this Course, learners will be able to:

1. Recall and describe the key concepts and principles in toxicology.
2. Develop a comprehensive understanding of the significance of toxicological findings in forensic investigations.
3. Apply the knowledge and techniques of isolation and extraction methods used in toxicology for the purpose of isolating and identifying poisons in forensic samples.
4. Analyze and interpret chromatographic techniques used in toxicology, including paper chromatography, thin-layer chromatography (TLC), high-performance thin-layer chromatography (HPTLC), and column chromatography, to separate and identify toxic compounds in forensic samples.
5. Evaluate the properties, classification, fractionation, commercial uses, adulteration, and forensic significance of petroleum products.

Unit I - Basics of Toxicology

Introduction, history, Classification of poisons, characteristics and modes of action of poisons, types of poisoning, fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes. Significance of toxicological findings.

Unit II – Methods of Isolation and Extraction of Poison

Introduction, principle, working, applications, limitations, and forensic significance of distillation, fractional distillation, steam distillation, dialysis, electrodialysis, solvent extraction, dry ashing, etc.

Unit III – Chromatographic Techniques used in Toxicology

Introduction, principle, theory, stationary phases, mobile phases, retardation factor, applications and forensic significance of paper chromatography, TLC, HPTLC, column chromatography etc.

Unit IV – Petroleum Products

Introduction, classification, fractionation of petroleum products, commercial uses of different petroleum fractions, nature and purpose of dyes used in petroleum products, adulteration of petroleum products, forensic significance of petroleum products.

Practical Paper (BFS2T03): Basics of Forensic Chemistry & Toxicology

1. To determine the density of given liquid.
2. To determine relative viscosity of given organic liquids by viscometer.
3. To determine the surface tension of given liquid by Stalagmometer.
4. To study kinetics of acid catalysed ester hydrolysis.
5. Organic qualitative analysis.
6. To determine strength of given acid.
7. To standardize the given NaOH solution & find the strength of given HCl solution.
8. Paper chromatography of toxic metal ions.
9. Thin Layer Chromatography of organic poisons.
10. Identification of toxic metal ions in given solution by colour tests.
11. Identification of adulteration in petrol using density method.

B.Sc. Sem-II (Forensic Science - Major)

DSC II (Forensic Physics)

Paper (BFS2T04): Basics of Forensic Physics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Recall and describe the primary causes and types of vehicular accidents, sources of information for accident investigation, methods for estimating vehicle speed from skid/scuff marks, and various aspects related to motor vehicle examination, including brake systems and steering failure.
2. Develop a comprehensive understanding of tools and tool marks, including the identification and documentation of different types of tool marks the collection and preservation of tool mark evidence, and the forensic examination of tool marks.
3. Apply knowledge and techniques related to glass evidence, including the composition of glass, methods for comparing glass fragments, classification of glass samples, analysis of glass fractures, and the proper collection and preservation of glass evidence.
4. Analyze different types of manufactured fibers, including their microscopic examination, dye composition, chemical composition, and other properties for examination.

Unit I: Vehicular Accidents

Primary Causes of Road Accident, Types of Road Accident, Sources of Information, Eye Witnesses, Tyre and Other Marks, Pedestrian Impacts and Vehicle Speed, Vehicle Condition, Vehicle Speed and Damage, Types of Skid Marks, Curved Scuffmarks, Speed Estimation from Skid/Scuffmarks. Time and Distance, Reaction Time and Peripheral Vision of a Driver, Photography and Plans, Brake System and Steering Failure, Motor Vehicle Examination.

Unit II: Tools & Tool Marks

Common Hand Tools, Marks Made by Hand Tools (Impression / Compression Marks, Dent, Saw Marks, Drill Marks and Holes, Punctures, Point to Point Blade Cut Marks, Scratch and Scour Marks), Collection, Documentation and Forensic Examination of Tool Marks.

Unit III: Glass Evidence

Composition of Glass, Comparison of Glass Fragments, Measuring and Comparing Density and Refractive Index of Glass, Classification of Glass Samples, Glass Fractures, Collection and Preservation of Glass Evidence.

Unit IV: Fibre Evidence

Types, Identification and Comparison of Manufactured Fibres (Microscopic Examination, Dye Composition, Chemical Composition, Other Properties for Examination), Significance of Match, Collection and Preservation of Fibre Evidence. Forensic Examination of Cloth and Cloth Fibres.

Practical (BFS2T04): Forensic Physics

1. Study of Hand Tools
2. Study of Tool Marks
3. Examination of Fibres under Microscope
4. Strength Measurements of Fibres
5. Comparison of Glass Fragments
6. Study of Glass Fractures
7. Measurement of Refractive Index of glass
8. Measurement of Density of glass
9. Examination of broken glass
10. Examination of skid marks
11. Forensic Examination of Cloth

B.Sc. Sem-II (Forensic Science - Major)

VSC (Forensic Science)

VSC I-A (BVS2P03): Documentation of Crime Scene

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall techniques for crime scene photography and note-taking.
2. Comprehend the purpose and significance of different types of crime scene photography and sketching.
3. Apply photography techniques, note-taking skills, and sketching techniques to document crime scenes accurately.
4. Analyze crime scenes to determine appropriate photography angles and sketching details.
5. Evaluate the quality and effectiveness of crime scene photography, note-taking, and sketching.
6. Create comprehensive documentation of crime scenes through photography, note-taking, and sketching.

List of Practical

1. To perform an overview photography of the crime scene of outdoor crime scene.
2. To perform a midrange photography of the crime scene of outdoor crime scene.
3. To perform a close-up photography of the crime scene of outdoor crime scene.
4. To perform an overview photography of the crime scene of indoor crime scene.
5. To perform a midrange photography of the crime scene of indoor crime scene.
6. To perform a close-up photography of the crime scene of indoor crime scene.
7. Note-taking at the crime scene.
8. To draw a rough sketch of the crime scene.
9. To draw a fair sketch of the crime scene.
10. Taking videography of crime scene.

B.Sc. Sem-II (Forensic Science - Major)

VSEC

VSC I-B (BVS2P03): Basics Techniques in Microbial Forensics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Apply the appropriate staining techniques to visualize and identify bacteria accurately.
2. Analyze and interpret growth curve data to understand the different phases of bacterial growth.
3. Demonstrate knowledge of the principles and procedures involved in isolating bacteria from various samples.
4. Prepare and differentiate between differential media and transport media for bacterial culturing.
5. Perform agarose gel electrophoresis to separate DNA samples and analyze the results for bacterial identification.

List of Practicals

1. Determination of the growth curve of bacteria.
2. To perform simple staining of bacteria.
3. To perform Gram staining of bacteria.
4. Isolation of bacteria from spoiled food samples using the streak plate method.
5. Isolation of bacteria from a water sample using pour plate method.
6. Preparation of differential media for bacterial culturing (MacConkey's Medium)
7. Preparation of transport media for bacterial culturing (Peptone water Medium)
8. Steam sterilization of media and glassware.
9. Determination of antibiotic sensitivity of bacteria.
10. Determination of oligodynamic activity on bacteria.
11. Isolation of DNA from Bacterial cell.
12. Separation of DNA on agarose gel electrophoresis.

B.Sc. Sem-II (Forensic Science - Major)

VSEC (Digital & Cyber Forensics)

VSC I-C (BVS2P03): Python Programming

Course Outcome: By the end of this Course, the learners will be able to:

1. Have an understanding of Python programming, including installation, basic syntax, variables, operators, conditional statements, looping, functions, data structures (lists, strings, dictionaries), file handling, and object-oriented concepts.
2. Create and utilize functions in Python, understanding their role in modular programming and code reusability.
3. Evaluate the usage of conditional statements (if, elif, else) in Python and demonstrate their effectiveness in controlling program flow.
4. They will be able to apply their knowledge to create and execute Python programs with various functionalities.

List of Practical

1. Installing python
2. Write a program in Python to display "Hello World" string on screen
3. Demonstration of constant and variables in python
4. Demonstration of operators in python
5. Demonstration of conditional statements in python
6. Demonstration of looping in python (for, while, nested)
7. Function in python
8. Working with lists in python
9. Working with strings in python
10. Working with dictionaries in python
11. Working with files in python
12. Python programming using object-oriented concepts

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Geology

Submitted by

Board of Studies,

Bachelor of Geology

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Geology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Introduction to Geology	BGE1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Introduction to Geology	BGE1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Rock Forming Minerals	BGE1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Rock Forming Minerals	BGE1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Geological Mapping Techniques	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**	**-**	**530**	**170**	**-**	**150**	**250**	**-**

B.Sc. Sem-II (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Geology and General Geology	BGE2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Physical Geology and General Geology	BGE2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Optical Mineralogy and Crystallography	BGE2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Optical Mineralogy and Crystallography	BGE2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Evaluation to Landforms	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**	**-**	**530**	**170**	**-**	**150**	**250**	**-**

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Igneous Rocks	BGE3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Igneous Rocks	BGE3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Sedimentary Rocks	BGE3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sedimentary Rocks	BGE3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Metamorphic Rocks	BGE4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Metamorphic Rocks	BGE4P07			2	1	-	-	-	-	25	25	25
3	DSC	Palaeontology	BGE4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Palaeontology	BGE4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Structural Geology	BGE5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Structural Geology	BGE5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Economic Geology	BGE5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Economic Geology	BGE5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Indian Stratigraphy	BGE5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Indian Stratigraphy	BGE5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BIT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BIT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Remote Sensing	BGE6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Remote Sensing	BGE6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Hydrogeology	BGE6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Hydrogeology	BGE6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Geomorphology	BGE6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Geomorphology	BGE6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BIT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BIT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Geology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mineralogy	BGE7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mineralogy	BGE7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Igneous Petrology	BGE7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Igneous Petrology	BGE7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Metamorphic Petrology	BGE7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Metamorphic Petrology	BGE7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Sedimentary Petrology	BGE7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Sedimentary Petrology	BGE7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BIT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BIT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BIT7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BIT7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Principles of Stratigraphy	BGE8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Principles of Stratigraphy	BGE8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Geochemistry	BGE8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Geochemistry	BGE8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Paleoclimates and Quaternary Geology	BGE8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Paleoclimates and Quaternary Geology	BGE8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Introduction to Micropaleontology and Mineral Exploration	BGE8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Introduction to Micropaleontology and Mineral Exploration	BGE8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BIT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BIT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Igneous Petrology	BGE7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Igneous Petrology	BGE7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Metamorphic Petrology	BGE7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Metamorphic Petrology	BGE7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Sedimentary Petrology	BGE7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Sedimentary Petrology	BGE7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BGE7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BGE7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Principles of Stratigraphy	BGE8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Principles of Stratigraphy	BGE8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Geochemistry	BGE8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Geochemistry	BGE8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Instrumentation Techniques, Geostatistics and Computer application in Geology	BGE8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Instrumentation Techniques, Geostatistics and Computer application in Geology	BGE8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BIT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BIT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

ABBREVIATIONS: Generic/Open Electives: **OE**, Vocational Skills & Skill Enhancement Courses: **VSEC**, Vocational Skill Courses: **VSC**, Skill Enhancement Courses: **SEC**, Ability Enhancement Courses: **AEC**, Indian Knowledge Systems: **IKS**, Value Education Courses: **VEC**, On Job Training (Internship/Apprenticeship): **OJT**, Field Project: **FP**, Community Engagement & Service: **CEP**, Co-curricular Courses: **CC**, Research Methodology: **RM**, Research Project: **RP**

VSC Basket (Geology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Geological Mapping Techniques	Geology	**BVS1P01**
II	**VSC**	Evaluation to Landforms	Geology	**BVS2P03**
III	**VSC**	Remote Sensing Data Acquisition and Application	Geology	**BVS3P05**
V	**VSC**	Understanding of Geohazards	Geology	**BVS5P07**
VI	**VSC**	Artificial Recharge of Groundwater	Geology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Geology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Introduction to Earth's Geological History	BGE5T12
		B. Introduction to Geodynamics and Tectonics	
VI	Elective 2	A. Introduction to Paleoclimates	BGE6T16
		B. Introduction to Watershed Management	
VII (Honors)	Elective 3	A. Introduction to Quaternary Geology	BGE7T21
		B. Introduction to Micropaleontology	
VIII (Honors)	Elective 4	A. Introduction to Mineral Exploration	BGE8T27
		B. Introduction to Environmental Geology and Geohazards	
VII (Research)	Elective 3	A. Introduction to Quaternary Geology	BGE7T20R
		B. Introduction to Micropaleontology	
VIII (Research)	Elective 4	A. Introduction to Mineral Exploration	BGE7T25R
		B. Introduction to Environmental Geology and Geohazards	

B.Sc. Geology Syllabus (CBCS) Revised in 2023-24 (DSC)

Program Outcomes (POs) for B. Sc. Programme

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from sciences/ mathematics/ social sciences/ humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Semester I

Paper I: (Introduction to Geology)

Course Outcomes (COs)

1) Identify and describe various physical processes and understand branches of geology
2) Compare various domains of geological science.
3) Outline application of different terminologies of geological science.
4) Categorize applications and economic importance of geological science.
5) Justify selection of geological science to utilize in social benefit of human kind interms of wealth and culture.
6) Create a base to understand geological hazards and cope-up policy.

Program Specific Outcomes (PSOs)

(i) Understand fundamental concepts, principles and processes underlying the field of Geology, its different subfields and its linkage with related disciplinary areas/subjects

(ii) Demonstrate an understanding of a wide range of geological processes (e.g. genesis of rocks and formation of geological structures, formation of minerals and their alteration.)

(iii) Undertake field tour in any part of India with respect to lithology, structure and stratigraphy and produce geological maps

Unit I

Definition of Geology branches of geology and relation to other sciences: Physical geology Structural geology, Tectonic (Dynamic) geology, Mineralagy, Petrology, Historical geology, Palentology, Economic geology, Applied geology, Geophysics, Geochemistry, hydrogeology etc. Earth as a member of solar system. Gross features of the Earth. Brief idea about core, mantle, crust, hydrosphere, atmosphere, biosphere and elemental abundance in each constituent.

Unit II

Convection in Earths' core and production of its magnetic field. Causes of Earthquakes, classification of earthquakes based on depth, propagation of earthquake waves, measurement of earthquake intensity, seismograms and seisographs, distribution of earthquakes and seismic belts. Volcanoes, types of volcanoes: active, dormant, extinct, explosive, effusive and mixed volcanoes. Types of volcanic eruptions

Unit III

Origin of Earth, Different methods of age determination: physical, geophysical, biological, astronomical, chemical. Radiometric methods of determination of age of Earth, Internal structure and chemical composition of various layers. Application of geophysics in understanding dynamics of the earth.

Unit IV

Concept and theory of Isostasy. Palaeoclimates: Indicators, glacial periods- causes of glacial ages and glacial eustasy. Continental drift: continental matching, matching geology, past galciations, ancient plants and animals, polar wandering curves.

Books
Recommended:

1) Arthur Holmes (1978) Principles of Physical Geology
2) Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3) Gilluly,Water and Woodword: Principles of Geology
4) Robinson, E.S.(1982): Basic Physical Geology
5) Judson,Deffeyws and Hargrave,R.: Physical Geology.
6) Sanders J.E., Anderson Jr., A.Z., Carola: Physical Geology.
7) Cazen, Hatcher and Siemekowski: Physical Geology
8) Borges, Gwalani and Veena Rao: Fundamentals of Geology.
9) Patwardhan A.M.: The Dynamic Earth System.
10) Howell: Introduction to Geophysics.
11) Hamblin, Kenneth: The Earths' Dynamic System.
12) Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
13) Mallory and Cargo: Physical Geology.
14) Judson Kauffman and Leet: Physical Geology.
15) Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
16) Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
17) Manroe and Wicander: Physical Geology: Exploring the Earth

Practicals:

Study and preparation of charts, Preparation of bar graphs, seismographic divisions, distribution of continents at different time frames.

Paper II (Mineralogy)

Course Outcomes (COs)

1) Identify and describe various physical properties of megascopic specimens and optical properties of minerals under microscope.
2) Compare various crystals based on symmetry, symmetry functions and explain crystal system, mineral groups based on physical and optical properties.
3) Outline application of different micro analytical tools used in mineral analysis.
4) Categorize industrial applications and economic importance of various minerals.
5) Justify selection of microanalytical technique selected for the mineral analysis.
6) Prepare a report on a mineral sample by performing the necessary tests and suggest its applications in various fields.

Program Specific Outcomes (PSOs)

(i) Understand fundamental concepts, principles and processes of mineral forming processes and its linkage with related disciplinary areas/subjects
(ii) Demonstrate an understanding of a wide range of rock forming minerals.
(iii) Undertake the chemical compositions of various minerals, categorized as silicate mineral types.

Unit I

Chemical bonding and compound formation. Mineral composition of the earth's crust. Chemistry of minerals (Polymorphism, Isomorphism and Pseudomorphism). Various physical properties of the minerals.

Unit II

Properties dependent on magnetism, electricity and radioactivity. Silicate structures. Rock forming minerals- silicates, oxides and sulphides. Chemical and physical properties and geological occurrences of the following mineral groups: olivine, garnet and aluminous silicates.

Unit III

Chemical and physical properties and geological occurrences of the following rock forming mineral groups: quartz, feldspar, feldpathoids and zeolites.

Unit IV

Chemical and physical properties and geological occurrences of the following mineral groups: pyroxenes, amphiboles and micas.

Books Recommended:

1) Read : Rutley's Elements of Mineralogy.
2) Berry, Mason and Dietrich : Mineralogy
3) Dana and Ford: A Text book of Mineralogy
4) Deer, Howie and Zussman: An introduction to rock forming minerals.

Practicals :

Study of physical properties in hand specimen of the following minerals:
Quartz and its varieties, orthoclase, microcline, albite, labradorite, nepheline, leucite, sodalite, natrolite, stilbite, apophyllite, muscovite, biotite, chlorite, hypersthene, augite, diopside, hornblende, tremolite, actinolite, asbestos, olivine, garnet, kyanite, sillimanite, topaz, staurolite, tourmaline, epidote, serpentine, talc, rhodonite, rhodochrosite, aragonite, calcite, dolomite, magnesite, barite, gypsum, apatite, beryl, fluorite, corundum, kaolinite, zircon and halite.

SEMESTER- I

VSC: Geological Mapping Techniques (BVS1P01)

Practical:

Study and preparation of thematic maps (world, India) - Maps of India - political maps, physical map, rainfall trends, wind maps, drainage maps, soil and land-use maps, mineral deposits, food – crop maps, irrigation maps, agro-climatic zone maps, road and inland maps, railway maps, population maps, natural hazard maps

Books Recommended:

1) Macmillan Publishers India Private Limited (2021)
2) Survey of India toposheets
3) Compton, R.R. (1962) Manual of Field Geology, John Wiley and Sons, Inc.
4) Forrester, J.D. (1957) Principles of Field Geology and Mining Geology, John Wiley.
5) Lahi, F.H. (1987) Field Geology, CBS Publishers.
6) Mathur, S.M. (2001) Guide to Field Geology, Prentice-Hall, New Delhi

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, Motilal Banarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution of Civil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Geology Semester II

Paper I: (Physical Geology and General Geology)

Unit I

Rock weathering and erosion. Geological work done by wind and river.

Unit II

Geological work done by underground water, glaciers and oceans. Brief idea about soil. formation and types of soil.

Unit III

Earth movements: Diastrophism (Orogeny and epeirogeny). Definition and types of geosynclines. Mountain building process and types of mountains. Evolution of continents and oceans.

Unit IV

Evolution of unified theory of plate tectonics. Nature and types of plate margins, sea-floor spreading. Origin and significance of mid-oceanic ridges and trenches; origin and distribution of island arcs.

Books Recommended:

1. Arthur Holmes (1978) Principles of Physical Geology
2. Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3. Gilluly,Water and Woodword: Principles of Geology
4. Robinson, E.S.(1982): Basic Physical Geology
5. Judson, Deffeyws and Hargrave, R.: Physical Geology.
6. Sanders J.E., Anderson Jr., A.Z., Carola: Physical Geology.
7. Cazen, Hatcher and Siemekowski : Physical Geology
8. Borges, Gwalani and Veena Rao: Fundamentals of Geology.
9. Patwardhan A.M.: The Dynamic Earth System.
10. Howell : Introduction to Geophysics.
11. Hamblin, Kenneth: The Earths' Dynamic System.
12. Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
13. Mallory and Cargo: Physical Geology.
14. Judson Kauffman and Leet: Physical Geology.
15. Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
16. Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
17. Manroe and Wicander: Physical Geology: Exploring the Earth

Paper II: (Optical Mineralogy and Crystallography)

Unit I

Petrological microscope: its parts and functioning. Elementary ideas about mineral optics.Critical angle, refractive index, determination of refractive index by i) Becke line method and ii) Abbe refractometer. Twinkling, birefringence, pleochroism, interference colours, extinction and extinction angle, twinning, isotropism and anisotropism. Phenomenon of double- refraction and nicol prism.

Unit II

Optical characters of the following rock forming minerals in ordinary and plane polarized light: Quartz, microcline, orthoclase, albite, labradorite, muscovite, biotite, chlorite, hornblende, hypersthene, augite, olivine, garnet, calcite, kyanite, sillimanite, tourmaline, epidote, tremolite and actinolite.

Unit III

Laws of Crystallography, constancy of interfacial angle, rationality of indices and symmetry. Elementary ideas about crystal structure, crystal faces, edges, solid angles and zone. Crystallographic axes and axial angles. Crystal notations, Miller's indices and WeissParameters. Crystal systems and classification of crystals into six systems. Study of Galena and Zircon class of symmetry.

Unit IV

Crystal symmetry. Study of Beryl, Barytes, Gypsum and Axinite classes of symmetry.

Books Recommended:

1. Read : Rutley's Elements of Mineralogy.
2. Berry, Mason and Dietrich : Mineralogy
3. Dana and Ford: A Text book of Mineralogy
4. Deer, Howie and Zussman: An introduction to rock forming minerals.
5. Smith: Minerals and Microscopes.
6. Roger and Kerr: Optical mineralogy

Practicals:

Study of optical characters of minerals listed for theory course using polarizing microscope.Study of elements of symmetry and description of various forms of crystals from normal classes of six crystal systems.

SEMESTER- II

VSC: Evaluation to Landforms (BVS2P03)

Practical:

Preparation of charts for atmosphere; hydrosphere; biosphere; plotting of major mountain chain of World and in India; plotting of drainage orders and major rivers of India; plotting of major rivers on World map; plotting of deserts on World map.

Recommended Books

1) Arthur Holmes (1978) Principles of Physical Geology
2) Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3) Hamblin, Kenneth: The Earths' Dynamic System.
4) Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
5) Mallory and Cargo: Physical Geology.
6) Judson Kauffman and Leet: Physical Geology.
7) Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
8) Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
9) Manroe and Wicander: Physical Geology: Exploring the Earth

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Home Science)

Submitted by

Board of Studies,
Bachelor of Science (Home Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Home Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Fundamentals of Food and Nutrition	BHS1T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Fundamentals of Food and Nutrition	BHS1P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Human Development-I (Infancy and Toddlerhood)	BHS1T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Human Development-I (Infancy and Toddlerhood)	BHS1P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	1	-	-	1	2	40	10	20	-	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1P01			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO1T02	1	-	-	1	2	40	10	20	-	-	-	-
8	GE/OE	Refer GE/OE Basket	BGO1P02			2	1	-	-	-	-	3	-	50	25
9	VSC	Basic Garments and Accessory Making	BVS1P01	-	-	4	2	-	-	-	-	50	50	50	
10	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50	
11	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-	
12	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-	
13	IKS	History of Home Science - 1	BIK1T01	2	-	-	2	3	80	20	40	-	-	-	
14	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50	
				12	-	20	**22**		**450**	**150**		**200**	**300**	12	

B.Sc. Sem-II (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Textile and Sewing Techniques	BHS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Textile and Sewing Techniques	BHS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Interior Design	BHS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Interior Design	BHS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2P03	-	-	2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2T04	1	-	-	1	2	40	10	20	-	-	-
8	GE/OE	Refer GE/OE Basket	BGO2P04	-	-	2	1	-	-	-	-	-	50	25
9	VSC	Food Preservation and Bakery Science	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
10	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
12	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
13	IKS	History of Home Science - 2	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**170**		**200**	**300**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Home Science Extension	BHS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Home Science Extension	BHS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nutrition through life Span	BHS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nutrition through life Span	BHS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	1	-	-	1	2	40	10	20	-	-	-
10	GE/OE	Refer GE/OE Basket	BGO3P05	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
12	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
13	FP	Field Project (FRM) Housing and Interior Decoration	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				11	-	22	**22**		**410**	**140**		**225**	**325**	

B.Sc. Sem-IV (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Human Development- II (Childhood and Adolescent Development)	BHS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Human Development- II (Childhood and Adolescent Development)	BHS4P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Surface Ornamentation Techniques	BHS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Surface Ornamentation Techniques	BHS4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	1	-	-	1	2	40	10	20	-	-	-
10	GE/OE	Refer GE/OE Basket	BGO4P06	-	-	2	1	-	-	-	-	25	25	25
11	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
12	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
13	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**170**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Name of Program - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Resource Management	BHS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Resource Management	BHS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Developmental Programme in India	BHS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Developmental Programme in India	BHS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Basic Dietetics	BHS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Basic Dietetics	BHS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BHS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BHS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Home Science Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Gerontology and Care of Elderly	BHS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Gerontology and Care of Elderly	BHS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Pattern Making	BHS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Pattern Making	BHS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Event Management and Entrepreneurship	BHS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Event Management and Entrepreneurship	BHS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BHS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BHS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Home Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7T7	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7P7	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7T8	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7P8	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7T9	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7P9	-	-	2	1	-	-	-	-	25	25	25
7	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS7T0	2	-	-	2	3	80	20	40	-	-	-
8	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS7P0	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BHS7T1	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BHS7P1	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BHS7T2	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BHS7P2	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8T225	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8P225	-	-	2	1	-	-	-	-	25	25	25
7	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BHS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BHS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BHS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BHS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BHS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BHS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8P2R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8P2R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8P2R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BHS8T2R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BHS8P2R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Home Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Garments and Accessory Making	Home Science	**BVS1P01**
II	**VSC**	Food Preservation and Bakery Science	Home Science	**BVS2P03**
III	**VSC**	Applied Chemistry - I	Home Science	**BVS3P05**
V	**VSC**	Textile Paintings and Embroidery	Home Science	**BVS5P07**
VI	**VSC**	Innovative Teaching Aids	Home Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Home Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Waste Management	BHS5T12
		B. Digital Communication Methods	
		C. Advanced Dietetics	
VI	Elective 2	A.Toy Based Paedology	BHS6T16
		B. Fashion Design	
		C. Work Simplification and Ergonomics	
		D. Food And Nutrition	
VII (Honors)	Elective 3	A. Food Science and Nutrition	BHS7T21
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VIII (Honors)	Elective 4	A. Food Science and Nutrition	BHS8T27
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VII (Research)	Elective 3	A. Food Science and Nutrition	BHS7T20R
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VIII (Research)	Elective 4	A. Food Science and Nutrition	BHS7T25R
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	

'R' in the subject code indicates 'Research'.

B.Sc. Home Science Semester –I (DSC)
BHS1T01
Fundamentals of Food and Nutrition

Total Marks	**150**
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

OBJECTIVES:

- To understand the functions of food and the role of various nutrients, their requirements and effect of deficiency and excess.
- To promote basic knowledge pertaining to various food groups and nutrients.
- To make students familiar with the different methods of cooking, their advantages and disadvantages.

COURSE CONTENT: THEORY

UNIT- I

I-Introduction to Food and Nutrition-

1. Basic terms used in Food and Nutrition-Definitions-Foods, Nutrition, Balanced Diet

2. Functions of food-Physiological, psychological and social

3. Characteristics of basic food groups and their contribution to the diet

II- Energy-1. Definition and factors affecting BMR.

2. Energy measurement of food (Bomb calorimeter)

III- MACRONUTRIENTS:

Carbohydrates – Definition classifications, functions, sources, deficiency states, and digestion-absorption.

UNIT- II

MACRONUTRIENTS:

I- **Proteins**- Definition, classifications, functions, sources, deficiency states and digestion-absorption.

II- **Fats**- Definition, classifications, functions, sources, deficiency states, and digestion-absorption.

UNIT- III

MICRONUTRIENTS:

I- Vitamins- Functions, Sources and Deficiency of:

a) Fat Soluble Vitamins:

i) Vitamin A; ii) Vitamin D; iii) Vitamin E; iv) Vitamin K

b) Water Soluble Vitamins:

i) Thiamine (B_1) ii) Riboflavin (B_2) iii) Niacin (B_3) iv) Cyanocobalamin (B_{12}) v) Vitamin C

II- Minerals- Functions, Sources and Deficiency of:

a) Major Mineral -i) Calcium ii) Iron iii) Iodine

b) Trace elements- i) Sodium ii) Potassium

Unit -IV

FIBRE, WATER and METHODS of COOKING

I-Fibre: Types of dietary fibre and sources.

II-Water: Functions of water in human body, water balance, sources of water

III- Methods of Cooking:

i. Objectives of cooking food.

ii. Advantages of cooking food.

iii. Different cooking methods and different cooking media.

iv. Effect of different cooking methods on nutritive value of food.

CIE

Total Marks	**20**

PRACTICAL: **(SEE-25 marks)**

1.Food Presentation and Table Setting.

2.Simple cooking- preparation, serving, calculation of cost and yield.

a) **Cereals:** – Plain Rice, Pulao, Sweet Rice Masale Bhat (any 2)

b) Chapati, Puri, Paratha, Missi Roti, Puran Poli, Bhakri (any 2).

c) **Pulse Preparatio**n: Whole, Dehusk and Sprouted (any 2).

d) **Vegetable Preparation**: Dry Curries and Baked (any 2).

SEE-Total Marks	**25**
Cooking	15
Presentation	05
Record	05
CIE	25

e) **Fruit Preparation:** Fresh, Dried Baked and Steamed (any 2).

f) **Milk Preparation**: Porridge, Desserts, Curds, and Paneer Preparation (any 2).

g) **Egg Preparation**: Boiled, Fried, Poached and Custard (any 2)

CIE **25 marks**

Any two of the following:

1. Market survey of the food commodities as per food groups and their cost.
2. Latest Kitchen appliances in the market-their use and upkeep.
3. Scrap Book: Related to food groups, sources, deficiencies of various nutrients.

REFERENCES:

1. Nutritive Value of Indian Foods: Gopalan C, Rama Shastri & Balasubramanin S.C., National Institute of Nutrition1993.
2. Food Science, Chemistry and Experimental Foods: Dr.M.Swaminathan,The Bangalore Printing and Publishing Co. Ltd. 1995.
3. Essentials of Food and Nutrition, Vol.I (Fundamental aspects): Dr. Swaminathan, 2nd edition BAPPCO, 2000.
4. Applied Nutrition: R. Rajlakshami Oxford & IBH Pub. Co.pvt Ltd,3rd edition, 1981.
5. Foods and Nutrition: The Educational Planning Group, Delhi, Arya Publishing House. 3rd edition, 1991.
6. B. Srilakshmi, Nutrition Science, sixth edition, new age international (P) Ltd, New Delhi (2018).
7. Joshi. A. S, "Nutrition & Dietetics", third edition, Tata McGraw hill education Pvt. Ltd., New Delhi (2010).
8. The book of Ingredients: Philip Dowell & Adrian Bailey, Michaey, Michael Joseph, Ltd, 1980.
9. Indian Food Composition Tables: Longvah T, Ananthan R,Bhaskarachary K and Venkaiah K. National Institute of Nutrition,2017.

B.Sc. Home Science Semester –I (DSC)
BHS1T02
Human Development – I (Infancy and Toddlerhood)

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

Objectives:

- To develop an understanding about the discipline of Human Development
- To acquire a detailed understanding of developmental milestones and domains from conception to middle childhood
- To gain insight on context specific cultural practices of development in children and explore the role of family and community in the life of children
- To make student aware of methods of studying human behaviour.

COURSE CONTENT: THEORY

UNIT I: Introduction to Human Development

• Definition, History, Interdisciplinary nature and scope of Human Development

• Domains, Stages and Context of Human Development

• Principles of Growth and Development

• Factors influencing Growth and Development

UNIT II: Prenatal, Birth and the Neonate

• Fertilization, Pregnancy – Signs, Symptoms, Complications, Discomforts

• Conception and Stages of Prenatal Development

• Child Birth - Process and types, Birth complications

• Reflexes and Care of the new-born

UNIT III: Infancy

• Characteristics of infancy

• Major adjustments of infancy

• Physical and Motor Development of infants

• Emotions and Vocalizations of infants

• Sensory capacities of infants

UNIT IV: Toddlerhood

- Developmental tasks and Characteristics
- Physical and Motor Development
- Social and Emotional Development
- Cognitive, Moral and Language Development

CIE **(25 marks)**

Preparation of Workbook (Any One)

- Developmental task
- Immunization
- Album on the stages of Pre-natal development
- Care during Pregnancy

Practicals:

1. Methods of child study –
   - Anthropometry, Observation, Interview, Questionnaire, Case study, Projective, Psychological tests, Sociometry, Longitudinal and Cross-sectional approach
2. A survey of cultural practices related to pregnancy
3. Plan & develop activities to facilitate development in different domains and submit a flip / album of activities.
4 Audio and video resources to study prenatal development, infancy and toddlerhood.

SEE -Total Marks	**25**
Preparation of activities on different domains	**15**
2 Questions	**05**
Record	**05**

References:

- Berk, L. (2013). *Child development*. 9th ed. Boston: Pearson.
- Rice, F. P. (1998). *Human Development: A Life-span Approach*. New Jersey: Prentice Hall.
- Santrock, J. W. (2011). *Life-span development*. New York: McGraw-Hill.
- Singh, A. (Ed.) 2015. *Foundations of Human Development*. New Delhi: Tata McGraw- Hill.

B.Sc. Home Science Semester –I (VSC)
BVS1P01
Basic Garments and Accessory Making

Total Marks	100
Practical	**Marks**
SEE	50
CIE	50

PRACTICALS

1. Demonstration of taking body measurements.
2. Introduction to Tools for Garment construction- Measuring tools, marking tools, Cutting tools, sewing tools, Pressing tools,
3. Sewing machine –parts, functions, care
4. Drafting, cutting & stitching of ;-Apron, Baby Frock
5. Make fashion accessory-Head gears, Hand bags and Jewellery,
6. Make samples of Surface ornamentation- Appliqué, Quilting, smoking,

CIE = 50 Marks

Total Marks - SEE	**50**
Drafting	10
Stitching-	15
Fashion Accessory	10
Surface Ornamentation	10
Record	05

References:

1. Complete Guide to Sewing-Readers Digest, The reader's digest association, 1976
2. Dorling Kindersley- The complete Book of Sewing, London, New York.
3. Complete Book of Sewing, Alison Smith Dorling Kindersley, 1999
4. Singer Sewing Book, Gladys Cunningham, The Singer Company
5. Aswani K.T. Fancy Weaving Mechanism, Mahajan Books, Ahmedabad.
6. Deulkar Durga - Household Textile and laundry work, Atmaram and sons, Delhi,

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

B.Sc. Home Science Semester –I (IKS)
BIK1TO1
Indian Knowledge System
History of Home Science- I

Total Marks	100
Theory	Marks
SEE	80
CIE	20

OBJECTIVES:

1) To unable the students to acquire the knowledge of food and nutrition.
2) To know the history of human development.
3) To impart knowledge about textile and clothing.
4) To gain the knowledge about resource management.
5) To assess the knowledge regarding home science extension.

Unit I

- History of nutrition.
- Nutrition research in India.
- Introduction, definition and importance of traditional foods.
- Introduction and benefit of satvik diet.
- Regional food patterns-Typical breakfast, meals and snacks foods of different regions of India.
- History of millets, types of millets and health benefits of millets.
- Nutrition composition of millets -Jowar, Bajara and Ragi.

Unit -II

- Manusmriti : Indian mental concepts of children (IMCC)
- About Children in Manusmriti: 16 Sanskaars
- Children's education, guru, student, and varna,
- Hinduism and Children, Jainism and Children, Buddhism and Children

Unit III

Traditional Costumes of Different States of India

- History and Accessories of Male and Female Costumes of Maharashtra,
- History and Accessories of Male and Female Costumes of Punjab,
- History and Accessories of Male and Female Costumes of Gujrat
- History and Accessories of Male and Female Costumes of Rajasthan,
- History and Accessories of Male and Female Costumes of Tamil Nadu

UNIT- IV RESOURCE MANAGEMENT

1. Concept of Housing, Need of Housing and Functions of housing
2. Evolution of Housing – The First shelter, Temporary shelter, Permanent shelter
3. Shelter in ancient civilization
4. Changes in housing needs and standards due to influence of services and modern amenities.
5. Factors affecting housing

UNIT-V HOME SCIENCE EXTENSION

- Home science extension in India, History, concept, characteristics.
- Role of home science extension in National development
- Teaching and learning Indian knowledge system through extension education
- Folk and traditional media: Meaning, Strength of the folk & traditional media, Limitations of folk and traditional media.
- Traditional folk media: Folk song, folk dance, powada, puppet show, street play.

References:

- B. Srilakshmi, Nutrition Science, Sixth Edition, New Age International (P) Ltd, New Delhi (2018).
- B. Srilakshmi, Food Science, Third Edition, New Age International (P) Ltd, New Delhi (2006)
- Joshi. A. S, "Nutrition & Dietetics", Third Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi (2010).
- Ambedkar BR. *Buddha and his Dhamm. (Hindi translation: Anand Kausalyayan)* Nagpur: Samata Sainik Dal; 1993. pp. 217–9.
- Kapur M, Mukundan H. Child care in ancient India from the perspective of developmental psychology and paediatrics. 1st ed. New Delhi: Sri Satguru Publications; 2002.
- Sitholey P, Agarwal V, Vrat S. Indian mental concepts on children and adolescents. Indian J Psychiatry. 2013 Jan;55(Suppl 2):S277-82. doi: 10.4103/0019-5545.105551. PMID: 23858268; PMCID: PMC3705696, retrived from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3705696/
- The compendium of eight branches of Ayurveda- Astangasamgraha, Vol. 3. New Delhi: Sri Satguru Publications; 1999. (Translated by a board of scholars).

- Vastrashastra: Prof. Vimal Adhau Maharashtra Vidhyapeeth Granth Nirmit Mandalasathi, Vidhya Books Aurangabad.
- William Watson - Textile Design and colour, Longman Green and Co. London.
- Agan T.C. – The House Oxford and I.B.H. publishing Co.
- Andreas, P (2019), Housing for all : Building Catalogue, Dom publishers
- Balchin, P & M Rhoden, (2003), Housing – The essential Foundation, Routledge.

- Castro, a & Hope (2015), Housing and Habitat in the Ancient Mediterranean: Cultural and Environmental responses, Peeters Pub and Booksellers.
- Deshpande R.S. – Modern Indian Homes in India, United Book Corporation, Poona 2nd Edition
- Dwivedi, R.M (2007), Urban Development and Housing in India: 1947 to 2007, New Century Publication
- Hiraskar, G.K. (2016), The Great Ages of World architecture, Dhanpat Rai Publication Limited, New Delhi.
- Modern Houses in India (2017) Creaivity Publishers.

- Dahama,O.P. and Bhatnagar O.P. Education and Communication for Development, Oxford & IBH Publishing Co., New Delhi.
- Supe, S.V. An Introduction to Extension education, Oxford Publishing Company, New Delhi & Kolkata, 1999.

B.Sc. Home Science Semester –II (DSC)
BHS2T03
Textile and Sewing Techniques

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

OBJECTIVES :

1. To get acquainted with basic knowledge of textile fibers.
2. To understand the importance and necessity of various construction techniques for different fabrics, and to acquire the skills to apply those construction techniques in a sample form
3. To acquire knowledge and skill regarding stitching techniques for various garment components such as plackets, pockets, cuffs, collars, and fasteners which are ultimately used for stitching of any garments
4. To acquire knowledge and skill regarding stitching techniques for various garment components

Unit I :

1. Importance of Clothing :.
2. Classification of textile fibers, General and essential properties of textile fibers
3. Manufacturing process of natural fibers.;-Cotton, silk, wool
4. Physical and chemical properties of natural fibres

Unit II :

1. Manufacturing process, of man made fibers :- viscose rayon, nylon, polyester
2. Physical and chemical properties of manmade fibres
3. Latest fibres :- Introduction and use of - Organic cotton , Bamboo , Soy, Lyocel, Metallic, Lycra(spandex)

Unit III :

1. Types of Yarn – Simple, novelty, textured yarns, Yarn twist,
2. Mechanical Spinning - Ring spinning,
3. Chemical spinning – Dry, wet, melt.

Unit IV :

1. Introduction to Seams –Plain ,French, Lapped Flat fell,
2. Tucks- Pin, Cord, Cross
3. Pleats – Knife, box, inverted.
4. Gathers – Machine and hand gathers
5. Types and uses of -Belts, Frills, Zipper, Buttons, Hooks and loops,
6. Types and uses of –Yokes ,Collars ,Pockets, Sleeves

PRACTICALS :

1. Drafting cutting and stitching of :-Baba suit, Romper
2. Make an album of :

   a..Seams : French, Lapped, Flat fell

   b. Tucks : Pin, Cross, Corded

   c. Pleats : Side, Box, Inverted

Total Marks SEE	**25**
Drafting	05
Stitching-	10
Sample Making	05
Record	05
CIE	**25**

References:

- Deulkar Durga - Household Textile and Laundry Work, Orient Longman, Delhi.
- Dantyagi S. - Fundamentals of Textile and their care. Orient Longman, Delhi.
- Dorling Kindersley- The complete Book of Sewing, London, New York.
- Dorothy Siegart, Lyle-Modem Textiles, John Wiley and Sons.lnc New York
- Doongaji. S and Deshpande R - Basic Process of Clothing Construction.
- Erwin, Mabel and kinchen- Clothing for Modern, Mac Milan publishing, New York.
- Fabrics science by Joseph Puzzuto
- Modern textiles by Dorothy Siegert Lyle
- Understanding fabric from fiber to finished cloth by Dbbie and Giollo
- Understanding textiles by Phyllis G. Tortora and Billie J Collier
- Corbman,P.B., Textiles-Fibre to Fabric, Gregg Division/McGraw Hill Book Co.,US, 1985.
- Joseph M.L.,Essentials of Textiles (5th Edition), Holt, Rinehart and Winston Inc.,Florida, 1988.
- Complete Guide to Sewing-Readers Digest, The reader's digest association, 1976
- Complete Book of Sewing, Alison Smith Dorling Kindersley, 1999
- Singer Sewing Book, Gladys Cunningham, The Singer Company

B.Sc. Home Science Semester –II (DSC)
BHS2T04
Interior Design

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

Objective :

1) To develop good taste through the study of basic elements and principles of design
2) To acquire knowledge about aesthetic sense to become good art consumer
3) To acquire knowledge of using colors to create different effects in space, with the use of various color schemes.
4) To develop skill /techniques of using color in different media
5) To gain knowledge of flowers / floral decoration and arrangement

UNIT - I

1. Elements of Art – i) Line ii) Form iii) Colour iii) Texture vi) Space v) Light vi) Pattern vii) Idea
2. Principles of Design in Interior
   i. Harmony,
   ii. Balance,
   iii. Rhythm,
   iv. Proportion
   v. Emphasis

UNIT - II

1. Design in current life style - Concept of Design, Objectives of design –i) Beauty ii) Expressiveness iii) Functionalism
2. Importance of good taste
3. Aesthetic sense and its importance
4. Types of design: i) Structural ii) Decorative iii) Naturalistic iv) Stylized v) Geometric vi) Abstract vii) Modern viii) Traditional

UNIT – III

1. Importance of colour in Interior Decoration
2. Characteristics or dimensions of colour (a. Hue, b. Value, c. Intensity)
3. Classification of colour - a. Primary, b. Secondary, c. Intermediate, d. Tertiary, e. Quaternary

4 Colour Schemes:

i) Related colour scheme
ii) B. Contrast colour scheme

Unit - IV

1. Definition, Importance and Objectives
2. Material Required

3. Types of flower arrangement
   Traditional
   Oriental / Japanese
   Modern
   Floating
   Miniature
   Dry
4. Application of Elements of Art in flower Arrangement
5. Application of Principles of Art in Flower Arrangement.
6. Do's & Don'ts in flower arrangement

PRACTICALS

1. Classification of colors (Primary, Secondary and Intermediate)
2. Colour Wheel
3. Warm & Cool colours
4. Value Scale
5. Colour Schemes (Monochromatic, Analogous, Complementary, Triad and Neutral)
6. Types of flower decoration/arrangements (i) Single stick ii) Small Bunch iii) Miniature iv) Modern)
7. Accessories in home decoration (Creative Art)

CIE = 25

Practicals	**SEE Total Marks – 25**
Colour Wheel/ Warm & Cool colours/ Value Scale	05
Colour Scheme	10
Flower arrangement	05
Record Book	05

B.Sc. Home Science Semester –II (VSC)
BVS2P03
Food Preservation and Bakery Science

Total Marks	100
Practical	Marks
SEE	50
CIE	50

OBJECTIVES:

- To acquire knowledge of food preservation and preservation techniques.
- To know the importance and basic principles of food preservation.
- To understand the importance of baking.

Preservation

- Introduction of food preservation and bakery

1. Preparation of Squash/Syrup
2. Preparation of Pickle
3. Preparation of Jam and Jelly
4. Preparation of Chutneys
5. Preparation of Sauce
6. Preparation of Tutti frutti
7. Preparation of Murrabbas

Total Marks	**100**
SEE	**50**
Cooking	20
Presentation	15
Record	15
CIE	**50**

Bakery

1. Preparation of Cakes
2. Preparation of Nankhatai and Biscuits

CIE

- Scrap Book: Related to methods of food preservation.
- To organize exhibition of food products.

Any one of the following:

- Visit to preservation units.
- Visit to bakery units and bakery outlets.

REFERENCES:

- B. Srilakshmi, Food Science, third edition, new age international (P) Ltd, New Delhi (2006).

- N Shakuntala Manay and M Shakuntala Manay, Foods Facts and Principles, New Age International (P) Ltd, New Delhi (1995).
- Rahman M S (2007) Handbook of Food Preservation 2nd ed CRC Press .
- Srivastava R P and Kumar S (2002) Fruits and Vegetables Preservations : Principles and Practices, 3rd Edition . International Book Distributing Co. Lucknow.
- Dubey,S.C.Basic Baking IV Edtion, The Society of Indian Bakers, New Delhi.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao. Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

B.Sc. Home Science Semester –II (IKS)
BIK2T02
Indian Knowledge System
History of Home Science-II

Total Marks	100
Theory	Marks
SEE	80
CIE	20

Objectives:

1. To enhance the knowledge of food and nutrition.
2. To acquire knowledge regarding child care in ancient India
3. To familiarize with the traditional sarees of different states of India
4. To comprehend the knowledge aboutvastushastra.
5. To understand the evolution of knowledge system in home science extension and traditional folk media

COURSE CONTENT: THEORY

UNIT I

- Concept of health.
- Guidelines for good health
- Relationship between nutrition and health.
- Introduction and definition of yoga.
- Yogasana - meaning, principal and their health benefit.
- Introduction to Pranayama and Dhyana and their health benefits.
- Concepts of Aahara (Diet) according yogic text.

UNIT II

Child care in Ancient India (Perspectives of developmental psychology)

- Care of the newborns and children
- Rites of passage and rituals
- Common childhood disorders
- Treatment of childhood disorders

UNIT III

Traditional Sarees of Different states of India:

- Bandhani :-History, Colour, Designs and Threads used in it
- Patola :- History, Colour, Designs and Threads used in it
- Chanderi :- History, Colour, Designs and Threads used in it
- Paithani :- History, Colour, Designs and Threads used in it
- Dacca :- History, Colour, Designs and Threads used in it
- Brocades :- History, Colour, Designs and Threads used in it
- Kashmiri Shawls :- History, Colour, Designs and Threads used in it

UNIT IV RESOURCE MANAGEMENT

1. History of Vastushastra
2. Importance of Vastushastra
3. Placement of Rooms according to vastushaastra
4. Placement of Doors according to vastushaastra
5. Location of Water bodies according to vastushaastra

UNIT V

- Evolution of knowledge system in home science extension.
- Evolution of system approaches to agricultural innovations.
- Use of natural resources
- Different folk media to transmit knowledge, culture, traditions, custom, social values, norms.
- Traditional folk media: Drama, bhajan, kirtan, bharud, davandi.

References:

- Maimum Nisha, Health Food & Nutrition, Kalpaz Publication.
- B. Srilakshmi, Nutrition Science, sixth edition, new age international (P) Ltd, New Delhi (2018).
- Joshi. A. S, "Nutrition & Dietetics", third edition, Tata McGraw hill education Pvt. Ltd., New Delhi (2010).
- Sen Colleen Taylor Food Culture in India Greenwood Press,2005
- Swami Mangalteertham : Synthetic approach to Diet & Nutrition, Deogarh Nutan Publication, Deogarh, 2005 4. Swami Gambh
- Dr R Nagarathna and Dr H R Nagendra: Yoga and Health, Swami Vivekananda Yoga Prakashana, 2002.
- Kapil Kapoor, "Indian Knowledge Systems: Nature, Philosophy and Character" in Indian Knowledge Systems, Kapil Kapoor & Avadhesh Kumar Singh (eds), DK Printworld, New Delhi, 2002
- https://www.exoticindiaart.com/book/details/child-care-in-ancient-india-from-perspectives-of-developmental-psychology-and-paediatrics-nac410/
- Usha Shrikant - Ethinic Embroidery of India, SamaiaEnterprises , Mumbai.
- Vastrashastra:Prof.VimalAdhauMaharashtra VidhyapeethGranthNirmitMandalasathi, Vidhya Books Aurangabad.
- William Watson - Textile Design and colour, Longman Green and Co. London.
- Agan T.C. – The House Oxford and I.B.H. publishing Co.
- Deshpande R.S. – Modern Indian Homes in India, United Book Corporation, Poona 2nd Edition
- Goldstein H./Goldstein V. – Art in Every day Life Macmillan Co. , New York, 4th Edition
- Pak – Tin & Helan Yeap – Feng Shui – Health Harmony B. Jain Publishers Pvt. Ltd. New Delhi , 1998
- Edition Shrivastav - Remedial Vastushastra, Manoj Publication, Delhi, 2001
- Dahama, O.P. and Bhatnagar O.P. Education and communication for Development, Oxford & IBH Publishing Co., New Delhi, 1977.
- Supe, S.V., An introduction to Extension Education, Oxford Publishing Company, New Delhi and Kolkata.

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Scheme and Syllabus

Bachelor of Science (Information Technology)

Submitted by

Board of Studies,

Bachelor of Science (Information Technology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Information Technology- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Information Technology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in C	BIT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in C	BIT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	IT Support Technologies	BIT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	IT Support Technologies	BIT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using C++	BIT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Object Oriented Programming using C++	BIT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Operating System and Linux	BIT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Operating System and Linux	BIT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structure	BIT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structure	BIT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Java Programming	BIT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Java Programming	BIT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Java Programming	BIT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Java Programming	BIT4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BIT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BIT4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	.NET Framework using C#	BIT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	.NET Framework using C#	BIT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Base Management System	BIT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Base Management System	BIT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Warehousing	BIT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Warehousing	BIT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BIT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BIT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Python Programming	BIT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BIT6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Communication and Network	BIT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Communication and Network	BIT6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Unix Shell Programming	BIT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Unix Shell Programming	BIT6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BIT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BIT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Information Technology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	R-Programming	BIT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	R-Programming	BIT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cloud Computing	BIT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cloud Computing	BIT7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Analytics	BIT7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Analytics	BIT7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Software Architecture & Design	BIT7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Software Architecture & Design	BIT7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BIT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BIT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BIT7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BIT7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BIT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BIT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Internet of Things (IoT)	BIT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Internet of Things (IoT)	BIT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Information Architecture	BIT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Information Architecture	BIT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	3D Object Modelling	BIT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	3D Object Modelling	BIT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BIT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BIT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	R-Programming	BIT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	R-Programming	BIT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cloud Computing	BIT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cloud Computing	BIT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Analytics	BIT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Analytics	BIT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BIT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BIT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Artificial Intelligence	BIT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BIT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Internet of Things (IoT)	BIT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Internet of Things (IoT)	BIT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Information Architecture	BIT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Information Architecture	BIT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BIT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BIT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Information Technology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Information Technology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Web Technology	BIT5T12
		B. VB.NET	
VI	Elective 2	A. PHP	BIT6T16
		B. ASP.NET	
VII (Honors)	Elective 3	A. SQL and PL-SQL	BIT7T21
		B. Data Mining	
VIII (Honors)	Elective 4	A. Business Analytics	BIT8T27
		B. Machine Learning	
VII (Research)	Elective 3	A. Deep Learning	BIT7T20R
		B. Block Chain Technology	
VIII (Research)	Elective 4	A. Neural Networks	BIT7T25R
		B. Parallel Computing	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Information Technology- Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students analyze the requirements for system programming and exposes students for information systems

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for the study of modern methods of information processing and its applications.

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students who wish to go on to further studies in computer science and related subjects.

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Information Technology - Major)
SC-DSC (Paper I)
BIT1T01
PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings, structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.

File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B.Sc. Sem-I (Information Technology - Major)
SC- DSC (Paper II)
BIT1T02
IT SUPPORT TECHNOLOGIES

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the different types of IT support technologies.
2.To understand the different types of network topologies.
3.To understand the concepts of cryptography.

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Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of network topologies
3.Understand challenges of cloud computing in terms of application security.

Unit I

Introduction to the different types of IT Support Technologies.Infrastructure, Hardware Support, Security. Need for IT Support, traditional IT Support demands vs modern IT Support demands. Evolving support technologies.

Unit II

Introduction to LANs, WANs, MANs, Internet.Types of cables, switches, routers, repeaters. LAN topologies: Bus topology, Ring topology, Token passing rings. Cloud service and Deployment models, Server virtualization.

Unit III

Security concerns in modern IT, Challenges of cloud computing in terms of application security, server security, and network security. Security in computer networks: principles of cryptography, symmetric key, public key, digital signatures, firewalls.

Unit IV

Security in different layers: secure E-mail, SSL,IP security. Firewall planning and design, developing a security policy, firewall configuration strategies. Recent trends and challenges in the field of IT Support Technologies.

Books

1.Deal Richard, Cisco ASA configuration (1 ed.), Tata McGraw-Hill Education, 2009. ISBN 978-0070677241.
2.William Stallings, Data and Computer Communications (9 ed.), Pearson Education, 2010. ISBN 978-0131392052.
3.Raj Kumar Buyya,JamesBroberg and Andrezei M. Goscinski, Cloud Computing: Principles and paradigms (1 ed.), MIT Press, 2011. ISBN 978-0470887998.
4.B. A. Forouzan, Data communication and Networking (5 ed.), McGraw Hill, 2007. ISBN 978-1259064753.
5.A. S. Tanenbaum, Computer Networks (5 ed.), Prentice Hall, 2010. ISBN 978-0133485936.

B.Sc. Sem-I (Information Technology)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem -II (Information Technology - Major)
SC- DSC (Paper I)
BIT2T03
OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.
Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**
Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.
Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.Sc. Sem -II (Information Technology - Major)
SC- DSC (Paper II)
BIT2T04

OPERATING SYSTEMS AND LINUX

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.
4. To understand structure of Linux OS and commands.

Course Outcome: After completion of this course, students will be able to:
1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison : Deterministic Modeling , Queuing analysis, Simulators. Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT III

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods

UNIT IV

Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories. Shell: Creating User Account, Shell Program, bash shell, Changing shell prompt. Commands: Basic Syntax for a command,

Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp, Managing users accounts, Changing Password, Creating group accounts.

Books:

1.Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2.Operating System Concept :Silbershaz (Addision Education)
3.Operating System :A.S.Godbole (TMH)
4.Modern Operating Systems :Tenenenbaum (Pearson Education)
5.SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]

B.Sc. Sem-II (Information Technology)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV

Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister.
https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Mathematics)

Submitted by
Board of Studies,
Bachelor of Science (Mathematics)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Mathematics - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra and Trigonometry	BMT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra and Trigonometry	BMT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Differential Calculus	BMT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Differential Calculus	BMT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Sage Math software system	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Integral Calculus and Ordinary DEq	BMT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Integral Calculus and Ordinary DEq	BMT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Vector Analysis	BMT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Vector Analysis	BMT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Maxima software system	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Mathematics- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Partial Differential Equations	BMT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Partial Differential Equations	BMT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Analytical Solid Geometry	BMT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Analytical Solid Geometry	BMT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BMT1T01	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BMT1P01	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BMT1T02	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BMT1P02	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Mathematics- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mathematical Methods	BMT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mathematical Methods	BMT4P07			2	1	-	-	-	-	25	25	25
3	DSC	Sequences and Series	BMT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sequences and Series	BMT4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BMT2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BMT2P03			2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BMT2T04	2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BMT2P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Analysis	BMT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Analysis	BMT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Abstract Algebra	BMT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Abstract Algebra	BMT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mechanics	BMT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mechanics	BMT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BMT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BMT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)	BMT3T05	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)	BMT3P05	-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)	BMT3T06	2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)	BMT3P06	-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Complex Analysis	BMT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Complex Analysis	BMT6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Algebra	BMT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Algebra	BMT6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Graph Theory	BMT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Graph Theory	BMT6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BMT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BMT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)	BMT4T07	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)	BMT4P07	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Mathematics - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-1	BMT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-1	BMT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-1	BMT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-1	BMT7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Topology	BMT7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Topology	BMT7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Ordinary Differential Equations	BMT7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Ordinary Differential Equations	BMT7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BMT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BMT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BM7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BM7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-2	BMT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-2	BMT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis -2	BMT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis -2	BMT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Differential Geometry	BMT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Differential Geometry	BMT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Integral Equations	BMT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Integral Equations	BMT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BMT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BMT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-1	BMT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-1	BMT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-1	BMT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-1	BMT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Topology	BMT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Topology	BMT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BMT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BMT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BMT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BMT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Algebra-2	BMT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-2	BMT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-2	BMTT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-2	BMTT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Differential Geometry	BMT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Differential Geometry	BMT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BMT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BMT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Mathematics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Sage Math software system	Mathematics	**BVS1P01**
II	**VSC**	Maxima software system	Mathematics	**BVS2P03**
III	**VSC**	Mathematical foundation for data science	Mathematics	**BVS3P05**
V	**VSC**	Scilab	Mathematics	**BVS5P07**
VI	**VSC**	Statistics with R	Mathematics	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Mathematics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Linear Programming Problems	BMT5T12-A
		Statistics	BMT5T12-B
VI	Elective 2	Mathematical Modeling	BMT6T16-A
		Special Theory of Relativity	BMT6T16-B
VII (Honors)	Elective 3	Advanced Numerical Methods	BMT7T21-A
		Fluid Dynamics	BMT7T21-B
VIII (Honors)	Elective 4	General Theory of Relativity	BMT8T27-A
		Operations Research	BMT8T27-B
VII (Research)	Elective 3	Ordinary Differential Equations	BMT7T20R-A
		Advanced Numerical Method	BMT7T20R-B
VIII (Research)	Elective 4	Integral Equations	BMT7T25R-A
		General Theory of Relativity	BMT7T25R-B

'R' in the subject code indicates 'Research'.

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

As per National Education Policy 2020

B.Sc. Four Years (Honors/Research)

Curriculum Framework for Eight Semester Degree Course with Mathematics Major

B.Sc. Part I (Semester I and II)

With effect from
the Academic Year 2023-24
B.Sc. Part I (Semester I and II)

PROGRAM: B. Sc. Mathematics

Program Outcome:

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by
connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Program Specific Outcome:

PSO1: **Rational Thinking**: Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.

PSO2: **Problem solving ability**: Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.

PSO3: **Revisiting the question**: Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.

PSO4: **Analytical ability**: In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.

PSO5: **Numerical Ability**: Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.

PSO6: **Simulation Ability**: The problems that cannot be solved directly, can at times be solved through techniques of simulation by honors/research students.

PSO7: **Research**: Students thus motivated would prepare themselves for research studies in Mathematics and related fields.

PSO8: **Application**: Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.

B.Sc. Semester I (MATHEMATICS)

Sem I Paper - I **DSC (Core) Code: BMT1T01** **For Minor: BMT1T01**	Course Title: **Algebra and Trigonometry** **Course Outcomes:** CO1: **Foundational Knowledge**: Students will be able to update their basics of Set Theory, Matrices, Theory of equations and Complex variables and its applied aspects. CO2: **Elementary Skills**: Students will be able to understand the importance of hyperbolic functions and their relationships with trigonometric functions. CO3: **Basic Analytic skills**: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving. CO4: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for B.Sc. Semester – I Paper - I **BMT1T01: Algebra and Trigonometry**	**No. of hours**
	Unit I – <u>Algebra</u>: Set theory, equivalence relations, equivalence classes. Theory of Numbers: Divisibility, division algorithm, Euclidean algorithm, congruence, linear congruence.	**8**
	Unit II - <u>Matrices</u>: Hermitian and skew- Hermitian matrices, idempotent, nilpotent, involuntary, orthogonal and unitary matrices. Rank of a matrix, Equivalent matrices, Row canonical form, Normal form, System of homogeneous and non-homogeneous equations, Characteristic equation and roots, Application of Cayley-Hamilton Theorem.	**7**
	Unit III – <u>Theory of Equations</u>: Relation between the roots and the coefficients of general polynomial equation in one variable, Descartes' rule of signs, Calculation of f(x + h) by Horner's process, Transformation of equations, Reciprocal equations. Solution of cubic Equation (Cardon's Method) and Biquadratic equations (Ferrari's Method)	**7**
	Unit IV - <u>Trigonometry</u>: De Moivre's Theorem and its application, The n^{th} roots of unity, series expansions of circular, inverse circular and Hyperbolic functions, Separation of f(z) into real and imaginary parts. Logarithm of a complex variable, Properties of logarithmic function.	**8**
	<u>Reference Books:</u> 1) Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi. **2)** Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000. **3)** Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008.	

	4) Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981) **5)** A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010 **6)** Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974) **7)** Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012 Suggested digital platform: NPTEL/SWAYAM/MOOCs	
	PRACTICAL: BMT1P01: Algebra and Trigonometry	
Sem I **Paper - I** **DSC (Core) Code: BMT1P01** **For Minor: BMT1P01**	**Course Outcomes:** CO1: Students will be able to learn implications of equivalence relations in determining equivalence classes. CO2: Students will understand properties of divisibility through problem solving. CO3: Students will be able to perform different operations on the given congruence. CO4: Solution of linear congruence will be studied by students. CO5: Students will be able to perform matrix operations to determine invertible matrices, row canonical and normal form of the matrices. CO6: Students will be able to apply matrix operations to solve system of linear equations. CO7: Students will be able to find roots of a cubic and biquadratic equation. CO8: Students will be able to apply De Moivre's theorem to find n^{th} roots of a complex number find.	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT1P01: Algebra and Trigonometry Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	<u>List of topics for practical problems:</u> (1) Comparing relations and functions. (2) Exploring implication of equivalence relations in determining equivalence classes. (3) Properties of divisibility through problem solving. (4) Application of different operations on the given congruence. (5) Solution of linear congruence (6) Matrix algebra: (i) $AB \neq BA$ in general (ii) $A \neq 0, B \neq 0$ but $AB = 0$ (iii) $(AB)' = B'A', (AB)^{-1} = B^{-1}A^{-1}$	

(7) Different methods of finding Inverse of a matrix.

(8) Row canonical form, normal form and rank of a matrix.

(9) Solution of system of linear equations $AX = 0$ and $AX = B$, $B \neq 0$ using row operations.

(10) Linearly independent and dependent vectors in terms of a row.

(11) Application of Cayley-Hamilton theorem

(12) Solving Eigen value problems: Eigen values and eigen vectors of square matrices.

(13) Calculation of $f(x + h)$ by Horner's method

(14) Roots of a polynomial equation: Arithmetic, Geometric, Harmonic progression.

(15) Reciprocal equation, their types, and their solutions.

(16) Application of Cardano's method to find roots of a cubic equation.

(17) Application of De Moivre's theorem to find nth roots of a complex number.

(18) Trigonometric functions, hyperbolic functions and their relations.

(19) Separation of real and imaginary parts of trigonometric and hyperbolic functions.

(20) Logarithm of a real valued and complex valued functions.

Reference Books:

1. Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi.
2. Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000.
3. Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008.
4. Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981)
5. A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010
6. Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974)
7. Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012

Suitable computer programs can be used: SageMath/Maxima/SciLab/etc

Sem I **Paper - II** **DSC (Core) Code: BMT1T02** **For Minor: BMT1T02**	Course Title: **Differential Calculus** **Course Outcomes:** CO1: **Foundational Knowledge**: Students will be able to update their basic knowledge of Maxima and Minima of functions of single variables and their application. CO2: **Elementary Skills**: Students will undergo problem solving training by learning Indeterminate forms and L' Hospital's Rule and their applicability. CO3: **New Concepts learning**: Students will be able to learn new concept of functions of two variables, Taylor series, and maxima and minima of such functions. CO4: **Analytic Skills**: The problem-solving skills will bring forth the importance of Jacobian in understanding the existence of inverse transformation and other aspects of independence of pair of functions. CO5: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for BSc Semester – I Paper -II **BMT1T02: Differential Calculus**	**No. of hours**
	Unit I – <u>Functions of Single Variable – Part 1:</u> Intermediate value theorem, Rolle's Theorem, Mean value theorems and their geometrical interpretations, Applications of mean value theorems. Maxima and Minima; cases of one variable involving second or higher degree polynomials	**8**
	Unit II – <u>Functions of Single Variable – Part 2:</u> Successive differentiation and n^{th} differential coefficient of functions, Leibnitz's theorem, Maclaurin's and Taylor's theorems, Indeterminate forms and L' Hospital's Rule	**7**
	Unit III -. <u>Functions of Two Variables – Part 1:</u> Limit and continuity of functions of two variables, Partial derivatives, Homogeneous functions, Total differentials, Composite functions, Asymptotes.	**7**
	Unit IV - <u>Functions of Two Variables – Part 2:</u> Jacobians and its properties, Taylor's series of function of two variables, Maxima and Minima of function of two variables, Lagrange's method of multiplier.	**8**
	<u>Reference Books:</u> 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974	

	4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019 5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992 6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 **7.** Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010 Suggested digital platform: NPTEL/SWAYAM/MOOCs	

Sem I Paper - II **DSC (Core) Code: BMT1P02** **For Minor: BMT1P02**	**PRACTICAL: BMT1P02: Differential Calculus**	
	Course Outcomes: CO1: Students will be able to make out the maximum or minimum nature of the functions by applying different conditions on the functions. CO2: Working on Geometric interpretation of Mean value theorems through graphs of a function will make students grasp the subject admirably. CO3: Students will learn application of Leibnitz, Maclaurin's and Taylor's theorems. CO4: Students will be able to apply L' Hospital's Rule to solve the problems CO5: Solving problems when functions involved are homogeneous CO6: Students will able to solve Jacobians and learn properties due to Jacobian. CO7: Analyzing Maxima and Minima of functions of two variables	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT1P02: Differential Calculus Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: (1) Application of Rolle's theorem (2) Geometric interpretation of Mean value theorems through graph of a function (3) Application of Mean Value Theorems (4) Comparing results due to Rolles' theorem and Lagrange's mean value theorem on a given function with different conditions. (5) Application of Intermediate value theorem, and analyze it through its graph (6) Determination of n^{th} differential coefficient of functions (7) Application of Leibnitz's theorem (8) Application of Maclaurin's theorem and Taylor's theorems (9) Comparing different Indeterminate forms, and their conversions if possible (10) Solution of limiting problems using L' Hospital's Rule (11) Performing iterative limits on functions of two variables (12) Solving partial derivatives for functions of two variables (13) Solving problems when functions involved are homogeneous	

	(14) Solving total differentials of scalar functions (15) Finding asymptotes of a function and analyze it through its graph. (16) Solving Jacobians of functions f & g (17) Analyzing independent nature of functions f & g through Jacobians (18) Verification of $J J' = 1$ for a given function and analyze existence of inverse transformation (19) Analyzing Maxima and Minima of function of two variables (20) Application of Lagrange's method of multiplier **Reference Books:** 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019 5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992 6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 7. Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010 **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

Vocational Skill Enhancement Course (VSC)

SEMESTER - I

VSC – 01 : Sage Math Software System

Sage is free, open-source Mathematics software that supports research and teaching in algebra, geometry, number theory, cryptography, numerical computation, and related areas.

(**Download from http://www.sagemath.org/**)

SYLLABUS

	PRACTICAL: Sage Math Software System	
Sem- I **VSC - 01** **Code:** **BVS1P01**	Course Title: **SAGE MATH SOFTWARE SYSTEM** Course Outcomes: **Students will be able** 1) to explore topics in Calculus, Applied Linear Algebra and Numerical Method along with several applications 2) to learn an alternative software as against the commercial products Magma, Maple, Mathematica and MATLAB 3) to learn the most recent algorithms and tools for many domains of mathematics 4) to use as wonderful scientific and graphical calculator.	**Credit 2** **No. of hours** 30
	Syllabus for BSc Semester – I: VSC - 01 **Code BVS1P01: SAGE MATH SOFTWARE SYSTEM**	**No. of hours**
	TOPICS: 1. Introductory Tutorial 2. Evaluating Sage Commands 3. Functions in Sage 4. Annotating with Sage 5. Basic Symbolics and Plotting 6. Basic 2D Plotting 7. Basic 3D Plotting 8. Calculus 1- Differentiation 9. Calculus 2- Integration 10. Advanced 2D Plotting 11. Graphing Functions and Plotting Curves 12. Plotting Data	**30**
	Reference books / materials: **1.** Computational Mathematics with Sage Math, By Paul Zimmermann, Alexandre Casamayou, Nathann Cohen, Guillaume Connan, Thierry Dumont, Laurent Fousse, François Maltey, Matthias Meulien, Marc Mezzarobba, Clément Pernet, Nicolas M. Thiéry, Erik Bray, John Cremona, Marcelo Forets, Alexandru Ghitza, Hugh Thomas. **2.** https://doc.sagemath.org/html/en/prep/index.html **3.** https://www.ictmumbai.edu.in/Mathematics/SageMath Lecures_AjitKumar_ICT Mumbai.pdf **4.** http://lamastex.org/preprints/compSageMathZimmerman120517.pdf **5.** ajitmathsoft.wordpress.com/sage math	

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere-Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (8 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (8 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution of Civil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Sem- II **Paper - I** **DSC (Core) Code: BMT2T03** **For Minor: BMT2T03**	Course Title: **Integral Calculus and Ordinary Differential Equations** **Course Outcomes:** CO1: **Foundational knowledge**: Students to update their knowledge of improper integrals, Beta and Gamma functions and their applicability. CO2: **Basic skills**: Students will be able to understand the importance of varied methods of solving differential equations of first and second order. CO3: **Analytical skills**: The main objective of the course is to equip students with necessary analytic skills due to integrability and solutions of differential equations. CO4: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for BSc Semester – II Paper - I **BMT2T03: Integral Calculus and Ordinary Differential Equations**	**No. of hours**
	Unit I - <u>Reduction Formulae and Beta, Gamma Functions:</u> Reduction formulae for basic trigonometric functions, Integration of irrational functions, Beta and Gamma functions, their properties, Relation between Beta and Gamma functions, Evaluation of integrals using Beta and Gamma functions.	**8**
	Unit II – <u>Multiple Integrals:</u> Double integration, Application of double integrals, Change the order of integration, Change of variable, Triple integration.	**7**
	Unit III – <u>First Order Differential Equations:</u> Exact differential equations, Integrating factors, Linear and Bernoulli's differential equations, First order higher degree differential equations solvable for x, y and p, Clairaut's form, Orthogonal trajectories.	**7**
	Unit IV - <u>Second Order Linear Differential Equations:</u> The general solution of the homogeneous equations, Operator methods for finding particular solutions, Euler's Equidimensional Equations, Use of a known solution to find another, The method of variation of parameters.	**8**
	<u>Reference Books:</u> 1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). 2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991. 3) Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010. Suggested digital platform: NPTEL/SWAYAM/MOOCs	

Sem- II **Paper - I**	**PRACTICAL: BMT2P03:** **Integral Calculus and Ordinary Differential Equations**	
DSC (Core) Code: BMT2P03 **For Minor: BMT2P03**	**Course Outcomes**: CO1: Students will be able to solve problems using reduction formulae, Beta and Gamma functions. CO2: Application of double integration in solving problems on area of a region. CO3: Students will able to solve problems by changing the order of integration CO4: Students will learn application of triple integration CO5: Students will be able to apply integrating factor in solving non-exact differential equations CO6: Students will be able to solve Euler's Equidimensional Eqs CO7: Students will able to use concept of Wronskian in solving problems by method of variation of parameters	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT2P03: Integral Calculus and Ordinary Differential Equations Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: **Abbreviations: Eq- Equation, DEq – Differential Equations** (1) Application of Reduction formulae for basic trigonometric functions (2) Solving problems of integration of irrational functions (3) Properties of Beta and Gamma functions (4) Relationship between Beta and Gamma functions (5) Solution of integrals using Beta and Gamma functions. (6) Solution of problems involving double integration (7) Application of double integration in solving problems on area of a region (8) Solving problems by changing the order of integration (9) Solution of double integral using polar coordinates (10) Learning triple integration through examples (11) Solving exact DEqs (12) Comparing exact and non-exact DEqs, and need of integrating factor in solving non-exact DEqs	

	(13) Solution of Bernoulli's DEqs (14) Solutions of First order higher degree DEqs (15) Finding orthogonal trajectory of the given family, and then sketch both the families together to decipher the orthogonality (16) Application of Wronskian in understanding the independent/dependent nature of functions (17) Solutions of homogeneous DEqs (18) Solutions of Euler's Equidimensional Eqs (19) Determination of a solution from a known solution (20) Application of method of variation of parameters **Reference Books:** (1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). (2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991. (3) Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 (4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 (5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010. **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

Sem- II **Paper - II** **DSC (Core) Code: BMT2T04** **For Minor: BMT2T04**	Course Title: **Vector Analysis** **Course Outcomes:** CO1: **Foundational knowledge:** To impart foundational knowledge of vector algebra and vector differentiation. CO2: **Basic skills**: To inculcate in students foundational base of gradient of a scalar function, divergence and curl. CO3: **Concept learning**: New concept of vector integration shall be introduced and problems of work done by force shall be solved. CO4: **Application of Vector Theorems**: To solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: **Application**: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects.	**Credit 2** **No. of hours** 30
	Syllabus for BSc Semester – II Paper -II **BMT2T04: Vector Analysis**	**No. of hours**
	Unit I – <u>Vector Differentiation:</u> Vector triple products, product of four vectors, ordinary derivatives of vectors, space curves, continuity and differentiability, differentiation formulae, partial derivatives of vectors, differentials of vectors.	**8**
	Unit II - <u>Gradient, Divergence and Curl:</u> The vector differential operator del, Gradient, directional derivatives, Divergence, solenoidal vector, Curl, irrotational vector field.	**7**
	Unit III - <u>Vector Integration:</u> Ordinary integrals of vectors, Line Integral, Work done by force, exact differential and scalar potential, Surface integral, Volume integral.	**7**
	Unit IV – <u>Vector Theorems:</u> Green's Theorems in the plane (statement only), Gauss divergence Theorem (statement only), Stokes' Theorem (statement only) and their applications.	**8**
	<u>Reference Books:</u> 1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974) 2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad. 3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). Suggested digital platform: NPTEL/SWAYAM/MOOCs	

	PRACTICAL: BMT2P04: **Vector Analysis**	
Sem- II **Paper - II** **DSC (Core) Code: BMT2P04** **For Minor: BMT2P04**	**Course Outcomes:** CO1: Students will be able to update themselves with foundational knowledge of vector algebra and vector differentiation by solving examples. CO2: The basic skills required in science will be ingrained in students through foundational base of gradient of a scalar function, divergence and curl by solving examples. CO3: New concept of vector integration shall be learnt by students and problems of work done by force shall be solved by them. CO4: Students will be able to solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects, and this will help students immensely in their future.	**Credit 1** **No. of hours** 30
	Syllabus for BSc Semester – II Paper -II **Practical BMT2P04: Vector Analysis** Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: (1) Application of product of four vectors (2) Determination of ordinary derivatives of the functions (3) Finding partial derivatives of the functions (4) Determination of differentials of vector functions (5) Solving examples involving gradient of the scalar function, and plotting its graph (6) Application of gradient of function in obtaining directional derivatives (7) Application of divergence in determination of solenoidal vector (8) Learning concept of curl of vector function (9) Application of curl in irrotational/rotational field (10) Performing gradient operation in calculating angle between the surfaces (11) Solving ordinary integrals of vectors (12) Solving line integrals along various paths (13) Application of work done by force along different paths, and to verify if it is independent of the paths (14) Application of surface integrals (15) Application of volume integrals (16) Solving problems by Green's theorem in the plane	

	(17) Application of Green's theorem in the plane (18) Determination of area by Greens's theorem in the plane (19) Application of Gauss theorem (20) Application of Stokes' theorem **Reference Books:** 1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974) 2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad. 3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

BSc Semester – II

Vocational Skill Enhancement Course (VSC)

SEMESTER - II

VSC -02 : Maxima Software System

Maxima is a free, open source computer algebra system, which is primarily used for symbolic computation, including differentiation, integration, Taylor series, Laplace transforms, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices and tensors.

	Maxima Software System	
Sem- II **VSC - 02** **Code:** **BVS2P03**	**PRACTICAL:** **Course Outcomes**: **Students will be able** 1. to develop skills to deliver practical knowledge in its application 2. to explore topics in Calculus, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices 3. to provide algorithms and tools for many domains of mathematics 4. to use as wonderful scientific and graphical calculator	**Credit** **2** **No. of hours** 30
	Syllabus for BSc Semester – II: VSC - 02 **Code BVS2P03: MAXIMA SOFTWARE SYSTEM**	**No. of hours**
	TOPICS: 1. Introduction to Maxima 2. Mathematical functions in Maxima 3. Plotting: 2D and 3D graphical output. 4. Polynomials: Standard forms for polynomials, and Maxima functions operating on them 5. Limits: Limits of expressions 6. Differentiation: Differential calculus 7. Integration: Integral calculus 8. Equations: Defining and solving equations 9. Differential Equations: Defining and solving differential equations 10. Numerical: Numerical integration 11. Matrices: Matrix operations 12. Number Theory: Number theory problems	**30**

	Reference Books: 1. Computational Mathematics Using Maxima Software - Paper 3 - A Manual for SY BSc Mathematics , Dr. Kalyanrao Takale, Dr. Amjad Shaikh, Dr. Veena Kshirsagar, Dr. Shrikisan Gaikwad, Prof. S. R. Patil. 2. Computational Mathematics Using Maxima Software , Dr. K Takale, Dr. S Gailwad, Dr. A Shaikh, Dr. V Kshirsagar, Dr. V Jadhav, Prof. S Patil. 3. Mathematics for Engineers and Science Labs Using Maxima, 1st Edition, by Seifedine Kadry, Pauly Awad. 4. Algebra And Calculus Using Maxima Software, Dr. K. C. Takale, Dr. A. S. Shaikh, Dr. V. S. Jadhav, Dr. S. B. Gaikwad, Prof. S. R. Patil, Nirali Prakashan.	

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Microbiology)

Submitted by

Board of Studies,
Bachelor of Science (Microbiology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Microbiology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Microbiology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				Th	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Microbiology	BMI1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Microbiology	BMI1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Basic Techniques in Microbiology	BMI1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Basic Techniques in Microbiology	BMI1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Calibration, validation and handling of laboratory equipment	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II(Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microbial Diversity	BMI2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microbial Diversity	BMI2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Chemistry of Biomolecules	BMI2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Chemistry of Biomolecules	BMI2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Preparation and standardization of Lab reagents	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Metabolism	BMI3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Metabolism	BMI3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Microbiology	BMI3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Microbiology	BMI3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Food Microbiology	BMI4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Food Microbiology	BMI4P07			2	1	-	-	-	-	25	25	25
3	DSC	Dairy Microbiology	BMI4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Dairy Microbiology	BMI4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Medical Microbiology- Host Parasite Relationship	BMI5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Medical Microbiology- Host Parasite Relationship	BMI5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Molecular Biology	BMI5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Molecular Biology	BMI5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Immunology	BMI5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Immunology	BMI5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BMI1T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BMI1P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Microbiology	BMI6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Microbiology	BMI6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Medical Microbiology- Microbial Diseases	BMI6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Medical Microbiology- Microbial Diseases	BMI6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Recombinant DNA Technology and Applications	BMI6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Recombinant DNA Technology and Applications	BMI6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BMI6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BMI6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Microbiology- Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology –I	BMI7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology –I	BMI7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology-I	BMI7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology-I	BMI7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation II	BMI7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation II	BMI7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Microbial Metabolites	BMI7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Microbial Metabolites	BMI7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BMI7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BMI7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BMI7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BMI7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology-II	BMI8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology-II	BMI8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology -II	BMI8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology -II	BMI8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation – II	BMI8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation – II	BMI8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Biomolecules and their Interactions	BMI8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Biomolecules and their Interactions	BMI8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BMI8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BMI8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology –I	BMI7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology –I	BMI7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology-I	BMI7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology-I	BMI7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation – I	BMI7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation – I	BMI7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BMI7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BMI7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BMI7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BMI7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Enzymology-II	BMI8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology-II	BMI8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology -II	BMI8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology -II	BMI8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation –II	BMI8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation –II	BMI8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BMI8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BMI8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Microbiology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Calibration, validation and handling of laboratory equipment	Microbiology	**BVS1P01**
II	**VSC**	Preparation and standardization of Lab reagents	Microbiology	**BVS2P03**
III	**VSC**	Diagnostic Microbiology	Microbiology	**BVS3P05**
V	**VSC**	Water analysis	Microbiology	**BVS5P07**
VI	**VSC**	Biofertilizers & Biopesticides	Microbiology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Microbiology- Major)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Bioprocess Technology	BMI5T12
		B. Haematology and Clinical Biochemistry	
VI	Elective 2	A. Applied Agricultural Microbiology	BMI6T16
		B. Biostatistics	
VII (Honors)	Elective 3	A. Drug, Vaccine and Disease Management	BMI7T21
		B. Bioinformatics	
VIII (Honors)	Elective 4	A. Pharmaceutical Microbiology	BMI8T27
		B. Bioethics, Biosafety and IPR	
VII (Research)	Elective 3	A. Drug, Vaccine and Disease Management	BMI7T20R
		B. Bioinformatics	
VIII (Research)	Elective 4	A. Pharmaceutical Microbiology	BMI8T25R
		B. Bioethics, Biosafety and IPR	

R' in the subject code indicates 'Research'.

Introduction:

Microbiology is a branch of science that deals with study of microorganism i.e. bacteria, protozoa, algae, fungi, viruses. It studies their interaction with their environments as well as how these organisms are harnessed in human endeavour and their impact on society. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. .Microbiological study is mainly focused on health care, agricultural, food, dairy, environmental and industrial use.

Microbiology is at the heart of the healthcare industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as molecular biology, cell biology, recombinant technology, and immunotherapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in health care/ pharma industry in various departments such as- production, R&D, QC, sales & marketing, content writing/ technical writing etc. & entrepreneurship. Also can be employed in diagnostic centers, in hospitals as laboratory staff or paramedical, hospital management as bio safety & hygiene management staff. In Medical academics also contribution can given.

In Agrculture low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are the issues to be addressed . Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers, biopesticides are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly. In this field students can get employment in govt. sector, private sector in production, QC, R&D, Academics & a vast scope for entrepreneurship.

Food microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. In food & beverage industry microbiologists play an important role in production , QC, R& D, supply chain management. Many fermented products are produced where microbiologist have a key role. Dairy industry also demands microbiologists as it produces packed milk to development of fermented products. Functional foods like probiotic foods & single cell proteins are the examples. Food Safety is a new area for employment. For entrepreneurship large opportunities are available. Packed Mineral water is another sector. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environmental microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of microbiology. All these issues are now being addressed by using biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories**.**

Objetive to be achieved

- To enrich Knowledge and train them in field of Microbiology
- To aware students about applied Microbiology as well as in research field
- To inculcate sense of scientific responsibilities and social and environment awareness
- To get successful career in the Microbiology field

Course Structure:

- As per scheme given in table
- For the purpose of computation of workload, the following mechanism may be adopted as per UGC guidelines:
  - i) 1 Credit = 1 Theory period of one-hour duration per week
  - ii) 1 Credit = 1 Tutorial period of one-hour duration per week
  - **iii)** 1 Credit = 1 Practical period of two-hour duration per week

B. Sc. Semester-I
Discipline Specific Core Course (DSC-1)-MICROBIOLOGY - Paper-I
(BMI1T01) (FUNDAMENTALS OF MICROBIOLOGY)

DSC-1 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
	Unit-I		
History of Microbiology	1. Discovery of Microbes, 2. Theory of biogenesis & abiogenesis 3. Contributions of- Antonie van Leeuwenhoek, Louis Pasteur , Robert Koch, Joseph Lister, Winogradsky, Beijerinck, John Tyndall, Thomas M. Rivers 4.Branches of Microbiology- Definition and scope of a) Systemic Microbiology- Bacteriology, Mycology, Phycology, Virology, b) Biotechnology, c) Geo microbiology, d)Exobiology, e) Medical microbiology, f) Environmental MicrobiologY g) Industrial Microbiology h) Food Microbiology.		**7 Hrs**
	Unit-II		
Bacterial cell structure	1. Differences between prokaryotes and eukaryotes 2. Description of sizes, shapes and arrangements of bacteria 3. **Typical Bacterial cell structure**- a) Structure of cell wall (Gram positive & Gram negative bacteria) b) Cell membrane:- Fluid mosaic model, mesosomes 4. Ribosomes, Nucleoid, Plasmids, cytoplasmic inclusions 5. Capsules, slime layer, pilli, flagella 6. Endospore structure- formation, germination. 7. Exospores, Myxospores, Eukaryotic spores 8. Significance of dormancy		**7 Hrs**
	Unit III		
Microbial Nutrition	1. Nutritional types of bacteria 2. Basic nutritional requirements. 3. Types of culture media- Selective, Differential, Enriched, Synthetic and non synthetic (Definition, ingredients, principle and applications). 4. Media for isolation of fungi- Definition, ingredients, principle and applications 5. Enrichment Culture		**8 Hrs**

Unit IV		
Microbial growth	1. Bacterial reproduction. 2. Axenic cultures. 3. Growth curve 4. Mathematical expression of growth. 5. Continuous culture – Chemostat and turbidostat 6. Synchronous growth 7. Diauxic culture 8. Factors influencing microbial growth.	**8 Hrs**

Reference Books:

1. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Kathleen Park Talaro& Arthur Talaro - Foundations in Microbiology International edition 2002,| McGraw Hill.
3. Michael T. Madigan & J. M. Martin, Brock, Biology of Microorganisms 12th Ed. International edition 2006, Pearson Prentice Hall
4. A.J. Salle, Fundamental Principles of Bacteriology.
5. Stanier. Ingraham et al ,General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd
6. Microbiology TMH 5th Edition by Michael J. Pelczar Jr., E.C.S. Chan ,Noel R. Krieg
7. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
8. Kanungo R. (2017). Ananthanarayan and Paniker's Textbook of Microbiology. 10th edition. Universities Press, Hyderabad, India
9. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
10. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
11. Reddy S. M., Girisham S. and Narendra Babu G. (2017). Applied Microbiology (Agriculture, Environmental, Food and Industrial Microbiology). Scientific Publishers, Jodhpur, Rajasthan, India

List of Experiments:
Perform at least 5 practical (Excluding 1, 2 & 3).

1. General guidelines for safety in microbiology laboratory, possible laboratory hazards, safety precautions and disposal of laboratory waste and ethics in microbiology.
2. General concept of basic equipments & apparatus.
3. Preparation of media & stains.
4. Study of permanent slides of Streptococci, Diplococci, Capsule forming bacteria, Micrococcus sp. *Clostridium tetani*, *Bacillus anthracis*, *Vibrio cholera*, *Mycobacterium tuberculosis, Treponema palladium,* Cell organelles
5. Demonstration of microbes from environment, skin & teeth – Study colony characteristics (Major).
6. Staining—Simple staining.
7. Differential staining - Gram staining,(Major).
8. Bacterial motility by hanging drop method (Major).
9. Anaerobic cultivation of bacteria.
10. Effect of pH or temperature on growth of bacteria. (Major)
11. Measurement of microbial cell size by Micrometry. (Major)

Scheme of practical examination-

1. One long expt.----------..10 Marks
2. One short expt.----------..05 Marks
4. Viva-voce----------05 Marks
5. Record----------05 Marks

Total Marks= 25

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will understand the contributions of different scientists in the fields of Microbial science..
2.	Students will have knowledge about the established and emerging fields of science with respect to Microbiology.
3.	Students will have knowledge about basic structure & nutritional requirement of bacteria
4.	Develop practical skills to handle microorganism aseptically
5.	Understand the use of apparatus and their use without fear.
6.	Correlate their Microbiology theory concepts with practical outcomes.

B. Sc. Semester-I

Discipline Specific Core Course (DSC-2)-MICROBIOLOGY - Paper- II

(BMI1T02) (BASIC TECHNIQUES IN MICROBIOLOGY)

DSC-2 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
	Unit-I		
Microscopy	**Principle, applications and ray diagram:** 1. Simple, compound microscope—Bright field Microscopy, 2. Dark field Microscopy, 3. Electron microscopy (TEM, SEM), 4. Phase-contrast microscopy, 5. Fluorescent microscopy.		**7 Hrs**
	Unit-II		
Staining Techniques.	1. Stains & dyes, chromophore, auxochrome, chromogenes, types of stains 2. Theories of staining 3. Staining techniques : Simple, negative staining, differential staining- Gram staining, acid-fast staining 4. Staining of specific structures: flagella , spores, capsule		**7 Hrs**
	Unit III		
Microbial Techniques	1. Isolation of pure culture by various methods. 2. Determination of nutritional requirement by auxonographic technique, replica plating technique & multi-point inoculator technique. 3. Measurement of growth 4. Preservation of microorganisms, National & international collection centers		**8 Hrs**
	Unit IV		
Microbial control	1. Terms & definitions used in microbial control- Sterilization, inhibition, Microbiostatic, microbicidal, disinfectant, sanitizer, viricide, sporicide, antimetabolite antibiotic, germicide, Preservative etc. 2. Concept of microbial death 3. Properties of ideal antimicrobial agent. 4. Physical control methods—types, mode of action & applications only-a) High & low temperature b) filtration c) radiation d) osmotic pressure. 5. Chemical agents—Different types, mode of action & applications only- a) Phenols b) Alcohols c)Halogenes d) Heavy metals e) Quaternary ammonium compounds f) surface active agents g) phenol-coefficient 6. Mechanism of cell injury 7. Chemotherapeutic agent—sulphonamides only- mode of action & application, Antibiotics, examples according to mode of action, source		**8 Hrs**

Reference books -

1. Introduction to Microbial Techniques by Gunasekaran
2. Microbiology: Fundamentals and Applications by Ronald M. Atlas, New York: Macmillan Publication
3. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
5. Debnath M., Prasad G. B. and Bisen P. S. (2012). Microbes: Concepts and Applications. Germany: Wiley.
6. McDonnell G. E. (2020). Antisepsis, Disinfection, and Sterilization: Types, Action, and Resistance. United States: Wiley.
7. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An Application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.
8. Pierce B. E. and Leboffe M. J. (2019). Microbiology: Laboratory Theory and Application: Essentials. United States: Morton Publishing
9. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: An Introduction. Twelfth edition. Pearson, London.
10. Sharma K. (2007). Manual of Microbiology (Second Edition). ANE Books, New Delhi, India.

List of Experiments:
Perform at least 5 practical (Excluding 1)

1. General guidelines for safety in microbiology laboratory, possible laboratory hazards, safety precautions and disposal of laboratory waste and ethics in microbiology.
2. Isolation of pure culture by streak & spread plate method,
3. Isolation of pure culture by serial dilution and pour plate method. (Major).
4. Effect of Oligodyanamic action of heavy metal on microbial growth. (Major).
5. Effect of UV radiation on bacteria. (Major).
6. Effect of salt & sugar concentration on bacterial growth. (Major).
7. Bacterial endospore staining.
8. Capsule Staining.
9. Staining of Metachromatic granules.
10. Flagella Staining.

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand the needs and basics of techniques used in observing microbes.
2.	Students will be aware of applications of basic techniques.
3.	Students will learn sterilization and disinfection principles and procedures
.4	Students will learn cultivation & aseptically handling of microorganism.

Calibration, Validation & Handling of Laboratory Equipments
Course Code: (BVS1P01)

VSC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

1. Calibration, validation and handling of Ph meter
2. Calibration, validation and handling of Incubator
3. Calibration, validation and handling of Oven
4. Calibration, validation and handling of Laminar Air Flow
5. Calibration, validation and handling of Autoclave
6. Calibration, validation and handling of Electric Balance
7. Calibration, validation and handling of Thermometer
8. Calibration, validation and handling of Pressure Gauge
9. Handling and general maintenances of Microscope
10. Washing and cleaning of Laboratory glass ware for Microbiological work
11. Handling of centrifuge machine
12. Calibration of colorimeter
13. Calibration constant temperature water bath

Scheme of Practical Examination:

1. Two long expt.----------. 15 Marks each
2. Viva-voce---------- 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1. Praful B. Godkar and Darshan P Godkar, 2011, Textbook of Medical Laboratory Technology 2nd edition, Bhalani publishing house, Mumbai
2. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York
3. J Ochei & Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw- Hill,
4. New Delhi.
5. Indian Pharmacopoeia Commission (IPC)
6. U.S. Pharmacopoeia (USP)

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of calibration, validation handling of laboratory instruments
2.	The knowledge is very useful for opting job in industries.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group

Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Semester-II

Discipline Specific Core Course (DSC-)-MICROBIOLOGY - Paper-III
(BMI1T03)
(MICROBIAL DIVERSITY)

DSC - 3 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20 = 100**	**Credit: 2+1=03**
	Unit-I		
Prokaryotic microbes	1. General characters of a) Proteobacteria, b) Mycoplasma, c) Rickettsia and d) Chlamydia 2. Cyanobacteria: Characteristics of anabena and applications of cyanobacteria 3. Actinomycetes: Characteristics of Streptomyces and their applications 4. Archae bacteria: Types of archae bacteria (Brief description), Methanogenic bacteria and their importance		**7 Hrs**
	Unit-II		
Eukaryotic microbes	1. Fungi and yeast: General characters, Asexual and sexual mode of reproduction, 2. Algae:-General characters and industrially important algal cells 3. Protozoans: General characters and life cycle Of *Entamoeba histolytica*		**7 Hrs**
	Unit III		
Acellular microbes: Viruses.	1. Discovery of viruses, General structure, symmetry and classification 2. Cultivation, chick embryo & tissue culture method 3. Detection of viral growth 4. T4-Bacteriophages- lytic cycle, 5. Lambda phage- Lysogenic cycle.		**8 Hrs**
	Unit IV		
Microbial interaction	1. Positive and negative interaction: Commensalism, synergism, syntropism, mutualism, parasitism, predation, antagonism, competition 2. Life cycle of Bdellovibrio 3. Protist-Plant interaction: Root nodule bacteria 4. Protist-Animal interaction: Rumen bacteria, insect midgut bacteria, luminescent bacteria		**8 Hrs**

Reference Books:

1. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Stanier.Ingrahametal, General Microbiology 4th & 5th Ed.1987, Macmillan Education Ltd
3. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
5. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
6. Madigan M.T, Martinko J M, Dunlap P V and Clark. D P. 2008. Brock Biology of Microorganisms. 12th Ed. Pearson/ Prentice Hall
7. Arora B. and Arora D. R. (2020). Practical Microbiology. CBS Publishers and Distributors, New Delhi, India.
8. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.

List of Experiments:
Perform at least 5 practical

1. Study of permanent slides of special bacteria--- Fungi (*Aspergillus, Penicillium* and *Mucor*) Protozoa (*Plasmodium vivax*, *Trypanosoma* and *amoeba*) & Algae (*Spirullina, Anabena* and *Euglena*), *Mycoplasma, Rickettsia* and *Chlamydia.*
2. Slide culture techniques for the cultivation and study of mould. (Major)
3. Isolation of Anabaena and study its morphology
4. Isolation of Protozoa from water.
5. Isolation of Bacteriophage. (Major)
6. Isolation of Rhizobium from root nodules. (Major)
7. Enumeration of phytoplankton by haemocytometer.
8. Study of bacterial motility by hanging drop method. (Major)

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Acquire basics and importance of Microbiology
2.	Learn about basic characteristics features of microorganisms
3.	Describe the classification of Bactria
4.	Gain insights into the important characters, classification & life cycle of viruses.

B. Sc. Semester-II

Discipline Specific Core Course (DSC-4)-MICROBIOLOGY - Paper-IV

(BMI1T04)

(CHEMISTRY OF BIOMOLECULES)

DSC - 4 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 2+1=03**
	Unit-I		
Carbohydrates and Lipids	1. Classification of carbohydrates, 2. Structure of glucose, fructose, maltose, lactose, sucrose, raffinose, starch, hyaluronic acid, glycogen, cellulose, osazone formation 3. Classification of lipids, structure of triglyceride, compound lipids, derived lipids		**7 Hrs**
	Unit-II		
Amino acids and proteins	1. Classification of amino acids, 2. Titration curve, acidic, basic and neutral amino acids, 3. Peptide bond theory, 4. Organizational levels of proteins, 5. Concept of oligomeric protein		**7 Hrs**
	Unit III		
Enzymology	1. Definitions and nature of enzymes, classification, nomenclature, 2. Primary concept of enzyme kinetics, MM equation, modifications of MM equations, 3. Activation energy, transition state, ES complex, enzyme activity, katal, specific activity ,turnover number 4. Allosteric sites, allosteric modulaters, 5. Functional diversity such as holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group, isoenzymes, 6. Membrane bound enzymes, multienzyme complex, zymogens		**8 Hrs**
	Unit IV		
Nucleic acid and Vitamins	1. Structure of purines, pyrimidines, nucleosides, nucleotides, 2. Structure of DNA, RNA, and various forms of DNA 3. Types of vitamins, Classification on the basis of solubility, functions of vitamins, 4. Hypervitaminosis – Definition, causes, symptoms, treatment of Vit. A and D 5. Hypovitaminosis – Definition, causes, symptoms, treatment of Vit. B12, A and D		**8 Hrs**

Reference Books:

1. Lehninger. Principles of Biochemistry. 4th Edition. D. Nelson and M. Cox. W.H. Freeman and Company. New York2005
2. Microbiology an Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
3. Prescott, Hurley. Klein-Microbiology, 5th & 6thedition, International edition 2002 & 2006, McGraw Hill.
4. Garrett, R. H. and Grisham, C. M. (2004) Biochemistry. 3rd Ed. Brooks/Cole Publishing
   Company, California.
5. Conn Eric, Stumpf Paul K., Bruuening George, Doi Roy H., (1987) Outlines of Biochemistry 5th Ed , John Wiley and Sons, New Delhi.
6. Miller A. D. and Tanner J. (2013). Essentials of Chemical Biology: Structure and Dynamics of Biological Macromolecules. Germany: Wiley.
7. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.

List of Experiments
Perform at least 5 practical

1. Preparation of normal and molar solutions.
2. Preparation of buffer solutions (any 4)
3. Qualitative detection of carbohydrates.
4. Qualitative detection of Protein or amino acids.
5. Qualitative detection of Lipids
6. Determination of pKa value of amino acid. (Major)
7. Quantitative estimation of DNA by DPA method. (Major)
8. Quantitative estimation of RNA by Orcinol method. (Major)
9. Quantitative estimation of protein by Folin Lowry method (Major)
10. Extraction and detection beta carotene
11. Detection of amylase/lipase/gelatinase. (Major)

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Students will learn about different types of biomolecules and their functions.
2.	To categorize on the types of enzymes and their mechanism.
3.	Students will learn about the various diseases due to deficiency of vitamins.

Preparation & Standardization of Laboratory Reagents
Course Code: (BVS2P03)

VSC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

1. Preparation of standard Molar solution of Glucose
2. Preparation of standard Molar solution of Glycine
3. Preparation of standard Molar solution of NaoH and its standardization
4. Preparation of standard Molar solution of HCL and its standardization
5. Preparation of working standard molar solution from stock standard molar solution
6. Preparation of physiological saline solution
7. Preparation of standard buffer solution. Exa. Phosphate buffer and carbonate buffer
8. Preparation of standard normal solution of Bicarbonate and its standardization
9. Preparation of standard normal solution of acetic acid and its standardization
10. Preparation of Leishman stain
11. Preparation of crystal violet solution
12. Preparation of Lugol's iodine
13. Preparation of malachite green solution for spore staining

Scheme of Practical Examination:

4. Two long expt.----------. 15 Marks each
5. Viva-voce---------- 10 Marks
6. Record---------- 10Marks

Total Marks = 50

Reference Books:

1. Plummer, David T. Introduction to Practical Biochemistry, Tata McGraw-Hill Publishing New Delhi
2. Praful B. Godkar and Darshan P Godkar, 2011, Textbook of Medical Laboratory Technology 2nd edition, Bhalani publishing house, Mumbai
3. **Thimmaiah S.K.**, **Standard Methods of** Biochemical **Analysis,** Kalyani Pub.
4. Victor W. Rodwell, David Bender, **Harper**'s Illustrated **Biochemistry** Thirty-First Edition
5. Indian Pharmacopoeia Commission (IPC)

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of solution and reagents preparation.
2.	The knowledge is very useful for opting job in industries.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Physics)

Submitted by

Board of Studies,

Bachelor of Science (Physics)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research) (Physics - Major)

Four Year (Eight Semester Degree Course) Teaching and Examination Scheme

B.Sc. Sem-I (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Measurement, Mechanics, and Properties of Matter	BPH1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Measurement, Mechanics, and Properties of Matter	BPH1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Kinetic Theory of Gases and Thermodynamics	BPH1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Kinetic Theory of Gases and Thermodynamics	BPH1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Electronic and Electrical Components	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Acoustic and Ultrasonics	BPH2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Acoustic and Ultrasonics	BPH2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Oscillations and Blackbody Radiation	BPH2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Oscillations and Blackbody Radiation	BPH2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Instrumental Errors in Measurement	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Solid State Physics	BPH3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Solid State Physics	BPH3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Optics	BPH3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Optics	BPH3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BPH1T01	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BPH1P01	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BPH1T02	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BPH1P02	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Lasers and Optical Fibres	BPH4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Lasers and Optical Fibres	BPH4P07			2	1	-	-	-	-	25	25	25
3	DSC	Mathematical Physics	BPH4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Mathematical Physics	BPH4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BPH2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BPH2P03			2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BPH2T04	2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BPH2P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Electrostatics and Electric Currents	BPH5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Electrostatics and Electric Currents	BPH5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Magnetostatics and Magnetism	BPH5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Magnetostatics and Magnetism	BPH5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electronic Devices and Circuits	BPH5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electronic Devices and Circuits	BPH5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BPH5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BPH5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)	BPH3T05	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)	BPH3P05	-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)	BPH3T06	2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)	BPH3P06	-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Quantum Mechanics-I	BPH6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics-I	BPH6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Classical Mechanics	BPH6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Classical Mechanics	BPH6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Atomic and Molecular Physics	BPH6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Atomic and Molecular Physics	BPH6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BPH6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BPH6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)	BPH4T07	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)	BPH4P07	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Physics - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Numerical Methods and Complex Analysis	BPH7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Numerical Methods and Complex Analysis	BPH7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Statistical Physics	BPH7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Statistical Physics	BPH7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electrodynamics	BPH7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electrodynamics	BPH7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Mathematical Physics	BPH7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Mathematical Physics	BPH7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BPH7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BPH7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BPH7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BPH7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Quantum Mechanics -II	BPH8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics -II	BPH8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Spectroscopy	BPH8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Spectroscopy	BPH8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Nuclear and Particle Physics	BPH8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Nuclear and Particle Physics	BPH8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Electrodynamics	BPH8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Electrodynamics	BPH8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BPH8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BPH8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Numerical Methods and Complex Analysis	BPH7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Numerical Methods and Complex Analysis	BPH7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Statistical Physics	BPH7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Statistical Physics	BPH7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electrodynamics	BPH7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electrodynamics	BPH7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BPH7T21R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BPH7P21R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BPH7T22R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BPH7P22R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Quantum Mechanics -II	BPH8T23R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics -II	BPH8P23R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Spectroscopy	BPH8T24R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Spectroscopy	BPH8P24R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Nuclear and Particle Physics	BPH8T25R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Nuclear and Particle Physics	BPH8P25R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BPH8T27R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BPH8P27R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Physics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Electronic and Electrical Components	Physics	**BVS1P01**
II	**VSC**	Instrumental Errors in Measurement	Physics	**BVS2P03**
III	**VSC**	Regulated Power Supply	Physics	**BVS3P05**
V	**VSC**	Optical Instruments	Physics	**BVS5P07**
VI	**VSC**	Installation of Rooftop Solar Systems	Physics	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Physics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Digital Electronics and Microprocessor	BPH5T12A
		Optoelectronics and Devices	BPH5T12B
VI	Elective 2	Analogue and Communication Electronics	BPH6T16A
		Astrophysics and Special Theory of Relativity	BPH6T16B
VII (Honors)	Elective 3	Experimental Techniques in Physics	BPH7T21A
		Sources of Energy and Energy Storage Devices	BPH7T21B
VIII (Honors)	Elective 4	Biophysics and Biodevices	BPH8T27A
		Nanomaterials and Properties	BPH8T27B
VII (Research)	Elective 3	Experimental Techniques in Physics	BPH7T21RA
		Sources of Energy and Energy Storage Devices	BPH7T21RB
VIII (Research)	Elective 4	Biophysics and Biodevices	BPH8T27RA
		Nanomaterials and Properties	BPH8T27RB

'R' in the subject code indicates 'Research'.

B. Sc. Semester-I Discipline Specific Core Course (DSC-1)-PHYSICS - Paper-I (BPH1T01) (Measurements, Mechanics, and Properties of Matter)			
DSC-1 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Measurements	Definition of Physics; levels and need of measurement; CGS and SI units, fundamental and derived physical quantities, and their units. Length, mass, and time measurements. Definition of Seven Fundamental Units and their applications in industries and society. Least count, accuracy, and precision of measuring instruments (Viz. Meter scale, Vernier Callipers, Screw Gauge, Travelling microscope, spectrometer, voltmeter, ammeter, etc.). Errors in measurement, Significant figure. Dimensions of Physical quantities, dimensional analysis, and its applications.		**7 Hrs**
Unit-II			
Newtonian Mechanics	Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Collisions. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal and centrifugal forces and their applications		**7 Hrs**
Unit III			
Motion	Frame of reference, motion in a straight line: position-time graph, speed, and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.		**8 Hrs**
Unit IV			
Properties of Matter	Elastic behaviour, Stress-strain relationship, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's principle and its applications. Surface energy and surface tension, angle of contact, application of surface tension – drops, bubbles, and capillary rise.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012.
3. Introduction to Classical Mechanics, 2nd ed. - Atam P. Arya by Prentice Hall Publishing
4. Continuum Mechanics and Elements of Elasticity Structural Mechanics - Victor E. Saouma.
5. Feynman Lectures on Physics (Volumes 1,2,3)- Feynman, Leighton and Sands.
6. Theory of elasticity, McGraw-Hill Education (India) Private Limited, 2010
7. Handbook of Measurement Error Models, Edited By Grace Y. Yi, Aurore Delaigle, Paul Gustafson, 2021, published by Chapman & Hall

List of Experiments:

1. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by torsional pendulum
2. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by Maxwell's needle
3. Spectrometer: To find least count of a spectrometer.
4. Spectrometer: To determine angle of prism.
5. To determine 'Y' (Young's Modulus) of a wire material by method of vibrations-Flat spiral Spring
6. To find the Young's Modulus of a material by method of bending of beam
7. To determine Coefficient of Viscosity (η) of a given liquid by Poiseuille's Method
8. Determination of Surface Tension of mercury / Angle of contact of liquids
9. To determine equivalent focal length of a lens system by magnification method.
10. Spectrometer: To determine refractive index μ of the material of prism
11. To determine the moment of inertia of a fly-wheel.
12. To find the surface tension by capillary rise method
13. To determine the surface tension of a liquid by Jaeger's method.

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Develop interest in measurement with conceptual knowledge of physics.
2.	Develop practical skills in accurate measurements with minimal errors.
3.	Understand and practice these skills while performing physics practical.
4.	Understand the use of apparatus and their use without fear.
5.	Correlate their physics theory concepts with practical outcomes.
6.	Understand the concepts of errors and their estimation.

B. Sc. Semester-I Discipline Specific Core Course (DSC-2)-PHYSICS - Paper- II (BPH1T02) (Kinetic theory of gases and Thermodynamics)			
DSC-2 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Kinetic Theory of Gases	Assumptions of kinetic theory of gases, Molecular collision, Mean free path and collision cross section, Expression for mean free path (Clausius Expression) Degrees of freedom, Law of equipartition of energy, Derivation of Maxwell's law of distribution of velocities and its experimental verification. Momentum and viscosity of gas, Transport of energy and thermal conductivity, Transport of mass and diffusion, their relationship,		**7 Hrs**
Unit-II			
Real Gases and Thermodynamics	Van der wall's real gas, Equation of state, Critical constants, Van der wall's constants, Critical coefficient, limitations. Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamics, Thermodynamic processes (isothermal, adiabatic, isochoric, isobaric), Indicator diagram, Work done during isothermal and adiabatic processes, Specific heats at constant pressure and volume, First law of thermodynamics,		**7 Hrs**
Unit III			
Heat Engine and Entropy	Thermodynamic processes (Reversible and Irreversible), Heat engine, Carnot's ideal heat engine, Carnot's cycle and it's efficiency, Second law of thermodynamics, Carnot's theorem. Concept of entropy, Change in entropy in reversible cycle, Principle of increase of entropy of the universe in reversible and irreversible process. Second law of thermodynamics in terms of entropy, Thermodynamic scales of temperature, Absolute zero on thermodynamic scale, Third law of thermodynamics, T-S diagram.		**8 Hrs**
Unit IV			
Maxwell's Relations	Maxwell's thermodynamic relations [$\delta (T, S)/ \delta (x, y) = \delta (P, V)/ \delta (x, y)$] and it's applications, Clausius-Clapeyron latent heat equation, Joule-Thomson effect, Porous plug experiment, Joule-Thomson coefficient. Inversion temperature, Boyls law.		**8 Hrs**

Reference books -

1. Heat, Thermodynamics and Statistical Physics, by- Singhal, Agrawal.
2. Heat and Thermodynamics, by- Brijlal, Subramanyam.
3. A Text Book of Heat, by- J. B. Rajam.
4. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Hemne.
5. Heat and thermodynamics, by- C. L. Arora.
6. Principles of Thermodynamics by Jean-Philippe Ansermet, Sylvain D. Brechet, Cambridge University Press; 1st edition (2019)
7. Introduction to Electrodynamics by David J. Griffiths (Author)Cambridge University Press; 4th edition (2017)

List of Experiments:

1. To determine the pressure coefficient of air by constant volume air thermometer.
2. To verify the Stefan's law of radiation by using an incandescent lamp.
3. Thermal conductivity of a metal rod using Forbes method.
4. Thermal conductivity of a bad conductor by Lee's disc method.
5. To determine the critical temperature and critical pressure of a gas.
6. To determine the coefficient of thermal conductivity of glass in the form of a tube.
7. To determine specific heat of a given liquid by method of cooling.
8. Mechanical equivalent of heat by Calendar- Barne's constant flow method.
9. To determine the mechanical equivalent of heat (J) with the help of Joule's calorimeter.
10. To determine temperature coefficient of resistance of platinum using platinum resistance thermometer
11. Study of heating efficiency of electrical kettle with varying voltages.
12. To determine the ratio of specific heats of a gas (γ) by Clement and Desormes method.
13. To study the Boyle's law and to verify it experimentally.
14. To study Charle's law and to verify it experimentally.
15. To verify the Stefan's law of radiation by using an incandescent lamp.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Understand the assumptions of kinetic theory of gases, ideal and real gases.
2.	Understand the nature of calorimetry by specific heat of solids and gases.
3.	Analyses different transport phenomena in gases
4.	Describe basic concepts of Thermodynamics.
5.	Analyses the laws of thermodynamics in different cases and entropy.
6.	Restate definition of system, surrounding, closed and open system, extensive and intensive variables and properties.
7.	Design various types of basic heat engines.
8.	Apply Maxwells thermodynamic relations.
9.	Understanding the low temperature physics

B. Sc. Semester-1 Vocational Skill Course (VSC - 1) - PHYSICS Course Code (BVS1P01) (Electronic and Electrical Components)			
VSC-1 Practical	**04 Hours /Week**	**Marks: 100**	**Credit: 02**
Components	**Name of Experiments** (Any 10 experiments to be performed)		
Resistors	1. **To study the coding of given Carbon Resistance and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**		
Extension Activity: Laws of series and parallel combination of resistances and finding the possible errors involved in both the combinations using tolerance information			
Capacitors	2. **To study the coding of given Capacitor (Ceramic/ Electrolytic/ Miller etc.) and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**		
Extension Activity: Laws of series and parallel combination of Capacitors and finding possible errors involved in both the combinations using tolerance information.			
Transformers	3. **To study the efficiency, turn's ratio, and power calculations of Transformers (Step-up/ Step-down / power etc.) and comparison between theoretical and practical values with errors involved in the measurements.**		
Extension Activity: Find the induction of Primary and Secondary windings of the transformer. Also find the mutual inductance between them			
Semiconductor Diodes	4. **To study the characteristic properties of a Diode, Zener Diode and LED and compare the respective cut-in, breakdown and knee voltages. Gather information about the limiting values of these components.**		
Extension Activity: Using a small power supply design a working device such as a half wave/ full wave rectifier or a regulated power supply using a Zener diode or a working LED/s of different colours.			
Power Controlling Devices	5. **To study the Circuit Breakers (MCBs and RCCBs) with their current limits. Study of Wires (Aluminium, Copper, Still, etc.) with their gauges and to find their current carrying capacities.**		
Extension Activity: Loading effect on fuses and MCBs. Study of current carrying capacities of given wires with temperature measurement.			
Analogue and Digital Meters	6. **To study the voltmeter, ammeter, galvanometer and other analogue devices and comparison of their loading effect with the digital Multimeter and/or Digital Storage Oscillator.**		
Extension Activity: Open a non-working ammeter, voltmeter, and a galvanometer. Find the differences among them. Justify why a digital voltmeter is preferred over these analogue devices?			

Induction Motors	7. **To study the Principle, Construction and Working of DC and AC Induction Motors and Measurement of their RPM with electrical parameters.**
Extension Activity: Study of a BLDC Motor and comparison of its efficiency with other type of motors.	
Light emitting devices	8. **Study of different types of Bulbs (Viz. Incandescent, CFL, Plasma tubes and LEDs). Analysis and comparison of their efficiencies using a Luxmeter.**
Extension Activity: Use of a Solar Photo Cell for measurement of light intensity of these devices. Use of filters for calibration with wavelength range of these devices.	
Semiconductor Transistors	9. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Energy Storages Devices	10. **Study of Supercapacitors and Rechargeable Batteries. Their Charging and Discharging through a load and finding their energy densities.**
Extension Activity: Use sophisticated instruments for the measurement of charge-discharge cycle of any one of these devices.	
Active Components	11. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Introduction to Measuring Devices	12. **Study and Use of ExpEyes-17 / SeeLab 3.0 for performing various experiments in Physics**
Extension Activity: Characteristics of most of the electronic components using either ExpEyes-17 / SeeLab 3.0 or equivalent equipment.	

References:

1. Electronic Devices and Circuits by Allen Mottershead, Prentice Hall India Learning Private Limited.
2. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.
3. Electronic Devices and Circuit Theory, by Boylestad / Nashelsky; Pearson Education India; 11th edition (1 January 2015)
4. Basic Electronics by B. L. Theraja, S. Chand & Company Limited, New Delhi
5. Electrical Circuit Theory M Scheme Sem Iii Electrical & Electronics Polytechnique By A Balakrishnan (Author), T Vasantha (Author); NV Publications Pollachi

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
7.	Get acquainted hands-on practice for electronic components and their uses in electronic circuits
8.	Get acquainted hands-on practice for electrical components and their uses in electrical circuits
9.	Apply the practical knowledge in conducting various practical during graduation.
10.	Apply the practical knowledge in repairing household electronic and electrical gadgets.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Semester-II Discipline Specific Core Course (DSC-)-PHYSICS - Paper-III (BPH2T03) (Acoustic and Ultrasonics)			
DSC - 3 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20 = 100**	**Credit: 2+1=03**
Unit-I			
Musical Sound and Noise	Musical Sound, characteristics of musical sound (Loudness, Quality, and Pitch) sound intensity level, bel and decibel, Consonance and Dissonance, Harmony and melody, Musical interval, Musical Scales (diatonic scale), temperament, Musical instruments (sitar, flute, harmonium), Weber-Fechner law, Limits of human audibility, Noise, Noise thermometer, Noise standards, Noise Hazards, and control.		**7 Hrs**
Unit-II			
Acoustics	Absorption coefficient, Reverberation and reverberation period, Live and Dead room, Sabine's formula, Factors affecting the acoustics of the building, Sound absorbers, Requirements for good acoustics. Transducers and their characteristics, Active and Passive Transducers, Microphone (Moving coil electrodynamic microphone, Crystal microphone, Condenser microphone), Loudspeaker (Moving coil loudspeaker), Hearing aids, Earphone, headphone, Recording and reproduction of sound.		**7 Hrs**
Unit III			
Ultrasonic Waves	Introduction, Properties of Ultrasonic waves (velocity, specific acoustic impedance, intensity & pressure), detection of ultrasonic waves, production of USW, Mechanical method (Galton whistle), electrostatic method, piezoelectric effect, piezoelectric generator, Magnetostriction oscillators, measurement of Frequency and velocity of ultrasonic waves (Acoustical Grating), Sing around technique		**8 Hrs**
Unit IV			
Application of Ultrasonic Waves	Measurement of depth of sea, SONAR system, Non-destructive testing, Pulse Echo testing, Soldering Cavitation), Ultrasonic welding, cleaning, flowmeters, Medical applications: ultrasonography, Types of scan, applications of B scan (Qualitative), Ultrasonic Microscopy, Blind stick		**8 Hrs**

Reference Books:

1. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
2. Oscillation, Waves and Sound by- Sharma and Saxena.
3. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
4. Science and Technology of Ultrasonics, Bldev Raj, V, Rajendran, P, Palanichamy, Narosa Pub. House, 2004
5. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
6. 7. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

9. Mechanics: D.S. Mathur, S. Chand, and Company.
10. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012

Physics Practical / Laboratory

List of the experiments-

1. To determine the frequency of unknown tuning fork by Helmholtz resonator
2. To determine the velocity of sound by resonance method.
3. To determine unknown frequency and to verify the law of inverse variation of frequency and volume of air by Helmholtz resonator.
4. To determine the velocity of sound wave in air (gas) with Kundt's tube.
5. To determine the velocity of ultrasonic wave using ultrasonic interferometer.
6. To study the characteristics of micro phone.
7. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
8. Study of Piezoelectric transducer.
9. To study the Noise level in the different places with the help of sound level meter.
10. To study the characteristics of an NTC/PTC thermistor as transducer.
11. To study the thermocouple as transducer.
12. To determine velocity of ultrasonic waves using by acoustical grating method.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the different aspects and attributes of a musical sounds. Also response of ear to sound and audible limits of human ear
2.	Learn about various musical scales and musical instruments
3.	Learn about acoustics of a hall and requirement of a good acoustic of a hall
4.	Learn about different microphones their design and action and also about loudspeaker.
5.	Learn about the characteristics and production method as well as detection of USW.
6.	Learn about different applications of USW like SONAR, soldering, cleaning and medical applications like sonography etc.

B. Sc. Semester-II Discipline Specific Core Course (DSC-4)-PHYSICS - Paper-IV (BPH2T04) (Oscillations and Black body radiation)			
DSC - 4 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 2+1=03**
Unit-I			
Free Oscillation	Introduction to linear and angular S.H.M., , Differential equation of S.H.M. and its solution, Mass attached to spiral spring, Torsional pendulum, Composition of two perpendicular linear S.H.M.s for 1:1 and 1:2 (analytical method), Lissajous's figure. Applications of Lissajous figures.		**7 Hrs**
Unit-II			
Damped and Forced Oscillation	Differential equation of damped harmonic oscillator and its solution, logarithmic decrement, Energy equation of damped oscillations, Power dissipation and quality factor. Forced oscillation, Differential equation of forced oscillation and its solution, Resonance, Sharpness of resonance, Power Absorption, Power dissipation, Quality factor and bandwidth,		**7 Hrs**
Unit III			
Waves in Media	Introductions, transverse and longitudinal waves, General equation of progressive wave, Speed of transverse wave on a stretched string, differential equation of a wave motion in a fluid, Wave equation for a transverse wave in a string, harmonics and overtones, phase velocity and group velocity and their relation. Doppler effect.		**8 Hrs**
Unit IV			
Black Body Radiation	Properties of Thermal Radiation, Blackbody radiation, spectral distribution, Weins Displacement law, Wiens distribution Law, Sahas Ionization Formula, Rayleigh Jeans Law, Ultra-Violet catastrophe concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
3. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
4. Oscillation, Waves and Sound by- Sharma and Saxena.
5. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
6. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

List of Experiments

1. Study the speed of waves on stretched string.
2. Determination of velocity of sound using volume resonator.

3. To Stefan's constant by incandescent bulb
4. To study the Lissajous's figure using CRO.
5. To determine the frequency of tuning fork using sonometer.
6. To study the logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
7. To study the logarithmic decrement using compound pendulum.
8. To find Planck's constant using photocell.
9. To study the oscillation of bifilar suspension
10. To study the oscillations of oscillations of compound pendulum
11. To study the oscillations of rubber band and draw its potential energy curve.
12. To study the oscillations of spring and find spring constant and verify laws of spring.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the simple harmonic motion, and properties of different oscillatory motion of an object
2.	Understand the damped and forced oscillation
3.	Understand mechanical waves in a medium and wave equation of the transverse waves on string and longitudinal waves in a fluid.
4.	Understand black body radiation and development of quantised nature of blackbody radiation.
5.	Understand the temperature of heavenly bodies

B. Sc. Semester-II
Vocational Skill Course (VSC) - PHYSICS Course Code (BVS2P03)
(Instrumental Errors in Measurement)

VSC-3 Practical	04 Hours /Week	Marks: 100	Credit: 02

Instruments	Name of Experiments (Any 10 experiments to be performed)
Vernier Calliper	1. **To study the probable and percentage error of the measuring instrument vernier calliper.**
Extension Activity: Find least count of the vernier calliper. Find significant figures, probable error and percentage error after taking observations and calculations.	
Screw Gauge	2. **To study the probable and percentage error of the measuring instrument screw gauge.**
Extension Activity: Find least count of the screw gauge. Find significant figures, probable error and percentage error after taking observations and calculations.	
Travelling Microscope	3. **To study the probable and percentage error of the measuring instrument travelling microscope.**
Extension Activity: Find least count of the travelling microscope. Find significant figures, probable error and percentage error after taking observations and calculations.	
Sextant	4. **To study the probable and percentage error of the measuring instrument sextant.**
Extension Activity: Find least count of the screw gauge attached with sextant instrument. Find significant figures, probable error and percentage error after taking observations and calculations.	
Spectrometer	5. **To study the probable and percentage error of the measuring instrument Spectrometer.**
Extension Activity: Find least count of the Spectrometer and identify its different parts. Find significant figures, probable error and percentage error after taking observations and calculations.	
Compound Pendulum	6. **To study the probable and percentage error of the gravity related apparatus compound pendulum**
Extension Activity: Find significant figures, probable error and percentage error after taking observations and calculations. Drawing of graph.	
Meter Bridge	7. **To study the probable and percentage error of the measuring electrical equipment meter bridge.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Light emitting devices	8. **To study the probable and percentage error of the measuring electrical equipment potentiometer.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

Rheostat, Milliammeter, Voltmeter, and Galvanometer	9. **To study the probable and percentage error of the measuring electrical equipment Rheostat, Milliammeter, Voltmeter, and Galvanometer**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Analogue and Digital Multimeter	10. **To study the probable and percentage error of the measuring electrical equipment analogue and digital multimeter**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Magnetometer	11. **To study the probable and percentage error of the magnetic equipment like magnetometer in the determination of horizontal component of earth's magnetic field.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Copper Calorimeter	12. **To study the probable and percentage error of the copper calorimeter for measuring heat of physical changes and heat capacity.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

References:

1. An Advanced course in practical physics by C. Chattopadhyay and P. C. Rakshit.
2. Practical Physics by S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics by C. L. Arora
4. Measurement uncertainties: Physical parameters and calibration of instruments by S. V. Gupta
5. B. Sc. Practical Physics by Harnam Singh and P.S. Hemne

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Understand the function of different instruments.
2.	Choose and apply proper instrument for the measurement.
3.	Handle the instrument carefully and apply the practical knowledge in his further study.
4.	Find the different man made and instrumental errors in doing different practical.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Statistics)

Submitted by
Board of Studies
Bachelor of Science (Statistics)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(STATISTICS - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Probability Theory	BST1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Probability Theory	BST1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Descriptive Statistics	BST1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Descriptive Statistics	BST1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	R For Beginners	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Probability distributions	BST2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Probability distributions	BST2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Economic Statistics	BST2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Economic Statistics	BST2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Excel for beginners	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Statistical Methods	BST3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Statistical Methods	BST3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Statistics	BST3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Applied Statistics	BST3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Statistical Inference	BST4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Statistical Inference	BST4P07			2	1	-	-	-	-	25	25	25
3	DSC	SQC&LPP	BST4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQC&LPP	BST4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Nonparametric Methods & Survival Analysis	BST5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Nonparametric Methods & Survival Analysis	BST5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Sampling survey Techniques and Indian Official Statistics	BST5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sampling survey Techniques and Indian Official Statistics	BST5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Industrial Process and Quality Control	BST5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Industrial Process and Quality Control	BST5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BST5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BST5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Operations Research	BST6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Operations Research	BST6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Experimental designs	BST6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Experimental designs	BST6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Estimation Theory	BST6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Estimation Theory	BST6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BST6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BST6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (STATISTICS - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling I	BST7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling I	BST7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics I	BST7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics I	BST7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Industrial Statistics	BST7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Industrial Statistics	BST7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Testing Of Hypothesis	BST7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Testing Of Hypothesis	BST7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BST7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BST7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BST7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BST7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling II	BST8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling II	BST8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics II	BST8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics II	BST8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mathematical Programming	BST8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mathematical Programming	BST8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Sampling Theory	BST8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Sampling Theory	BST8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BST8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BST8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling I	BST7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling I	BST7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics I	BST7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics I	BST7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mathematical Programming	BST7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mathematical Programming	BST7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BST7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BST7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BST7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BST7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Linear &non linear Modelling II	BST8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling II	BST8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics II	BST8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics II	BST8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Sampling Theory	BST8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Sampling Theory	BST8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BST8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BST8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, AbilSTy Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, CommunSTy Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Statistics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	R For Beginners2	Statistics	**BVS1P01**
II	**VSC**	Excel for beginners	Statistics	**BVS2P03**
III	**VSC**		Statistics	**BVS3P05**
V	**VSC**		Statistics	**BVS5P07**
VI	**VSC**		Statistics	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (STATISTICS)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Statistical Computing Using C/C++ programming B. Survival analysis	BST5T12
VI	Elective 2	A Data Mining B. Stochastic Models in Finance	BST6T16
VII (Honors)	Elective 3	A. Demography B. Actuarial Statistics	BST7T21
VIII (Honors)	Elective 4	A. Time series Analysis B. Bioassay	BST8T27
VII (Research)	Elective 3	A. Demography B. Actuarial Statistics	BST7T20R
VIII (Research)	Elective 4	A. Time series Analysis B. Bioassay	BST7T25R

'R' in the subject code indicates 'Research'.

Rashtrasant Tukdoji Maharaj Nagpur University,Nagpur

Faculty of Science & Technology

Programme: B. Sc. (Statistics)

STATISTICS - MAJOR

B Sc SEM I & SEM II Syllabus

Sr Number	Semester	Course Code	Course Category	Name of course	Credits
1	I	BST1T01	DSCI	Probability Theory	2
2	I	BST1T02	DSCII	Descriptive Statistics	2
3	II	BST1T03	DSCIII	Probability Distributions	2
4	II	BST1T04	DSCIV	Economic Statistics	2

STATISTICS - MAJOR

POs

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the program, students would be able to

1. recall basic facts about statistics and should be able to display knowledge of conventions such as notations,terminology.
2. get adequate exposure to global and local concerns that explore them many aspects ofmathematical sciences.
3. Be equipped with statistical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
4. apply their skills and knowledge that is translate information presented verbally into statistical form, select and use appropriate statistical formulae or techniques in order toprocess the information and draw the relevant conclusion.
5. develop a positive attitude towards statistics as an interesting and valuable subject of study.
6. acquire basic knowledge of diagrammatic & graphical representation of Data with and without software.

STATISTICS
SEMESTER I

SUBJECT: STATISTICS
B.Sc.– I SEMESTER – I
Paper I
CODE - BST1T01

DSC I - PROBABILITY THEORY (2 CREDITS – 30 Hrs)

OBJECTIVES

A majority of topics in Statistics depend upon a strong foundation of Probability theory It also serves as base for applied probability theory. Another basic concept is that of a random variable , its distribution and associated properties. This course includes topics like Conditional probability, Baye's theorem,p.m.f., p.d.f., moments,etc.

OUTCOMES:

Students acquire knowledge about : independence of random variables, applications of Bayes' theorem, expectation of a random variable, etc.

Unit-I (7 Hrs)

(A) Important concepts in Probability: Definition of Probability,Classical and relative frequency approach to Probability. Richard Von Mises, Cramer and Kolmogorov's approaches to Probability, merits and demerits ofthese approaches. Only general ideas to be given.

(B) Random Experiment: Trial, sample point and sample space, definition of an event, operation of events, mutually exclusive and exhaustive events. Discrete sample space, properties of Probability based on axiomaticapproach.

Unit-II (7 Hrs)

(A) Conditional Probability: Independence of events, pairwise and mutual independence,theoremson independence.

(B) Bayes' theorem: Theorem and its applications. Chebyshev's inequality and applications with problems.

Unit-III (8 Hrs)

(A) Random variables: Definition of discrete random variables, ,idea of continuous random variable,

Probability mass function, Probability density function,

(B) Probability density function: Illustrations of random variables and its properties,expectation of a randomvariable and its properties.

Unit-IV (8 Hrs)

A) Moments: Measures of location, dispersion, skewness and kurtosis

(B) Probability generating function (if it exists): Moment generating function, their properties and uses

PRACTICALS ON PAPER I (I Credit)(15 Hrs)	
Sr Number	**Title of the practical**
1	Evaluation of Probabilities usingaddition theorems
2	Evaluation of Probabilities using multiplication theorems
3	Evaluation of Probabilities using concepts of counting technique
4	Problems on independence ofevents, pairwise independence ,Mutual independence
5	Problems on probabilities usingBayes' theorem.
6	Exercises on mathematical expectations
7	Finding measures of centraltendency,

REFERENCES:

1. Bhat B.R, Srivenkataramana T And RaoMadhava K.S. (1997): **STATISTICS: A BEGINNER'S TEXT,VOL II,NEW AGE INTERNATIONAL (P)LTD.**
2. Edward P.J, Ford J.S And Lin(1974): PROBABILITY FOR STATISTICALDECISION MAKING,PRENTICE HALL
3. **Goon A. M,Gupta M. K, Das Gupta,B (1999):** Fundamentals OfStatistics, Vol Ii, World Press, Calcutta**.**
4. Mood A.M,Graybill F.A And Boes D.C (1974): INTRODUCTION TO THEORY OF STATISTICS, Mcgraw HILL.
5. Freund J. E: Mathematical Statistics (Prentice Hall India)
6. P. L. Meyer: Introductory Probability and Statistical Applications, (Oxford and IBH)
7. SudhaPurohit, GoreS.D., Deshmukh S. R: 'Statistics Using R' (Narosa)
8. Walpole Ronald E.: INTRODUCTION TO STATISTICS, Macmillan,
9. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

SUBJECT: STATISTICS

B.Sc. – I SEMESTER – I Paper II

CODE - BST1T02

DESCRIPTIVE STATISTICS (2 CREDITS – 30 Hrs)

OBJECTIVES:

Students acquire knowledge about analysis of quantitative data, concepts central tendency , dispersion,etc.

OUTCOMES:

Students learn various measures of dispersion, correlation coefficient, measures ofcentral tendency and theirapplications

Unit-I (7 Hrs)

(A) Analysis of Quantitative data: Uni-variate data - Concepts of central tendency and location, Measures of central tendency: Mean, Median and Mode, Geometric Mean and Harmonic mean (Definitions, merits and demerits, properties, theoretical problems), weighted averages

Unit-II (7 Hrs)

(B) Concepts of dispersion, Measures of dispersion: Range, Mean Deviation, Quartile deviation andstandard deviation (Definitions, merits and demerits and properties), Measures of and relative dispersion: coefficient of dispersion and coefficient of variation, Moments: Rawand Central moments, expression for central moments in terms of raw moments, Sheppard's corrections for moments for grouped data (without derivation

Unit-III (8 Hrs)

(C) Partition values: Quartiles, Deciles, Percentiles (definition, formulae and procedure for finding these values graphically), Concepts of skewness and kurtosis and their measures including those based on quantiles),Box plot, q-q plot and their use in describing data.

Unit-IV (8 Hrs)

(D) Bivariate Data: Scatter diagram, Product moment correlation coefficient and its properties. Coefficient of determination (ANOVA APPROACH). Concepts of error in regression (NORMALITY OF ERRORS).

Principle of least squares. Fitting of linear regression and related results. Rank correlation—Spearman's andKendall's measures.

PRACTICALS ON PAPER II (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Calculation of various Measures of central tendency and Dispersion
2	Calculation of various Measures of Dispersion
3	Calculation of Quartiles and drawing box plots (Manually).
4	Calculation of Quartiles and drawing box plots (Manually).
5	Calculation of Measures of dispersion, skewness and kurtosis
6	Problems on calculation of coefficient of correlation
7	Problems on calculation of coefficient of rank correlation
8	Problems on fitting of lines of regression.

REFERENCES:

1 **Bhat B.R,Srivenkataramana T And RaoMadhava K.S(1997): STATISTICS: A BEGINNER'S TEXT,VOLI,NEW AGE INTERNATIONAL (P) LTD.**

2. Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLD PRESS, CALCUTTA.

3. CroxtonF.E,Cowden D.J And Kelin S(1973): APPLIED GENERAL STATISTICS, PRENTICE HALL OF INDIA

4. Agrawal B. L.: BASIC STATISTICS (New Age International Publishers)

5. Sudha Purohit, GoreS.D., Deshmukh S. R.: Statistics Using R (Narosa)

6 Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel(CENGAGE Learning) MS Excel

Vocational Skills Courses (VSC)

	Semester I (VSC) **For Statistics major**
	Name of the Paper – R for Beginners
	Paper code - BVS1P01 2 Credits (4 hrs practical per week)
	List of Practical's
1	**INTRODUCTION TO R**
1.1	Introduction
1.2	R as a statistical software and language
1.3	R as a calculator
1.4	R preliminaries
1.5	Methods of data input
1.6	Data accessing or indexing
1.7	Some useful built-in functions
1.8	Graphics with R
1.9	Getting help
1.10	Saving, storing and retrieving work
2	**DESCRITPIVE STATISTICS**
2.1	Introduction
2.2	Diagrammatic representation of data
2.3	Graphical representation of data
2.4	Measures of central tendency
2.5	Measures of dispersion
2.6	Measures of skewness and kurtosis
2.7	Selection of representative samples
2.8	Drawing Histogram using R
3	**CORRELATION AND REGRESSION ANALYSIS**
3.1	Introduction
3.2	Correlation
3.3	Inference procedures for correlation coefficient
3.4	Linear Regression
3.5	Validation of linear regression model

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

STATISTICS

SEMESTER II

SUBJECT: STATISTICS
B.Sc– I SEMESTER–II Paper III

DSC 3 **CODE– BST2T03**

PROBABILITY DISTRIBUTIONS (2 CREDITS – 30 Hrs)

Unit-I (7 Hrs)

(A) Discrete distributions: Discrete Uniform distribution (Finding Mean, Variance),Bernoulli, Binomial, Poisson Finding (Mgf and pgf, Mean, Variance, mode, skewness and kurtosis, recurrence relation for central moments and for probabilities, additive property),

Unit-II (7 Hrs)

Geometric distribution (Finding Mgf and Mean, Variance, Lack of memory property, problems), Negative Binomial Distribution (Finding Mgf and Mean, Variance, problems), and Hypergeometric, (Finding Mean, Variance, problems)

Unit-III (8 Hrs)

Continuous Univariate Probability distributions: Continuous Uniform (Finding Mgf and Mean,Variance), Normal distribution.Properties of normal distribution,Finding Mgf and Mean, mode,

median, Variance, recurrence relation for central moments, skewness and kurtosis, additive property, standardNormal variable, Area property of Normal distribution and Problems based on that.

Unit-IV (8 Hrs)

(A) Continuous Univariate distributions: Exponential (Finding Mgf and Mean, Variance, Lack of memory property), Gamma with one parameter and gamma with two parameters (Finding Mgf and Mean, Variance, Additive property), Beta distributions of both types (Finding r^{th} moment, Mean and variance).

PRACTICALS ON PAPER III (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Fitting of Binomial distribution (Manually)
2	Fitting of Poisson distribution (Manually)
3	Fitting of Normal distribution
4	Problems on Area Property of Normal distribution
5	Simple problems on Geometric distribution
6	Simple problems on Hypergeometric distribution
7	Simple problems on Negative Binomial distribution

REFERENCES:

1. Bhat B.R, Srivenkataramana T And RaoMadhava K.S. (1997): STATISTICS: A BEGINNER'S TEXT,VOLII,NEW AGE INTERNATIONAL (P) LTD.

2. Edward P.J, Ford J.S And Lin(1974): PROBABILITY FOR STATISTICAL DECISIONMAKING,PRENTICE HALL.

3. Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLDPRESS, CALCUTTA.

4. Mood A.M,Graybill F.A And Boes D.C (1974): INTRODUCTION TO THE THEORY OF STATISTICS,McGRAW HILL.

5. Freund J. E: Mathematical Statistics (Prentice Hall India)

6. SudhaPurohit, GoreS.D., Deshmukh S. R: 'Statistics Using R' (Narosa)
7. Meyer P.L.: INTRODUCTORY PROBABILITY AND STATISTICAL APPLICATIONS (Oxford and IBHPublishing Company)

8. Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel (CENGAGE Learning)

9. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

SUBJECT:

STATISTICS B.Sc.– I

SEMESTER–II Paper IV

DSC 4 CODE– BST2T04

ECONOMIC STATISTICS (2 CREDITS –30 Hrs)

OBJECTIVES:

1. To give the students' knowledge of Index numbers, cost of living index, national income
2. To let the students, know about laws of Demand and Supply and how the market keeps changing in accordance with time

OUTCOMES:

1. Students have gained knowledge about the market statistics, inflation and deflation,consumers priceindex, wholesale price index, etc
2. How to compute National income and understand the purchasing power of money
3. Market demand and price relation, supply and its relation to price, elasticities of priceand effect of timeseries on market

Unit-I (7 Hrs)

(A) Index number: Its definition, applications of index numbers, price relatives and quantityor volume relatives, link and chain relatives, problems involved in computation of index numbers, use of averages, simple and weighted aggregative and simple and weighted average methods, Laspeyre's, Paasche's, Marshall Edgeworth's, Walsch's, Kelly's Drobish Bowley's and Fisher's quantity and price index numbers, Time and Factor reversal tests of index numbers.

Unit-II (7 Hrs)

(B) Base shifting, Splicing of index number series, Consumer Price Index: steps in its construction, methods and uses, Index of Industrial Production: method of construction and itsuses, Wholesale price index number: method of construction and its uses, concept of purchasing power of money, inflation and deflation, Methods of computation of national income.

Unit-III (8 Hrs)

(C) Demand Analysis: Demand and Supply function, Static laws of demand and supply, priceelasticity of demand, price elasticity of supply, Income and cross elasticity of demand. Engel' law and Engel's curves, analysis of income and allied size distribution – Pareto distribution, fitting of Pareto's law, Lorenz curve andGini's coefficient.

Unit-IV (8 Hrs)

(D) Time Series Analysis: Economic time series, its different components, illustrations, additive and multiplicative models, methods of determination of trend, analysis of seasonal fluctuations, methods of construction of seasonal indices. Estimation of elasticity from time series data: Leontief's method, Pigou's method

PRACTICALS ON PAPER IV (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Construction of price and quantity Index numbers by simple aggregativemethod.
2	Construction of price and quantity Index numbers by weighted aggregative method. Using Laspeyre's, Paasche's, Mashall Edgeworth's, Walsch's, Drobish-Bowley's, Fisher's method and Kelly's fixed weight method.
3	Construction of price indices using simple and weighted average of price relatives using arithmetic mean and geometric mean.
4	Construction of chain base indices.
5	Problems on base shifting of index numbers.
6	Construction of cost-of-living index numbers by (i) aggregateexpenditure method (ii)family budget method.
7	Determination of trend in a time series using moving average method.
8	Determination of trend in a time series using least square method.
9	Construction of seasonal indices using ratio to moving average method.
10	Construction of seasonal indices using ratio to trend method.
11	Construction of seasonal indices using link relative method.
12	Fitting of demand curve / function and Estimation of price elasticity ofdemand from time series data.
13	Fitting of Pareto curve to income data.
14	Fitting of Lorenz curve of concentration.

REFERENCES

1 Croxton F.E and Cowden D.J. (1969): Applied General Statistics, Prentice Hall of India.

2 Goon A.M., Gupta M.K., Das Gupta. B. (1986): Fundamentals of Statistics, Vol.II, World Press, Calcutta

3 Gupta and Mukhopadhyay P.P.: Applied Statistics, Central Book Agency

4 Hooda R P: 'Statistics for Business and Economics'; MACMILAN Business books, third edition

5 Nagar A. L. and Das R. K. : Basic Statistics; Oxford University Press

6 Asthana and Shrivastav: Applied Statistics of India ,Chaitanya Publishing House

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Vocational Skill Courses (VSC) for Sem II

For Statistics major

	Semester II (VSC)
	Name of the Paper - EXCEL for Beginners
	Paper code – BVS2P03 2 Credits (4 hrs practical per week)
	List of Practicals
1	Data Entry, Editing & saving
2	Establishing and copying formulae ,Built in functions – Copy and paste. Find and Replace
3	Sorting - A tool that allows you to arrange data in ascending or descending order. Study of statistical function .
4	Introduction to spreadsheet, reading data, manipulating
5	Basic spreadsheets operations & functions – IF, nested IF, VLOOK UP, H LOOK UP,Functions that allow you to search for specific data in a table and return corresponding values.
6	Pivot Tables- An interactive table that allows you to summarize and analyze large amounts of data.
7	Conditional Formatting - A feature that allows you to control the type of data that can be entered into a cell.
8	Data Validation - A feature that allows you to control the type of data that can be entered into a cell.
9	Filtering - A technique that allows you to display only specific rows of data based on certain criteria.
10	Trend Analysis A technique that allows you to identify patterns and trends in data over time.
11	Charts and Graphs Plotting different type of diagrams (Bar ,subdivided Bar ,multiple bar etc) Visual representations of data that allow you to identify trends and patterns.
12	Plotting Scatter diagram
13	Problems on Calculation of coefficient of Correlation
14	Problems on Calculation of coefficient of rank Correlation
15	Problems on fitting of lines of regression
16	Fitting of Binomial distribution
17	Fitting of Poisson l distribution
18	Fitting of Normal distribution

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Zoology)

Submitted by

Board of Studies,

Bachelor of Science (Zoology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Zoology- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem.-I (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	BZO1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	BZO1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biology	BZO1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biology	BZO1T02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Vermicomposting	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)	BZO2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)	BZO2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cell Biology	BZO2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cell Biology	BZO2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Culture of Indian major Carps	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem.-III (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals- Chordates (Protochordata to Amphibia)	BZO3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals- Chordates (Protochordata to Amphibia)	BZO3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Genetics	BZO3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Genetics	BZO3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem.-IV (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals- Chordates (Reptilia to Mammalia)	BZO4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals- Chordates (Reptilia to Mammalia)	BZO4P07			2	1	-	-	-	-	25	25	25
3	DSC	Developmental Biology	BZO4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Developmental Biology	BZO4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem.-V (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	General Mammalian Physiology I	BZO5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	General Mammalian Physiology I	BZO5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Zoology	BZO5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Applied Zoology	BZO5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Evolutionary Biology	BZO5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Evolutionary Biology	BZO5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Systematic Entomology • Systematic Ichthyology • Male Mammalian Reproductive Physiology • Endocrinology	BZO5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Systematic Entomology • Systematic Ichthyology • Male Mammalian Reproductive Physiology • Endocrinology	BZO5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket		-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service		-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem.-VI (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	General Mammalian Physiology II	BZO6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	General Mammalian Physiology II	BZO6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Parasitology	BZO6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Parasitology	BZO6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology	BZO6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology	BZO6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Insect morphology and Physiology • Fish Physiology/ • Female Mammalian Reproductive Physiology • Biochemistry	BZO6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Insect morphology and Physiology • Fish Physiology/ • Female Mammalian Reproductive Physiology • Biochemistry	BZO6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem.-VII (Honors) (Zoology- Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Systematic Zoology	BZO7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Systematic Zoology	BZO7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Biotechnology	BZO7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Biotechnology	BZO7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Biostatics and Bioinformatics	BZO7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Biostatics and Bioinformatics	BZO7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Microtechniques	BZO7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Microtechniques	BZO7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BZO7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BZO7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem.-VIII (Honors) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Biotechniques	BZO8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biotechniques	BZO8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Ethology	BZO8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Ethology	BZO8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology	BZO8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology	BZO8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Immunology	BZO8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Immunology	BZO8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem.-VII (Research) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Systematic Zoology	BZO7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Systematic Zoology	BZO7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Techniques in Life Sciences	BZO7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Techniques in Life Sciences	BZO7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Biostatics and Bioinformatics	BZO7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Biostatics and Bioinformatics	BZO7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BZO7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BZO7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem.-VIII (Research) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Biotechniques	BZO8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biotechniques	BZO8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Ethology	BZO8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Ethology	BZO8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology And Immunology	BZO8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology And Immunology	BZO8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Zoology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Vermicomposting	Zoology	**BVS1P01**
II	**VSC`**	Culture of Indian major Carps	Zoology	**BVS2P03**
III	**VSC**	Aquarium preparation and maintenance	Zoology	**BVS3P05**
V	**VSC**	Silkworm culture	Zoology	**BVS5P07**
VI	**VSC**	Prawn culture	Zoology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (B.Sc. Zoology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Systematic Entomology	BZO5T12
		B. Systematic Ichthyology	
		C. Male Mammalian Reproductive Physiology	
		D. Endocrinology	
VI	Elective 2	A. Insect Morphology and Physiology	BZO6T16
		B. Fish Physiology	
		C. Female Mammalian Reproductive Physiology	
		D. Biochemistry	
VII (Honors)	Elective 3	A. Insect pests	BZO7T21
		B. Applied Fisheries	
		C. Reproductive Endocrinology and Toxicology	
		D. Nerve Physiology	
VIII (Honors)	Elective 4	A. Industrial Entomology	BZO8T27
		B. Fishery technology and fish pathology	
		C. Avian Biology	
		D. Hydrobiology	
VII (Research)	Elective 3	A. Insect pests	BZO7T20R
		B. Applied Fisheries	
		C. Reproductive Endocrinology and Toxicology	
		D. Nerve Physiology	
VIII (Research)	Elective 4	A. Industrial Entomology	BZO7T25R
		B. Fishery technology and fish pathology	
		C. Avian Biology	
		D. Hydrobiology	

'R' in the subject code indicates 'Research'.

FYUGP ZOOLOGY

Programme Specific Outcomes (PSOs) of Four Year Undergraduate Programme for Zoology:

- Students will be able to describe, identified, classified and differentiate the animals of different taxonomic ranks. They could differentiate morphological, anatomical, and histological features of different organs and organ-systems of different animal groups. They could understand and analyze the different evolutionary trends among different animal groups.
- Students could describe different component of environment and ecosystems an could understand and explain the significance of consequences of deterioration of ecosystem and biodiversity. They could estimate and evaluate the different physic-chemical parameters of waters like DO, dissolved CO_2, pH, hardness etc. to deduce its status.
- Students could able to describe, sketch and differentiate different cell organelles of animal cell and could examine normal and abnormal cellular physiology. Students could demonstrate cells organelles and acellular components in tissues as well as able to estimate protein, lipid and carbohydrates in tissues.
- They could able to describe, interpret inheritance pattern in animals . They could differentiate varied mechanisms controlling inheritance in animals.
- They could describe, analyze the different aspect of Applied Zoology. They could understand the practices of apiculture, sericulture, fisheries etc. and acquainted themselves with economic benefit of these practices as well as explain it to others.
- Students understand, analyze, interpret the innate and learned behaviour of different animal groups.
- Students will be able to perform different experiments which could help them to prove their hypotheses. They could able t o analyze the data with help of different statistical tools. Students will develop capabilities which help them to design and investigate the scientific research work. They could able to draft a scientific write up and could argue, defend his findings based on standard practices of research in Life Science

B.Sc. Sem. I . DSC: BZO1T01

Life and Diversity of Animals - Nonchordates (Protozoa to Annelida)

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to understand about early phyla viz., Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida.
- Students could able to identify, classify and analyze different animals belonging to phylum Protozoa to Annelida on the basis of levels or grades of organization, symmetry, coelom etc. upto class.
- Students will learn, analyze, describe a representative animal belonging to phylum Protozoa to Annelida
- Students could elucidate and explain uniqueness of phylum Protozoa to Annelida and they could able to demonstrate peculiar tissues, organs of animals belonging to these phyla.

Unit:I **7 Hrs.**

1.1 **Kingdom Protista, Phylum - Protozoa:** General characters of Protozoa.
1.2 **Paramecium:** Structure, locomotion and reproduction.
1.3 **Plasmodium:** Structure and life cycle.
1.4 **Parasitic Protozoans of Man :** *Entamoeba, Trypanosoma, Giardia and Leishmania* - Mode of infection, Damage and control.

Unit: II **7 Hrs.**

2.1 **Kingdom- Animalia:** Major phyla of Animalia, general characters and classification upto classes of Phylum Porifera.

2.2: **Sycon**: Structure, reproduction and development, Canal system in sponges.

2.3 C**oelenterata** : General characters and classification up to classes.

2.4 ***Obelia*** : Structure and life cycle, corals and coral reef formation.

Unit III **8 Hrs.**

3.1Platyhelminthes: General characters and classification up to class.

3.2*Taenia solium*: Structure and life cycle, parasitic adaptations in ***Taenia solium.***

3.3Aschelminthes: General characters and classification up to classes.

3.4*Ascaris* : External morphology, reproductive system and life cycle.

Unit – IV **8 Hrs.**

4.1 **Annelida**: General characters and classification up to classes.

4.2 **Leech**: Morphology, digestive and urinogenital system.

4.3**Annelidan larvae**: Trochophore larva and its significance.

4.4 Economic importance of Annelids: Harmful Annelids, Beneficial Annelids, Therapeutic value of Annelids.

Practical : BZO1P01

1. Study of museum specimens (Classification of animals up to orders)

I. Protozoa (Slides) : *Paramoecium ,Euglena, Plasmodium vivax*

II. Porifera: *Sycon, Leucosolenia, Hyalonema, Euplectella, Spongilla*

III. Coelenterata : *Obelia, Aurelia, Tubipora, Fungia, Adamsia*

IV. Platyhelminthes : *Planaria, Fasciola, Taenia*

V. Aschelminthes : *Ascaris, Drancunculus, Ancylostoma, Wuchereria*

VI. Annelida : *Aphrodite, Nereis, Chaetopteurs, Tubifix, Hirudinaria*

2. Study of permanent slides

Enatmoeba, Giardia, Sponge gemmules, Sponge spicules,V.S. *Sycon*, T.S. *Sycon,*

Obelia medusa, Miracidium, Redia and Cercaria larvae of *Fasciola*,T.S. male and

female *Ascaris,* Scolex of *Taenia,* Mature and gravid proglottids of *Taenia solium,*

T. S. of Leech through crop pockets, Trochophore larva

3. Anatomical observation (Demonstration only through You tube video and other ICT tools, models, and charts)

Digestive, nervous and reproductive system of Earthworm

4. Mounting

Spicules and gemmules of Sponge, *Obelia* colony, *Nereis* parapodia, Jaws of Leech,

Nephridia of Leech.

Practical Examination Scheme
Distribution of Marks – **Total Marks: 25**

i. Identification and Comment on Spots (4 Museum specimens + 2 slides)	06
ii. Anatomical observation or Examination of pond water to identify invertebrates.	08
iii. Permanent stained preparation	04
iv. Submission of certified practical record	03
v. Submission of Slides	02
vi.Viva voce	02

List of Recommended Books:

1. Barnes R.D.(1980) **– Invertebrate Zoology. Halt-Saunders international,** 4th Edition, Philadelphia, USA, pp. 1089.

2. Borradaile L.A.and Potts F.A. (1935). **The Invertebrata; a manual for the use of students, 2nd Edition.** McMilan Publisher, New York, USA, pp. 746.

3. Nigam H. C. (2013). **Biology of Nonchordates.** Shoban Lal Nagin Chand, India, pp. 871.

4. Kotpal, Agrawal and Khetrapal (2012). **Modern Text Book of Zoology – Invertebrates.** Rastogi Publication, Meerut, India, pp.

5. Puranik P.G.and Thakur R.S. **– Invertebrate Zoology**

6. Majupuria T.C. **– Invertebrate Zoology**

7. Dhami and Dhami **– Invertebrate Zoology**

8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi

9. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition,** Rastogi Publication Meerut

10. EJW Barrington– **Invertebrate Structure and Function** ELBS III Edition8

11. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut

12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition

13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra

14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi

15. Ayer E. – **Manual of Zoology**

16. M.D. Bhatia – **The Indian Zoological Memories – Leech**

17. Beni Prasad – **The Indian Zoological Memories – Pila**

18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd

19. A manual of Practical Zoology Invertebrates – P. S. Verma

DSC: BZO1T02

Environmental Biology

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to describe and explain atmosphere,hydrosphere, lithosphere and energy resources.
- Students could describe, elucidate different types and components of ecosystems. They could identify, describe and explain different biotic components and could explain and analyze their role in ecosystem.
- Students will describe, explain and aware about the significance and need of biodiversity conservation. They also understand, describe and explain legislations passed to conserve the biodiversity and acquainted themselves to nearby National Parks and Wildlife Sanctuaries.
- They will elucidate and differentiate causes of different types and hazards of pollution.
- Students will estimate the different physico-chemical parameters of water to analyze.

Unit–I *7 Hrs.*

1.1 Atmosphere: Major zones, importance, composition of air.

1.2 Hydrosphere: Global distribution of water, Physico-chemical characteristics of water.

1.3 Lithosphere: formation of soil, Causes of soil erosion.

1.4 Renewable and non-renewable energy sources.

Unit–II *7 Hrs.*

2.1 Ecosystem-Definition and Types- Forest, Grassland, Desert, Pond.

2.2 Food chain, food web.

2.3 Ecological pyramids- Definitions, pyramids in pond, forest and parasitic food chain.

2.4 Energy flow in an ecosystem, Single channel, Y –shape and Universal model.

Unit–III *8 Hrs.*

3.1 Biodiversity and its conservation, Biological Diversity Act, 2002.

3.2 Causes of reduction of biodiversity.

3.3 Salient features of Wildlife Protection Act, 1972, Zoological Survey of India: formation and role in animal conservation.

3.4 Hot spots of biodiversity in India,Introductory study of national parks and sanctuaries – Tadoba, Nagzira, Kanha.

Unit–IV *8 Hrs.*

4.1 Air Pollution: Sources, effect and control measures of air pollution, Acid rain, green house effect, ozone depletion and global warming.

4.2 Water Pollution: Sources, effect and control measures of water pollution, effect of mercury.

4.3 Noise pollution: Sources effect and control measures of noise pollution.

4.4 Biomagnification and Bioaccumulation.

Practical: BZO1P02

1. **Major Experiment**:
   i. Estimation of dissolved oxygen (DO) of water.
   ii. Estimation of soil organic carbon by Walkley and Black (Rapid Titration) method.
   iii. Estimation of total hardness of water.
2. **Minor experiment**

   i. To demonstrate the functioning of Simple and Compound Microscope (Minor)

   ii. Estimation of pH of water sample.

   ii. Estimation of noise frequency by using dB meter.

   iii. Quantitative analysis of plankton by Sedwick Rafter method.

   iv. Estimation of free CO_2 of water .

3. **Preparation of permanent stained preparation of zooplanktons**

4. Collection of photographs and identification of producers, primary consumers, secondary consumers, tertiary consumers, decomposers.

5. Preparation of permanent stained preparation of zooplanktons.

6. Study and collection of different types of zooplanktons.

7. Study tour at nearby forest and to record faunal biodiversity of nearby forest.

Practical Examination Scheme

Distribution of Marks – **Total Marks: 25**

i Major experiment	06
ii Minor experiment	04
iii. Identification of consumers and planktons (Any four)	04
iv. Preparation of permanent slide of plankton	03
v. Submission of certified practical record	02
vi. Submission of photographic cards of consumers, zooplanktons	02
vii. Submission of tour diary	02
viii. Viva voce	02

List of recommended Books:

1. Ashthana D.K.(2001). **Environmental Problem and Solution,** S. Chand Publication, pp. 434.

2. Agrawal K.C.(1987). **Environmental Biology.** Agrobios Publishers, pp. 439.

3. Agrawal K.C. (1996). **Biodiversity.** Agrobios Publishers, pp. 144.

4. Mukharjee B. (1980). **Environmental Biology.** Mcgraw Hill, pp. 640.

5. Arora S. (2008). **Fundamentals of Environmental Biology.** Kalyani Publisher, pp. 294.

6. Sharma P.D.(2012). **Ecology and Environmental Biology.** Rastogi Publication, pp. 640.

7. Verma P.S. and Agrawal V.K. (2000). **Environmental Biology,** S. Chand Publication, pp. 434.

8. Trivedi & Rao **– Air Pollution**

9. Chapman J.L. and Reiss M.J. (1998). **Ecology-Principles and Applications**, 2nd ed., Cambridge University Press, pp. 336.

10. Chatterjee B (2003). **Environmental Laws-Implementation Problems and Perspectives.** Deep and Deep Publications,India, pp. 304

11. Sharma P.D. (1997). **Environmental Biology**, Rastogi Publication, Meerut, pp. 416.

12. Trivedi R.K. (19976). **Handbook of Environmental Laws, Acts, Rules, Guidelines, Compliances and Standards.** Enviro Media

13. Odum E.P. and Barret G,W, (2005). **Fundamentals of Ecology**, 5th edition. Thomson Brooks/ Cole , pp.598.

14. Smith R.L. (1996). **Ecology and Field Biology**, Harper Collins

15. Saxena D.N. **– Environmental Biology**, Studium Press (India)

16. Davis – **Behavioral Ecology**

17. Kumar U. and Asija M.J. (2000). **Biodiversity – Principle and Conservation.** Agrobios Publishers, pp. 302.

18. Rao M. and Rao H.V.N. (2017). **Air Pollution,** Mcgraw Hill, pp. 339.

19. Satyanarayan S., S. B. Zade S.B., S.R. Sitre S.R.and Meshram P.U. – **A Text Book of Environmental Studies**, Allied publisher (India)

20. Smitz R.J. (1996). **Introduction to Water Pollution.** Asian Books Private Limited, pp. 320

21. Subrahmnyam N.S. and. Sambamurthy A V.S.S (2000). **Ecology.** Narosa Publishing House, pp. 616.

B.Sc. Sem. I
VSC course : Vermicomposting BVS1P01
Credit: 2
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Course outcomes: After completion of this course, student will –

- Get acquainted with hand on training of vermicomposting.
- Get acquainted with hand on training of vermiwash.
- Able to understand and learn about the vermicompost marketing.
- Able to do internship in any commercial vermicompost or vermiwash unit.

Practical:

1. Collection of Biodegradable wastes (Solid waste) and their segregation and processing
2. Bed Preparation for Pit/Windrow method
3. Pit Regulation, its maintenance and precautions
4. Earthworm collection and application on bed
5. Inspection of bed, watering and top up
6. Vermicompost collection, earthworm separation (Harvesting), air drying of vermicompost, sieving and storage of compost
7. Vermiwash: methods collection and processing
8. Cocoon formation, breeding methods of worms
9. Standardize technique with categorized biodegradable wastes
10. Analysis of vermicompost and vermiwash; soil testing
11. Applications/ packaging and marketing of byproducts
12. Visit to vermiculture farm/setup

Suggested reading:

Lekshmy MS and Santhi R. Vermitechnology. Saras Publication, pp. 416.

Singh K (2014). Textbook of vermicompost: vermiwash and biopesticides. Astral International, pp. 97.

Davies P. (2014). Vermicomposting and vermiculture, pp. 49.

Das M. (2013). Tools for vermitechnology. IK International Publishing House Pvt. Ltd., 1st ed., pp. 196

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem. II

DSC: BZO1T03

Life and Diversity of Animals – Non-Chordates: Life and Diversity of Animals (Arthropoda to Hemichordata)

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

1. Students will learn, identify, explain and analyze the taxonomic position of animals belonging to phylum Arthropoda to Hemichordata
2. They could describe, explain and analyze phylogeny to understand the course of evolution in animals from phylum Arthropoda to Hemichordata
3. They will able to describe, explain and differentiate various morphological, anatomical structures and functions of animals of phyla from Arthropoda to Hemichordata.
4. Students will able to understand , describe, explain and differentiate the larval forms and development of the invertebrates from phylum Arthropoda to Hemichordata
5. Students will able to describe, explain and analyze the ecological and economic importance of invertebrates.
6. Students will understand, able to describe, explain and analyze the ecological role of invertebrates in the biodiversity.

UNIT: I **7 Hrs**

1.1. Arthropoda: General characters of the phylum and classification up to classes with suitable examples

1.2. Cockroach: Digestive system, Male and Female reproductive system

1.3. **Insects as Vectors** : Mosquito, Housefly, Tse-Tse fly

l. 4. Study of crustacean larvae: Nauplius, Zoea and Megalopa

UNIT: II **7 Hrs**

2.1 Mollusca: General characters and classification up to classes

2.2 Pila: Respiratory system and Mechanism of Aquatic and Pulmonary respiration.

2.3 Economic importance of Mollusca: Edible oyster farming, pearl forming mollusc, types of pearl culture

2.4 Molluscan larva: Glochidium and Veliger

UNIT: III **8 Hrs**

3 .1 Echinodermata: General characters and classification up to classes

3.2 Asterias: External morphology, Straight and Crossed type of Pedicellariae.

3.3 Water vascular system and locomotion in *Asterias*

3.4 Echinoderm larva: Bipinnaria and Auricularia

UNIT: IV **8 Hrs**

4.1 Hemichordata: General characters and Phylogeny

4.2 Balanoglossus: External features and digestive system

4.3 Pre-Larval Development in Balanoglossus, Tornaria larva

4.4 Affinities of Balanoglossus with Annelida, Echinodermata and Chordata

Practical - BZO1P03

1. **Study of museum specimens** (Classification of animals up to orders)

I. Arthropoda : Crab, Prawn, Scolopendra, Julus, Dragonfly, Moth, Limulus
II. Mollusca : Chiton, Dentalium, Pila, Mytilus, Sepia, Octopus
III. Echinodermata : Asterias, Ophiothrix, Holothuria, Antedon, Echinus
IV. Hemichordata : Balanoglossus, Saccoglossus

2. Study of permanent slides- Nauplius, Zoea and Megalopa larva of Arthopoda, Glochidium larva, Bipinnaria larva, T.S. Balanoglossus through branchiogenital region, Tornaria larva

3. Anatomical observation (Demonstration Only -Through You Tube Video and other ICT tools, Models, Charts) –

I. Digestive system of Cockroach
II. Male and Female Reproductive system of Cockroach
III. Water vascular system in *Asterias*.

4. Mounting (Any two) - I. Crustacean larvae and planktons

II. Mouth Parts of Insects – Cockroach/Mosquitoes

III. Gill lamella of Pila

5. Collection of photograph of insect vectors.

6. Examination of pond water to identify aquatic Arthropods and Molluscs.

Practical Examination Scheme

Distribution of Marks – **Total Marks: 25**

i Identification and Comment on Spots (4 Museum specimens + 2 slides)	06
ii Anatomical observation or Examination of pond water to identify invertebrates.	08
iii Permanent stained preparation	04
iv Submission of certified practical record	03
v. Submission of Slides	02
vi. Viva voce	02

List of recommended books:

1. Barnes **– Invertebrate Zoology (Halt-Saunders international)** Philadelphia, USA

2. Barradaile L.A. and Potts F.A. – **The Invertebrate**

3. Nigam **– Biology of Nonchordates**

4. Kotpal, Agrawal & Khetrapal **– Modern Text Book of Zoology - Invertebrates,**

Rastogi Publication, Meerut

5. Puranik P.G. and Thakur R.S. **– Invertebrate Zoology**

6. Majupuria T.C. **– Invertebrate Zoology**

7. Dhami and Dhami **– Invertebrate Zoology**

8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi

9. Dr. S.S. Lal **Practical Zoology Invertebrates**. 9th edition**,** Rastogi Publication Meerut

10. EJW Barrington– **Invertebrate Structure and Function.** 8th Edition, ELBS III

11. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut

12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition

13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra

14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi

15. Ayer E. – **Manual of Zoology**

16. M.D. Bhatia – **The Indian Zoological Memories – Leech**

17. Beni Prasad – **The Indian Zoological Memories – Pila**

18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd

19. A manual of Practical Zoology Invertebrates – P. S. Verma

DSC: BZO1T04

Cell Biology
Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to describe, sketch, analyze, and explain the structure and function of the cell organelles.
- Students could describe, sketch, analyze, and explain the structure and function of nucleus and chromatin structure, its location.
- Students will able to describe, sketch, analyze, and explain the basic principle of life. Theu could also demonstrate and explain how a cell divides leading to the growth of an organism.
- Students could describe, sketch, analyze, and explain how a cell communicates with its neighbouring cells.
- Students will able to describe, sketch, analyze, and explain the abnormality in structural and functional aspects of cells.
- Students will able handle and use microscopes and oculometer to elucidate and measure and explain the minor details of tissues.
- Students will able to demonstrate osmosis. They could also demonstrate and explain mitochondria, salivary gland chromosome and Barr body in cells.

UNIT: I **7 Hrs.**

1.1 Ultra-structure of Plasma membrane and it's chemical composition

1.2 Endomembrane system: Protein sorting, transport, exocytosis, endocytosis

1.3 Cell-cell interaction: Cell adhesion molecules, cellular junction

1.4 Golgi Complex: Structure and functions.

UNIT 2 **7 Hrs.**

2.1 Cytoskeleton: Microtubules, Microfilaments, intermediate filaments.

2.2 Mitochondria: Structure and Oxidative phosphorylation, ETS.

2.3 Peroxisome: Structure and functions.

2.4 Ribosome: Structure, types, Lake's model and functions.

UNIT 3 **8 Hrs.**

3.1 Lysosome: Structure, polymorphism and functions

3.2 Structure and function of Nucleus and Nuclear membrane

3.3 Chemical Composition and base composition of DNA and RNA

3.4 Chromatin Modelling: Supercoiling, Chromatin organization, structure of chromosome

UNIT 4 **8 Hrs.**

4.1 Cell cycle and its regulation, Apoptosis

4.2 Cell Division: Mitosis and Meiosis

4.3 Signal transduction: Intracellular signalling, cell surface receptors, G-protein coupled receptors

4.4 Cellular aging and cell death

Practical: BZO1P04

1. **Major Experiment**
   a. Study of Osmosis in human RBCs (Hypertonic, hypotonic and isotonic).
   b. Demonstration of Mitotic cell division in *Allium cepa.*
   c. Demonstration of Salivary gland chromosome in Mosquito/ *Chironomous* larvae.
   d. Demonstration of Barr body in blood smear.
2. **Minor Experiment**
   a. Use of Ocular micrometer and measurement of Micro objects.
   b. Demonstration of Meiotic cell division in *Tradescantia* buds or Grasshopper Testis (Virtual/Pictorial).
   c. Demonstration of mitochondria in buccal epithelium by Janus green B method.
3. **Reading/Preparation/Presentation a report** on Indian Scientist who contributed in the field of Cell biology/Molecular Biology (Dr. Hargovind Khurana, Dr. Lalji Singh, Dr/ Shantiswaroop Bhatnagar, Dr. Arunkumar Yadav etc.)
4. **Preparation of photographic cards on various cell organelles.**

Practical Examination scheme

Distribution of Marks –	**Total Marks: 25**
1. Major Cytology Experiment	06
2. Minor Cytology Experiment	04
3. Report (Indian Scientists)	02
4. Submission of Laboratory report/slides/photographs	03
5. Submission of certified Practical Record	05
6. Viva voce	05

List of recommended Books:

1. Powar C.B. (1991). **Cell Biology**. Himalaya Publication, New Delhi, pp. 782.

2. Dr. S.P. Singh, Dr. B.S. Tomar (2007). **Cell Biology.** 9th revised edition, Rastogi Publication, Meerut

3. Gupta P.K. (2018). **Cell and Molecular Biology.** Rastogi Publication, Meerut, pp. 942.

4. Veer Bala Rastogi. **Introduction to Cell Biology**, Rastogi Publication, Meerut

5. Gerald Karp (2007). **Cell and Molecular Biology-Concepts and Experiments**, John Wiley and Sons, pp. 843.

6. De Robertis, E. D. P., Nowinski, W. W., Saez, F. A. (1965). Cell Biology, Saunders, pp. 446.

7. Verma P.S. and Agrawal V.K. **Concepts of Cell Biology**

8. Dowben R.M. (1971). **Cell Biology.** Harper and Row Limited, pp. 570.

9. Witt **– Biology of Cell**

10. Ambrose E.J. and Easty D.M. (1970). **Cell Biology.** Thomas Nelson and Sons Ltd, pp.500.

B.Sc. Sem. II
VSC course: Culture of Indian Major Carps BVS1P03
Credit: 2
.

Course outcomes: After completion of this course, student will–

- Able to sketch, describe, Identify and classify the Indian major carps.
- Design the layout of the various types of ponds for the rearing of various stages of IMC.
- Get acquainted with hands on training of various breeding techniques.
- Get acquainted with hands on training of rearing of fry to fingerlings.
- Able to understand the different types of crafts and gears used in fish harvesting (Catching).
- Get hands on training of handling of various gear, crafts used in fish harvesting (Catching).
- Able to do internship and work in any commercial breeding centre .

Practical:

- Identification and classification of Indian major carps and other cultivable carps along with IMC (*Labeo, Catla and Mrigal, L. calbasu*, Grass carp, Silver carp, *Cyprinus*)
- Study of preparation of nursery, rearing and stocking pond by visiting Fish farm or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of food and feeding habits of Indian major carps with the help of already available Food/ ICT tools/ models/ charts/ photographs etc.
- Study of carp seed rearing by visiting breeding centers or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of rearing of fry to fingerlings by visiting breeding centers or help of ICT tools/ models/ charts/ photographs etc.
- Study of harvesting tools. (Crafts and Gears) with the help of already available crafts and gears / ICT tools/ models/ charts/ photographs etc.
- Study of fertilizers with the help of already available Fertilizers/ ICT tools/ models/ charts/ photographs etc..
- Study of stocking density to various ponds by visiting Fish farm or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of preservation techniques with the help of ICT tools/ models/ charts/ photographs etc.
- Visit to breeding centers.
- Market survey.

Suggested reading:

- **Datta Munshi, JS and Shrivastva, M P (1988).** Natural history of fishes and systematic of fresh water fishes. Narendra Publishing House, pp. 381.
- **Jayaram KC (1981).** The freshwater fishes of India, Pakistan, Bangladesh, Burma and Shri Lanka Handbook: Zoological Survey of India, pp.475.
- **Mishra K. S. (2003).** An aid to the identification of common commercial fishes of India and Pakistan. Narendra Publishing House, pp. 320.
- **Bardach, J.E. (1974).** Aquaculture: The farming and husbandry of freshwater and marine organism. John Wiley and Sons, pp. 882.
- **Chonder S L(1970).** Handbook of breeding of Indian Major Carps by pituitary hormone injection. Satish Book Enterprises, pp. 100.
- **Jhingran V G (1991).** Fish and fisheries of India: Hindustan Publication Corporation, pp. 727.
- **Sinha VRP (1993).** A compemendium of aquaculture technologies:. Oxford and JBH Publication Co. New Delhi.
- **Pandey K and J.P. Shukla JP (2018).** A Textbook of fish and fisheries Rastogi Publication, Meerut, pp. 588.
- **Khanna SS and Singh HR (2014)**. A text book of fish biology and fisheries. 3rd edition, Narendra Publishing House.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B. Sc. in Applied Electronics & Software Technology

Submitted by

Board of Studies,

B. Sc. in Applied Electronics & Software Technology

FYUGP - Scheme I - VIII Semester as per NEP

B.Sc. in Applied Electronics & Software Technology (Honors/Research)
Four Year (Eight Semester Degree Course)Teaching and Examination Scheme

Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming I	BET1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming I	BET1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Electrical Engineering	BET1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Electrical Engineering	BET1P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BET1T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BET1P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BET1T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BET1P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mathematics I	BET1T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Social Science	BET1T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Communicative English	BET1T07	2	-	-	2	3	50	50	40	-	-	-
12	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-		100	50
Total				14	-	16	**22**		**530**	**170**		**200**	**200**	

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming I	BET2T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming I	BET2P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Electrical Engineering	BET2T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Electrical Engineering	BET2P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BET2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BET2P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BET2T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BET2P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mathematics I	BET2T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Social Science	BET2T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Communicative English	BET2T07	2	-	-	2	3	50	50	40	-	-	-
12	VEC	Environmental Sci.	BVE2T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1P02	-	-	4	2	-				-	100	50
Total				14	-	16	**22**		**530**	**170**		**200**	**200**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming II	BET3T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming II	BET3P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BET3T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BET3P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 5 (Refer Minor Basket)	BET3T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 5 (Refer Minor Basket)	BET3P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 6 (Refer Minor Basket)	BET3T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 6 (Refer Minor Basket)	BET3P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mechanics	BET3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSEC	Engineering Drawing	BET3T06	-	-	4	2	-	-	-	-	50	50	50
11	VSEC	Workshop	BET3T07	-	-	4	2	-	-	-	-	50	50	50
12	AEC	Engineering Mathematics II	BET3T08	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**250**	**250**	

Semester IV

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming II	BET4T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming II	BET4P01			2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BET4T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BET4P02			2	1	-	-	-	-	-	50	25
5	DSC	Electron Devices & Circuits	BET4T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electron Devices & Circuits	BET4P03			2	1	-	-	-	-	25	25	25
7	DSC	Linear Network Analysis	BET4T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Linear Network Analysis	BET4P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mechanics	BET4T05	2	-	-	2	3	80	20	40	-	-	-
10	AEC	Engineering Mathematics II	BET4T06	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution ofIndia	BVS4T02	2	-	-	2	3	80	20	40	-	-	-
12	CEP	Community Service	BCM5P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P04	-	-	4	2		-	-	-	-	100	50
Total				14	-	16	**22**		**400**	**100**		**300**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Semester V

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microprocessors	BET5T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microprocessors	BET5P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Integrated Circuits	BET5T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Integrated Circuits	BET5P02	-	-	2	2	-	-	-	-	-	50	25
5	DSC	Digital Signal Processing	BET5T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital Signal Processing	BET5P03	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Instrumentation & Control System	BET5T04	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Instrumentation & Control System	BET5P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Algorithm & Data Structure	BET5T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Algorithm & Data Structure	BET5P05	-	-	2	1	-	-	-	-	25	25	25
11	GE / OE	Communication Electronics	BET5T06	2	-	-	2	3	80	20	40	-	-	-
12	VSCE	MatLab & LabView	BET5T07	-	-	4	2	-	-	-	-	50	50	50
13	CEP	Unnat Bharat Abhiyan	BCM5P02	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**250**	**250**	**-**

Semester VI

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microprocessors	BET6T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microprocessors	BET6P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Integrated Circuits	BET6T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Integrated Circuits	BET6P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital Signal Processing	BET6T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital Signal Processing	BET6P03	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Instrumentation & Control System	BET6T04	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Instrumentation & Control System	BET6P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Algorithm & Data Structure	BET6T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Algorithm & Data Structure	BET6P05	-	-	2	1	-	-	-	-	25	25	25
11	GE / OE	Communication Electronics	BET6T06	2	-	-	2	3	80	20	40	-	-	-
12	VSCE	Simulation using MatLab & LabView	BET6T07	-	-	4	2	2	-	-	-	50	50	50
13	OJT	Industrial Training (Six Weeks)	BOJ6P01	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**250**	**250**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Semester VII

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microcontrollers	BET7T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microcontrollers	BET7P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	System Design	BET7T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	System Design	BET7P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Programming	BET7T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Programming	BET7P03	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Circuit Design	BET7T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Circuit Design	BET7P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Database Management System	BET7T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Database Management System	BET7P05	-	-	2	1	-	-	-	-	25	25	25
11	DSE	Industrial Organization & Management	BET7T06	2	-	-	2	3	80	20	40	-	-	-
12	DSE	Industrial Organization & Management	BET7P06	-	-	2	1	-	-	-	-	-	50	25
13	RM	Research Methodology	BET7T07	2	-	-	2	3	80	20	40	-	-	-
14	RM	Research Methodology	BET7P07	-	-	4	2	-	-	-	-	50	50	50
Total				14	-	16	**22**		**560**	**140**		**200**	**200**	

Semester VIII

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Microcontrollers	BET8T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Microcontrollers	BET8P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	System Design	BET8T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	System Design	BET8P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Programming	BET8T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Programming	BET8P03	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Circuit Design	BET8T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Circuit Design	BET8P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Computer Network	BET8T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Computer Network	BET8P05	-	-	2	1	-	-	-	-	25	25	25
11	DSE	Industrial Organization & Management	BET8T06	2	-	-	2	3	80	20	40	-	-	-
12	DSE	Industrial Organization & Management	BET8P06	-	-	2	1	-	-	-	-	-	50	25
13	RP	Project	BET8P01	-	-	8	4	-	-	-	-	100	100	100
Total				12	-	20	**22**		**480**	**120**		**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Note:- Total Credits 176

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

FYUGP-I-VIII Semester
Applied Electronics & Software Technology
(Honors/Research)
Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)
Scheme for Theory Examination
Duration for each theory Examination: **3 Hours**
Maximum Marks Allotted to each Theory: **80**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks, internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7.

Syllabus -- Eight Semesters

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-1 **APPLIED PHYSICS**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I: Motion of charges particles in uniform electric and magnetic fields, Thomson's method for determination of e/m of t1 electron, Electrostatic and magnetostatic focussi (qualitative idea); Bainbridge mass spectrograph, Cyclotron.
Unit II : Elementary ideas of C.R.O., electrostatic focusing in CRO,
Unit III : Crystals structure (cubic b.c.c. & f.c.c.), Atomic packing, Co-ordination numbers, Millers indices, Bragg's Law.
Formation of energy bands in solids (energy level approach) classification of solids in conductors, Insulators and semiconductors, Energy band diagram for silicon and germanium semiconductors, Fermi energy, Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, p-n junction, Transistor, Hall effect.
Unit IV : The quantum nature of radiation, Photoelectric effect, Compton effect, Wavelike character of particle, Davission and Germer's experiment, De Broglie wavelength, Heisenberg's uncertainty principle, Schroedinger's wave equation (qualitative aspect).
Unit V: Spontaneous and stimulated emission of radiation, Coherency Laser : Working principle, different types and application, Interference in thin films.

Books for reference:

1. Material Science and Engineering: V. Raghavan
2. Physics for students of science and Engineering Part II –David Haliday & Robert Resnick
3. Electronic Engineering material – John Allison (TMH)
4. Modern Physics – Sproul
5. Lasers and their application – M.L. Bessley (Tailer and France Ltd.)

1-P-1 **APPLIED PHYSICS**

Scheme of Examination;
No examination in semester I

Practical's

1. Determination of the resistivity of a semiconductor.
2. Determination of the band gap in a semiconductor using a p-n junction diode in reverse bias condition.
3. A study of the characteristics of a thermistor.
4. A study of single beam cathode ray oscilloscope (CRO) :-
5. A study of dual trace CRO:

i) Familiarization
ii) Determination of phase difference by direct method
iii) Determination of phase and frequency using lissajous patterns.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester I

1-T-2 **APPLIED CHEMISTRY**

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Structure of Molecules :
Isomerism, classification, optical isomerism, enatiomerism and distereoisomerism, geometrical isomerism; Conformational analysis of ethane and butane.

Unit II : Chemical bonding:
Introduction, Types of bonds, valence bond and molecular orbital approaches. Physical properties and chemical constitution, dipole moment and parachor.

Unit III : Air pollution and its control :
Introduction, causes of air pollution. Types of air pollutants, harmful effects of air pollution on human health. Control of air pollution.

Unit IV : Water treatment ;
Impurities in natural water (suspended, dissolved and bacterial), soft water and hard water, causes of hardness. Disadvantages of use of hard water for domestic and industrial purposes. Treatment of drinking water by filtration, coagulation, sedimentation and sterilization. Treatment of hard water for industrial purposes by Lime-soda method and ion-exchange method.

Unit V : Metals and Alloys ;
Introduction, characteristics of metals, alloys, purpose of making alloys, classification. Corrosion and protection of metals.

1-P-2 **APPLIED CHEMISTRY**

Scheme of examination (Practical)

No examination in semester I

1. Preparation and analysis of soap.
2. To determine the total hardness of hard water.
3. To determine the temporary hardness of hard water.
4. Determination of surface tension of liquid using stalagmometer.
5. Preparation of buffer solutions and determination of pH of buffer solution

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

1-T-3 COMPUTER PROGRAMMING I

Unit I:
Introduction, History of computers, Generation of computer.
Unit II:
Basic computer organization: input-output devices, Storage devices.
Unit III:
Relationship between hardware and software, System Software, Application Software
Unit IV:
Working with DOS, Basic DOS commands & advanced DOS commands.
Unit V: Flow chart
Books: Computer Fundamentals – P.K.Sinha

1-P-3 COMPUTER PROGRAMMING I

Scheme of Examination (Practical):
No examination in semester - I
Minimum 5 practical based on the theory syllabus.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T- 4 **ELECTRICAL ENGINEERING**

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Electric Circuits : Ohm's Law, Resistance in series, Resistances in parallel, Voltage source and current source (ideal and practical), Source Transformation

Unit II : Electric Circuits : Kirchoff's Current Law (KCL), Kirchoff's Voltage Law (KVL), Star-delta Transformation

Unit III: Magnetic Circuits: Magnetic field, Flux, Flux density, Magnetomotive force (mmf), Field intensity or magnetizing force, Magnetisation curve, Comparison of electric and magnetic circuits, Series and parallel magnetic circuits.

Unit IV : A.C. Circuits : Generation of single phase ac voltage and current, average and rms values, Form factor, Phasor representation of alternating quantity, Reactances and impedances,

Unit V : A.C. Circuits : A.C. through pure resistance, Inductance and capacitance, Power in ac circuit, Power factor, series and parallel as circuits, Resonance condition in series and parallel circuits.

Books :

1. A Text book of Electrical Technology : Volume I & II – B.L. Theraja
2. Worked Examples in Electrical Engineering – B.L. Theraja

1-P-4 **ELECTRICAL ENGINEERING**

Scheme of examination (Practical)
No examination in semester I

1. Verification of Kirchoff's Current Law.
2. Verification of Kirchoff's Voltage Law.
3. Verification of Superposition Theorem.
4. Study of B-H Curve.
5. Verification of various relations in R-L series circuit.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-5 ENGINEERING MATHEMATICS I

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Complex Numbers

Cartesian and polar form of complex numbers, D' – Movre's theorem, Exponential function of a complex variable, circular functions of a complex variable, Hyperbolic functions and their inverses

Unit II : Theory of Equations

General properties of polynomial equations, Relation between roots and coefficients, Transformation of equations, Horner's method of synthetic division, Reciprocal equations

Unit III : Tangents and Normals

Tangent and Normals, length of the tangent, subtangent, normal and subnormal

Unit IV : Expansion of functions

Maclaurins series, Taylor's theorem for functions of one variable

Unit V : Indeterminate Forms

Indeterminate forms, L' Hospital Rule for evaluating the indeterminate forms.

Books :

1 Higher Engineering Mathematics – Dr.B.S.Grewal
2 A Text Book of Engineering Mathematics – N.P.Bali, Manish Goyal
3 Engineering Mathematics – H.K.Das

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-P-5 COMMUNICATIVE ENGLISH

Course Outcomes :
By the end of the course the learners will be:

- Proficient in the four language skills namely Listening, Speaking, Reading and writing.
- Able to increase their vocabulary
- Able to master the basic grammatical concepts
- Able to produce good coherent Paragraphs and be adept at Writing.
- Able to understand the use of the Language through the Prose selections of eminent writers.
- Able to communicate effectively in their professional arena.

Applied Electronics and Software Technology
Semester I
Subject Communicative English

Theory: 40
Internal: 10
Total : 50

Unit I Reading Comprehension and Vocabulary Building 10
From the Prescribed Book: Glimpses, Board of Editors. Macmillan Education
A Snake in the Grass by R K Narayan
The Happy Prince by Oscar Wilde

Unit II Grammar 10

Subject word agreement
Tenses
Articles
Prepositions

Unit III Writing Skills 10

Job Application
Resume writing
Paragraph Writing
Precis Writing
Comprehension

Unit IV Use of Media and Technology in the Classroom **10**

Story Telling

PowerPoint Presentation

Unit V Speaking and Listening Skill **10**

Situational Conversation

Role Play

Voice Training and expression through Effective Public Speaking

Prescribed Book:

Glimpses, Board of Editors. Macmillan Education

Reference Books:

1. Professional Communication Skills : By Pravin S.R.Bhatia, A.M Sheikh: S.Chand and company
2. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
3. Mac Millan Foundation English R.K Diwedi and A.Kumar
4. Written and Spoken Communication in English- University Press
5. Applied English Grammar and Composition Dr. P.C.Das New Central Book Agency(P) Ltd
6. English Communication – A Textbook for the AECC – English As per the UGC Syllabus – Madhumita Chakraborty : Macmillan Education
7. Business Correspondence and Report Writing- Mc Graw Hill Education by R.C Sharma and Krishna Mohan
8. Soft Skills Dr. K. Alex by S. Chand

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-6 SOCIAL SCIENCE

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Industrial Psychology

i) Meaning and Definition
ii) Scope

Unit II : Fatigue in Industry

i.)Meaning and Definition of Fatigue
ii) Internal environment
iii) Factors creating fatigue
iv) Techniques of lessening physical fatigue, Other Techniques
v)External environment
vi) boredom and monotony

Unit III : Recruitment , Selection and training

i) Recruitment: sources of Recruitment
ii) Selection: steps in selection process
iii) Training: methods of training, Advantages of Training

Unit IV : Indian Constitution and Federal System

i) Remarkable features
ii) Federal System
iii) A Quasifederal constitution

Unit V : Fundamental Rights and Directive Principles of state policy

i) Fundamental rights
ii) Characteristics
iii) Fundamental Right enshrined in the constitution
iv) The directive principles of state policy

Bibliography

1) A new Outlook into Social Science – S. Shabbir, A. M. Sheikh, Jaya Dwadashiwar, S. Chand, Delhi
2) T. Ramasamy, 2012, Principles of Management, Himalaya Publishing House, Mumbai.
3) Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur.
4) King's, Personnel management & Industrial Relations, Harsha Rastogi, Delhi.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester I

1-P-6 ENGINEERING DRAWING I

Scheme of Examination (Practical)

No examination semester -I

Minimum 10 sheets based on syllabus :

1. Lettering, dimensioning, plane scales, diagonal scales, vernier scales and scale of chords.
2. Conic sections, general method of constructions, oblong method and concentric circle method for ellipse, rectangle method and tangent method for parabola, rectangular hyperbola, normal and tangent to the curves.

Books for reference :

1. Engineering Drawing by N.D. Bhatt
2. Engineering Drawing by A.R. Bapat.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-1 **APPLIED PHYSICS**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Magnetic Materials : Terminology and classification, Magnetic moments due to electron spin, Domain structure, Soft magnetic materials, Hard magnetic materials. Atomic Interpretation of diamagnetic paramagnetic, antiferromagnetic and ferromagnetic materials.

Ferromagnetic domains & polarization reversal, Alloys for care materials for rotating machines and transformers and for permanent magnets, non-magnetic steels. Non metallic magnetic materials, magnetic oxide, Thin film magnets, Magnetic materials for magnetic tape & memory devices.

Unit II : Dielectric Materials : Polarization Temperature & Frequency effects, electric breakdown, ferroelectric materials.

Unit III : Conductors & Resistors : Units and constants, The resistively range, Resistively of different materials. The free electron theory, conduction by free electrons, Conductor and resister materials, Superconductors.

Unit IV :Semiconductors : Introduction, The energy gap in solids, Entrinsic Semiconductors, extrinsic semiconductors, Semiconductor materials & their fabrication, Some Semiconductor devices.

Unit V :Semiconductor material technology : Method of materials preparation purification and doping, introduction to process of manufacturing semiconductor devices transistor.

Books for references :

1. Material Science and Engineering : V. Raghavan
2. Physics for students of science and Engineering Part II –David Haliday & Robert Resnick
3. Electronic Engineering material – John Allison (TMH)
4. Modern Physics – Sproul
5. Lasers and their application – M.L. Bessley (Tailer and France Ltd.)

2-P-1 **APPLIED PHYSICS**

Scheme of Examination (Practical)

Sessional - 20
Practical – 80
Total - 100

1. Study of the characteristics of germanium and silicon diodes and their comparison.
2. Study of the characteristics and verification of the stability action of zener diode.
3. Study of the input, output and transfer characteristics of a pnp-npn transistor in common base configuration.
4. Study of the input, output and transfer characteristics of a pnp/npn transistor in common emitter configuration.
5. Study of series and parallel combination laws for resistance and capacitance

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
Semester II

2-T-2 **APPLIED CHEMISTRY**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Thermochemistry
Introduction, heat of neutralization, heat of solution, heat of combustion, and their determination. Heat of reaction at constant volume and constant pressure. Laws of thermochemistry.

Unit II :Chemical kinetics
Introduction, molecularity, rate and order of reaction. Kinetics of first and second order reaction, their characteristics and methods for determination of order of reaction.

Unit III :Fuels
Introduction, classification, essential properties and selection of good fuels. Analysis of coal, refining of petroleum,synthetic fuels, biogas.

Unit IV : Non-metallic Engineering materials
a) Lime: Definition, classification and properties of lime.
b) Cement: Classification, manufacture of Portland cement. Chemistry of Portland cement, chemical composition, setting and hardening.

Unit V :Thermal insulators
Introduction, factors affecting thermal conductivity of insulators, characteristics of good thermal insulator, classification with examples. Glasswool, thermocole and cork.

Books :

1. Jain and Jain - Engineering Chemistry
2. Barrow G.M. - Physical Chemistry
3. Finer - Organic Chemistry
4. Bahl & Bahl - Organic Chemistry
5. Riggal - Industrial Chemistry
6. Martin Etal - Industrial and Manufacturing Chemistry.
7. Bahl & Tuli - Physical Chemistry

2-P-2 **APPLIED CHEMISTRY**

Scheme of examination(Practical)
Sessional : 20
Practical : 80
Total : 100

1. Preparation of an Azo dye and its application.
2. To study the heats of neutralization of

a) Strong acid by a strong base
b) Week acid by a strong base

3. To study heat of solution of a salt in water
4. To study the first order kinetics of the hydrolysis of Methyl acetate in an acid medium
5. To study second order kinetics of reaction of $K_2S_2O_8$ with KI

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-3 COMPUTER PROGRAMMING I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I :
Constants, Variables and keywords, Their types, rules to form keywords, constants and variable names , range of various types of constants. Hierarchy of various C operations.

Unit II
Control structure – 'if statement', 'if-else' statement, logical operators and conditional operators, relational operators

Unit III
Loop control structure : 'while', 'for loop', 'do-while' loop, break, continues statement.

Unit IV :
Functions : What is functions, Passing values between function, slope rule of functions, Function declaration and prototypes, Call by value, Call by reference, Recursion. Data types.

Unit V : Arrays
What are arrays, pointers and arrays, 2-dimensional arrays, Pointers and 2-dimensional arrays, Array of pointers, What are strings, Standard library string function, Array of pointers to strings structure.

Books for reference :

1. Computer Fundamentals – P.K. Sinha
2. Let us C - Yashwant Kanetkar
3. Exploring C - Yashwant Kanetkar
4. Mastering Turbo C - Dennis Ritchie
5. Programming in C - E.Balguruswamy
6. LABVIEW for everyone - Pravis Pring.

2- P-3 COMPUTER PROGRAMMING I

Scheme of Examination(Practical)

Sessional – 20
Paper - 80
Total - 100

Minimum 10 programs based on syllabus

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T- 4 ELECTRICAL ENGINEERING

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Single Phase Transformer
Introduction, Basic principle, Construction, Classification, EMF equation, Transformer on no-load and on load, Phasor diagram
Unit II : Single Phase Transformer
Equivalent circuit, Losses, Efficiency, Regulation, Open circuit test and short circuit test.
Unit III : DC Generator
Construction, Principles of operation, Classification, Emf equation, Losses and efficiency, Power stage diagram.
Unit IV : DC Motor
Construction, Principle of operation, Back emf, Voltage equation, Speed equation, Losses, Power stage diagram, Different types of motors.
Unit V : Single Phase Induction Motor
Construction, Principle of operation, Double field revolving theory, Types of single phase induction motor, split phase type, Capacitor start induction run & Capacitor start and run type.

Books :

1. A Text book of Electrical Technology : Volume I & II – B.L. Theraja
2. Worked Examples in Electrical Engineering – B.L. Theraja

2-P-4 ELECTRICAL ENGINEERING

Scheme of examination(Practical)
Sessional : 20
Practical : 80
Total : 100

1. Verification of various relations in R-C series circuit.
2. Verification of various relations in R-L-C series circuit.
3. Verification of various relations in R-L-C parallel circuit.
4. Study of single phase transformer
5. To open perform open circuit and short circuit test on single phase transformer.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-5 ENGINEERING MATHEMATICS I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Matrices

Addition, scalar multiplication and product of matrices, Elementary row operations, Rank and inverse of a matrix, Consistency and solution of a system of linear equations, Eigen values and eigen vectors

Unit II : Curvature and radius of curvature (cartesian, parametric and polar form), centre of curvature and circle of curvature (cartesian form only)

Unit III : Partial differentiation

Functions of several variables of first and higher order, Homogeneous functions, Euler's theorem on homogeneous functions

Unit IV : Differential equations of first order and first degree

Variable separable form, homogeneous equations, linear equations and exact equations

Unit V : Linear Differential Equations

Linear differential equations with constant coefficient, method of variation of parameters

Books :

1) Higher Engineering Mathematics – Dr.B.S.Grewal
2) A Text Book of Engineering Mathematics – N.P.Bali, Manish Goyal
3) Engineering Mathematics – H.K.Das

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-P-5 COMMUNICATIVE ENGLISH

Course Outcomes :

By the end of the course the learners will be:

- able to develop comprehensive skills through reading and writing exercises.
- able to write reports.
- able to draft communication related to business.
- able to plan and conduct effective meetings.
- able to produce clear and concise written business documents.
- able to use media and technology in classroom and eventually in the real world.
- able to create content and spread message on social media.
- able to communicate effectively through mock group discussions and know the nuances of interview technique.

Applied Electronics and Software Technology
Semester II
Subject Communicative English

Theory: 40
Internal: 10
Total : 50

Unit I Reading Comprehension and Vocabulary **10**
From the Prescribed Book: Glimpses, Board of Editors. Macmillan Education

Living or Dead?
The Ant and the Grasshopper

Unit II Grammar **10**
Question Tags
Active Passive Voice
Identification of Clauses
Modal Auxiliaries
Use of Adjectives and Adverbs

Unit III Writing Skills **10**
Notice
Report Writing

Writing Advertisement
Interpreting Visuals
Letter of Inquiry/ Complaint/ Invitation
Write a biographical sketch of any of the following:
a) Sundar Pichai , b) Sudha Murthy, c) Parag Agrawal- Twitter
d) Roshani Nadar

Unit IV Use of Media and Technology in the Classroom. **10**
Content Creation (YouTube video, Reel – all creativity on Social Media)
Filmmaking of a minute – script writing for the film.

Unit V Listening and Speaking skills **10**
Group Discussion
Interview Techniques
Telephonic Conversation

Prescribed Book:
Glimpses, Board of Editors. Macmillan Education

Reference Books:

9. Professional Communication Skills : By Pravin S.R.Bhatia, A.M Sheikh: S.Chand and company
10. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
11. Mac Millan Foundation English R.K Diwedi and A.Kumar
12. Written and Spoken Communication in English- University Press
13. Applied English Grammar and Composition Dr. P.C.Das New Central Book Agency (P) Ltd
14. English Communication – A Textbook for the AECC – English As per the UGC Syllabus – Madhumita Chakraborty : Macmillan Education
15. Business Correspondence and Report Writing- Mc Graw Hill Education by R.C Sharma and Krishna Mohan
16. Soft Skills Dr. K. Alex by S. Chand

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-6 SOCIAL SCIENCE

Scheme of Examination(Theory)
Sessional – 10
Paper - 40
Total - 50

Unit I : Communication

i) Meaning and Definition
ii) Importance of Communication
iii) Objectives of Communication
iv) Principles of Effective communication
v) Media of Communication

Unit II : Industrial Sociology

i) Meaning and Definition
ii) Scope Industrial Sociology
iii) Nature of Industrial Sociology

Unit III : Work Organisation

i) Meaning and Definition
ii) Importance
iii) Forms of industrial organization: Line Organization, Line and Staff Organization, Functional Organization
iv) Authority – Meaning and definition
v) Delegation of authority
vi) Process of delegation

Unit IV : Industrial culture in India

i) Modernization : impact on Indian society
ii) Industrialisation: impact on Indian society
iii) Urbanization : impact on Indian society

Unit V : Leadership in Industry

i) Meaning and Definition
ii) Characteristics of Leadership
iii) Importance of Leadership
iv) Leadership Styles

Reference Books. :

1.Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur
2 A new Outlook into Social Science – S. Shabbir, A. M. Sheikh, Jaya Dwadashiwar, S. Chand, Delhi
3. T. Ramasamy, 2012, Principles of Management, Himalaya Publishing House, Mumbai.
4.Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur.
5 King's, Personnel management & Industrial Relations, Harsha Rastogi, Delhi.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
Semester II

2-P-6 **ENGINEERING DRAWING I**

Scheme of Examination (Practical)
Sessional - 20
Practical – 80
Total - 100

Minimum 10 sheets based on syllabus :

1. Projection of points, Projections of lines inclined to both the planes and their applications, concept of traces.

2. Projection of planes.

Books for reference :
1.Engineering Drawing by N.D. Bhatt
2.Engineering Drawing by A.R. Bapat.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
B.Sc. in Cosmetic Technology

Submitted by
Board of Studies,
B.Sc. in Cosmetic Technology

FYUGP-Scheme I-VIII Semester

Cosmetic Technology (Honors/Research)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

BCT Semester-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Chemistry	BCT1T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Chemistry	BCT1P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Natural Cosmetic Agent	BCT1T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Natural Cosmetic Agent	BCT1P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Physical Chemistry	BCT1T03	1	-	-	1	2	40	10	20	-	-	-	-
6	GE/OE	Physical Chemistry	BCT1P03			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Organic Chemistry	BCT1T04	1	-	-	1	2	40	10	20	-	-	-	-
8	GE/OE	Organic Chemistry	BCT1P04			2	1	-	-	-	-	3	-	50	25
9	VSEC	Dermatherapy & Beauty Culture	BCT1T05	1	-	-	2	2	40	10	20	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT1P05					-	-	-	-	3	25	25	25
11	VSEC	Anatomy & Physiology	BCT1T06	1	-		1	2	40	10	20	-	-	-	-
12	VSEC	Anatomy & Physiology	BCT1P06			2	1	-	-	-	-	3	-	50	25
13	AEC	English Communication Skills	BCT1T07	2	-	-	2	3	80	20	40	-	-	-	-
14	VEC	Environmental Science	BVE1T01	2	-	-	2	3	80	20	40	-	-	-	-
15	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-	-
16	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	-	100	50
				14		14	**22**		**560**	**140**			**150**	**250**	

BCT Semester-II

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Chemistry	BCT2T01	2	-		2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Chemistry	BCT2P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Natural Cosmetic Agent	BCT2T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Natural Cosmetic Agent	BCT2P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Physical Chemistry	BCT2T03	1	-		1	2	40	10	20	-	-	-	-
6	GE/OE	Physical Chemistry	BCT2P03			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Organic Chemistry	BCT2T04	1	-		1	2	40	10	20	-	-	-	-
8	GE/OE	Organic Chemistry	BCT2P04			2	1	-	-	-	-	3	-	50	25
9	VSEC	Dermatherapy & Beauty Culture	BCT2T05	1	-	-	2	2	40	10	20	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT2P05					-	-	-	-	3	25	25	25
11	VSEC	Anatomy & Physiology	BCT2T06	1	-		1	2	40	10	20	-	-	-	-
12	VSEC	Anatomy & Physiology	BCT2P06			2	1	-	-	-	-	3	-	50	25
13	AEC	Fundamentals of Mathematics & Statistics	BCT2T07	2	-	-	2	3	80	20	40	-	-	-	-
14	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-	-
15	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	80	20	40	-	-	-	-
16	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	-	100	50
				14		14	**22**		**560**	**140**			**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCT Semester-III

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Technology	BCT3 T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Technology	BCT3 P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Chemistry	BCT3 T02	2	-	-	2	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Chemistry	BCT3 P02			2	1	-	-	-	-	3	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BCT3 T03	2	-	-	2	3	80	20	40	-	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BCT3 P03			2	1	-	-	-	-	3	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BCT3 T04	2	-	-	2	3	80	20	40	-	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BCT3 P04			2	1	-	-	-	-	3	-	50	25
9	GE/ OE	Introductory Pharmacology & Toxicology	BCT3 T05	2	-	-	2	3	80	20	40	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT3 T06	2	-	-	2	3	80	20	40	-	-	-	-
11	VSEC	Dermatherapy & Beauty Culture	BCT3 P06			2	1	-	-	-	-	3	25	25	25
12	AEC	Maintenance of Records	BCT3 T07	2	-	-	2	3	80	20	40	-	-	-	-
13	AEC	Maintenance of Records	BCT3 P07				1	-	-	-	-	3	-	50	25
14	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-	-	-	100	50
							22		**560**	**140**			**200**	**200**	

BCT Semester-IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Technology	BCT4T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Technology	BCT4P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Chemistry	BCT4T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Chemistry	BCT4P02	-	-	2	1	-	-	-	-	3	-	50	25
5	Minor	Minor3	BCT4T03	2	-		2	3	80	20	40	-	-	-	-
6	Minor	Minor3	BCT4P03			2	1	-	-	-	-	3	25	25	25
7	Minor	Minor4	BCT4T04	2	-		2	3	80	20	40	-	-	-	-
8	Minor	Minor4	BCT4P04			2	1	-	-	-	-	3	-	50	25
9	GE/ OE	Introductory Pharmacology & Toxicology	BCT4T05	2	-	-	2	3	80	20	40	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT4T06	1	-		1	3	40	10	50	-	-	-	-
11	VSEC	Dermatherapy & Beauty Culture	BCT4P06			2	1	-	-	-	-	3	25	25	25
12	VEC	German/French	BVE4T03	2	-	-	2	3	80	20	40	-	-	-	-
13	CEP	Community service	BCM4P01		-	4	2	-	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC4P04	-	-	4	2	3	-	-	-	-	-	100	50
							22		**520**	**130**			**225**	**225**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCT Semester-V

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes	BCT5T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Perfumes	BCT5P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT5T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT5P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Principles of Cosmeceutics	BCT5T03	3	-	-	3	3	80	20	40	-	-	-	-
6	DSC	Principles of Cosmeceutics	BCT5P03	-	-	2	1	-	-	-	-	3	25	25	25
7	Minor	Minor5	BCT5T04	2	-	-	2	3	80	20	40	-	-	-	-
8	Minor	Minor5	BCT5P04	-	-	2	1	-	-	-	-	3	-	50	25
9	Minor	Minor6	BCT5T05	2	-	-	2	3	80	20	40	-	-	-	-
10	Minor	Minor6	BCT5P05	-	-	2	1	-	-	-	-	3	25	25	25
11	GE/OE	Pharmacology and Interactions	BCT5T06	2	-	-	2	3	80	20	40	-	-	-	-
12	VSEC	Cosmetic Validation	BCT5T07	2	-	-	2	3	80	20	40		-	-	-
13	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	-	25	25	25
							22		**560**	**140**			**200**	**200**	

BCT Semester-VI

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes	BCT6T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Perfumes	BCT6P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT6T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT6P02			2	1	-	-	-	-	3	-	50	25
5	DSC	Principles of Cosmeceutics	BCT6T03	3	-	-	3	3	80	20	40	-	-	-	-
6	DSC	Principles of Cosmeceutics	BCT6P03			2	1	-	-	-	-	3	25	25	25
7	DSE	Cosmetic Engineering	BCT6T04	1	-	-	1	2	40	10	20	-	-	-	-
8	DSE	Cosmetic Engineering	BCT6P04			2	1	-	-	-	-	3	-	50	25
9	Minor	Minor 7	BCT6T05	1	-	-	1	2	40	10	20	-	-	-	-
10	Minor	Minor 7	BCT6P05			2	1	-	-	-	-	2	25	25	25
11	GE/OE	Pharmacology and Interactions	BCT6T06	2	-	-	2	3	80	20	40	-	-	-	-
12	VSEC	Cosmetic Validation	BCT6T07	-	-	2	1	-	-	-	-	2	25	25	25
13	OJT	Industrial Training **(Six Weeks)**	BOJ6P01	-	-	8	4	-	-	-	-	-	100	100	100
							22		**400**	**100**			**300**	**300**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

BCT Semester-VII

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes &Colours	BCT7T01	3	-	-	3	3	80	20	40	-	-	-	-
2	DSC	Perfumes &Colours	BCT7P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT7T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT7P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Plant Design	BCT7T03	2	-	-	2	3	80	20	40	-	-	-	-
6	DSC	Plant Design	BCT7P03	-	-	2	1	-	-	-	-	3	25	25	25
7	DSE	Quality Assurance Techniques	BCT7T04	2	-	-	2	3	80	20	40	-	-	-	-
8	DSE	Quality Assurance Techniques	BCT7P04	-	-	2	1	-	-	-	-	3	-	50	25
9	DSE	Herbal Cosmetics	BCT7T05	3	-	-	3	3	80	20	40	-	-	-	-
10	DSE	Herbal Cosmetics	BCT7P05	-	-	2	1	-	-	-	-	3	25	25	25
11	DSE	Elective-1(Refer Basket)	BCT7T06	2	-	-	2	3	80	20	40	-	-	-	-
12	RM	Research Methodology	BCT7T07	2	-	-	2	3	80	20	40	-	-	-	-
							22		**560**	**140**			**200**	**200**	

BCT Semester-VIII

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs.	SEE	CIE	Min	Exam Hrs.	SEE	CIE	Min
1	DSC	Perfumes &Colours	BCT8T01	3	-	-	3	3	80	20	40	-	-	-	-
2	DSC	Perfumes &Colours	BCT8P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT8T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT8P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Plant Design	BCT8T03	2	-	-	2	3	80	20	40	-	-	-	-
6	DSC	Plant Design	BCT8P03	-	-	2	1	-	-	-	-	3	25	25	25
7	DSE	Quality Assurance Techniques	BCT8T04	3	-	-	3	3	80	20	40	-	-	-	-
8	DSE	Quality Assurance Techniques	BCT8P04	-	-	2	1	-	-	-	-	3	-	50	25
9	DSE	Herbal Cosmetics	BCT8T05	3	-	-	3	3	80	20	40	-	-	-	-
10	DSE	Herbal Cosmetics	BCT8P05	-	-	2	1	-	-	-	-	3	25	25	25
11	DSE	Elective-2(refer basket)	BCT8T06	2	-	-	2	3	80	20	40	-	-	-	-
12	RP	Project	BCT8P01	-	-	2	1	-	-	-	-	3	25	25	25
							22		**480**	**120**			**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Note:- Total Credits 176

Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Cosmetic Technology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS1P01**
II	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS2P03**
III	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS3P05**
V	**VSC**	Cosmetic Validation	Cosmetic Technology	**BVS5P07**
VI	**VSC**	Cosmetic Validation	Cosmetic Technology	**BVS6P08**

Basket for Elective (DSE) Category for Bachelor of Cosmetic Technology

Semester	Course Category	Name of Course	Course Code
VII	Elective 1	A. Personnel Management in Cosmetic Industries	BCT7T06
		B. Production Management in Cosmetic Industries	BCT7T06
VIII	Elective2	A. Marketing Management of Cosmetics B. Financial Management of Cosmetics	BCT8T06

FYUGP-I-VIII Semester

Cosmetic Technology (Honors/Research)

Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)

Scheme for Theory Examination

Duration for each theory Examination: **3 Hours for 80 Marks & 2 hours for 40 Marks**

Maximum Marks Allotted to each Theory: **80/40**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks (for 80 Marks question Paper) and 10 Marks (for 40 Marks question Paper), internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7 in case of paper of 80 marks
4) The student should answer any 4 questions out of 6 in case of paper of 40 marks

Syllabus for Four year degree course
COSMETIC TECHNOLOGY
Semester - I

BCT1T01 Cosmetic Chemistry

Theory - 80
Sessional – 20

Total - 100

1] Sources of impurities and their control in Cosmetic raw materials. (6 Periods)

2] Limit tests, limit test of chlorides, sulfates, lead, arsenic and heavy metals.

(8 Periods)

3] Acid base theory, concept of pH, Buffer solutions, Acid Base titrations, Standard solutions, Acid base Indicators, Theory of Acid base titration curves (8 Periods)

4] Non-aq. titration of weak acid and weak bases – indicators used and application.

(8 Periods)

5] Theoretical basis of qualitative inorganic analysis. 6 Periods)

Reference Books:

1. Text book of Practical Pharmaceutical Chemistry by Beckette and Stentake.
2. Quantitative Inorganic analysis be I. Vogal.
3. Cosmetic Chemistry -1 by Dr. Sheela Kulkarni

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BCT1T02 Natural Cosmetic Agents

Theory - 80
Sessional – 20

Total - 100

1] History, development and role of natural product in cosmetic & medicine. (2Periods)

2] Different systems of classification of drugs of natural origin their merits & demerits.

(6 Periods)

3] Herbs description and morphology of organized and unorganized herbs. Organized herbs root, stem, leaf and fruit and seed. Unorganized herbs – mucilage, latex and extracts.

(4 Periods)

4] Carbohydrate-

a) Definition, classification and general identification tests.

b) study of following carbohydrates used in cosmetics with respect to their source,
chemical constituents and uses-i) Starches – Wheat, maize, rice, potato ii) Gums-Acacia, gaur-gum. pectin, agar, and cellulose (12 Periods)

5] Lipids-

a) Definition, classification and general identification tests.

b) i) oils – castor, linseed, olive, sesame, coconut, arachise oil

ii) fat and waxes – kokum butter, lanoline, beeswax, spermaceti, carnauba wax,
candellila wax, shea butter. (12 Periods)

Books recommended:

1. Text book of Pharmacognosy – Trease and Evan's
2. Pharmacognosy – By Claus and Tayler.
3. Text Book of Pharmacognosy – T. E. Wallis.
4. Materia Medica – By Nadkarni.
5. Wealth of India – CSIR
6. Indian medical plants: by Kirtikar & Basu
7. Pharmacognosy – by Dr. Kokate
8. Naturals and Cosmetics – by Dr. Satish Sakharwade

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BCT1T03 Physical Chemistry

Theory - 40
Sessional – 10

Total- 50

1] Thermo chemistry –Introduction, heat of reaction at constant volume and constant
pressure, Heat of combustion, heat of neutralization, heat of solution and their determination.
Laws of thermo chemistry.
(8 periods)

2] Physical Properties and properties of liquids molecules.
i) Surface tension ii) Viscosity
iii) Intermolecular forces and it's impact on states of matter, physical properties and chemical constitution, parachor, dipole moment.
(8 periods)

3] Osmotic pressure, osmosis, semi – permeable membrane, osmotic pressure measurement, laws of osmotic pressure Molecular wt. Calculations.
(8 periods)

4] Faraday's laws of electrolysis, conductivity of solutions, equivalent conductivity and
it's determination, principles of conductometric titration.
(6 periods)

5] E.M.F. of Galvanic cell, Std. Oxidation Potential of an electrode, glass, calomel, redox electrodes, Principles of potentiometric titration.
(6 periods)

Books recommended:
1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry
4. Vogel- Quantitative Inorganic Analysis.
5. Bahl and Tuli : Essentials of Physical Chemistry

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BCT1T04 Organic Chemistry

Theory - 40
Sessional – 10
Total - 50

1] Hydrocarbons (Saturated)
Alkanes, Terahedral natural of carbon, SP3 hybridisation, isomerism, liquid paraffin,
hard paraffin, preparation and reaction of cyclolkanes……
(7 Periods)

2] Hydrocarbon (Unsaturated) Alkenes SP2 Hybridisation, Markonikoff Rules, Cis-trans
Isomerism, Dienes: preparation properties chemical reaction classification of dienes Alkynes SP – hybridization, preparation, properties, reactions of acetylene. (7 Periods)

3] Estimation and Quantitative Analysis: Estimation of elements and their principals,
Determination of equivalent weight of acids and bases. Determination of empirical and
molecular formula of acids and bases.
(6 periods)

4] Ethers- Definition,Classificationpreparation, physical and chemical properties and reactionof ethers, diethyl ether, an aesthetic ether, thioether and vinyl ethers and their cosmetic uses(6Periods)

5] I) Aldehyde & Ketones-Definition and nomenclature, preparation,Classificationpreparation,physical and chemicalproperties and chemical reaction of aldehyde and ketones and their cosmetic uses (6 Periods)

II) Carboxylic Acid – classification, structure, preparation and chemical reaction of monocharboxylic acid Optical isomerism and their cosmetic uses (4Periods)

Books Recommended:

1. Text Book of Organic Chemistry by Morrison and Boyd.
2. L.M. Atherton, Bentley and Driver's Text Books of Pharmaceutical Chemistry. Oxford University Press, London.
3. Text book of Organic Chemistry by Bahl & Bahl.

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BCT1T05 Dermatherapy and Beauty Culture

Theory - 40

Sessional – 10
Total - 50

1. Skin: structure and functions of skin
i) Skin cleansing methods
ii) Skin hygiene
iii) Skin types
iv) Skin Tonning Methods
v) Skin Astringents

2. Bleaching
Preparation of paste.
i) Patch test
ii) Face bleaching
iii) Hand bleaching
iv) Leg bleaching
v) Precautions.

3. Hand
i) Skin Types
ii) Hand Cleansing
iii) Manicure
a. Requirement for Manicure
b. Procedure
c. Nail shaping
d. Cuticle removing
e. Hand Massage.
f. Application of varnish
iv) Electric Manicure

4. Nails
i) Disorders
ii) Treatment

iii) Care

5. Foot
i) Hygiene
ii) Pedicure
a. Requirement for Pedicure
b. Procedure.
c. Massage for pedicure.
d. Application of varnish

Books recommended:
1. Ann Eaton and Flurence Openshaw, Cosmetic Make – Up and Manicure.
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BCT1T06 Anatomy & Physiology

Theory - 40
Sessional – 10
Total - 50

1] Cell Structure & Elementary tissues of body-

i) Epithelial Tissues ii) Connective Tissues
iii) Nervous Tissues iv) Muscular Tissues (8 Periods)

2] i) Detail knowledge of structure and function of Skin (4 Periods)

ii) Skin appendages –
1 Sweat gland & Sebaceous gland
2 Nails
iii) Eye
iv) Tooth (10 Periods)

3] a) Keratinisationand
b) Colour & Pigmentation ,skin disorders due to external factors and treatment

c) Baby skin and adult skin (4 Periods)

4. Equipments used to determine Skin damage (5 Periods)
5. Suppliments used for maintaining skin health (8 Periods)
6. Temperature conservation – Temperature regulation and heat balance of body. (2 Periods)

Books Recommended:

1. Best and Taylor – The Living Body.
2. Kimber and Gray – Human Physiology and Anatomy
3. Fransis – Introduction to Human Anaomy.
4. Pharmacology and Pharmacotherapeutics By R.S. Satoskar and S. Bhandarkar
5. Ross & Wilson – Anotomy and physiology in health and illness – Ross & Wilson
6. Anatomy and physiology for Nurse – Windwood R.S.

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BCT1T07 English Communication Skills

Theory - 80
Sessional – 20

Total - 100

1] Writing skills:- Letter Writing, Informal letter, Formal letter, Bio-data/Resume, job Application (7 Periods)

2] Report Writing: Dialogue writing, Advertisement
(5 Periods)

3] Personality Development: Effective Public speaking, Goal setting, time management, stress management (7 Periods)

4] Speech Writing : View and Counterview, Expansion of Ideas, completion and Developing a story
(5 Periods)

5] Listening skills: Loud Reading, Speaking, Conversations, Telephonic conversation.
(7 Periods)

6] Interview techniques, group discussion, situational role play.
(5 Periods)

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BVE1T01 Environmental Science

Theory - 80
Sessional – 20

Total - 100

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.

Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

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BIK1T01 Indian Knowledge System

Theory - 80
Sessional – 20
Total - 100

SEM1 : VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

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BCT1P01(Practical) Cosmetic Chemistry

1] Preparation of Standard solutions: 1 normal, 1 molar, % w/v solution, % v/v solution
2] Standardization of volumetric apparatus.
3] Volumetric estimation involving Acidimetry, Alkalimetry oxidation & reductions.
4] Experiments based on limit tests of chlorides, Arsenic, ions sulphate & Heavy metals.
5] Practical significance of MSDS.

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BCT1P02 (Practical) Natural Cosmetic Agents

1]. Carbohydrates:
i. Study of organoleptic properties, identification and microscopic studies of:
a. Rice Starch b. Maize starch
c. Potato starch d. Wheat starch
ii. a. Agar b. Gum Acacia.
c. Tragacanth. d. Gaur Gum
e. Pectin f. Cellulose
2] Study of chemical identification of fixed oils and waxes.
3] Detection of Adulteration in Olive oil, Coconut oil, Almond oil, and other vegetable oil.
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BCT2P03 (Practical) Physical Chemistry

1. Study of surface tension of liquids using a stalagmometer.
2. Study of Viscosity of liquids using Ostwald's Viscometer.
3. Study of variation of viscosity of liquid mixtures using an Ostwald's viscometer and its use to determine the concentration of such mixtures.
4. Study the total hardness of water
5. Study the temporary hardness of water.
6. Study the heat of solution of a salt in water.
7. Study the heat of neutralization of a strong acid by a strong base as well as weak acid and strong base using a calorimeter.

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BCT2P04 (Practical) Organic Chemistry

1] Organic Preparations based on:
i) Alkaline Hydrolysis
ii) Acidic Hydrolysis
iii) Acetylation
iv) Oxidation

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BCT1P05 (Practical) Dermatherapy and Beauty Culture

Practicals based on methods and practices as per the following contents

1. Skin
   i) Skin cleansing methods
   ii) Skin hygiene
   iii) Skin types
   iv) Skin Tonning Methods
   v) Skin Astringents

2. Bleaching Preparation of paste.
   vi) Patch test
   vii) Face bleaching
   viii) Hand bleaching
   ix) Leg bleaching
   x) Precautions.
3. Hand
   i) Skin Types
   ii) Hand Cleansing
   iii) Manicure

g. Requirement for Manicure
h. Procedure
i. Nail shaping
j. Cuticle removing
k. Hand Massage.
l. Application of varnish
iv) Electric Manicure

4. Nails
   i) Disorders
   ii) Treatment
   iii) Care

5. Foot
   i) Hygiene
   ii) Pedicure
e. Requirement for Pedicure
f. Procedure.
g. Massage for pedicure.
h. Application of varnish

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BCT1P06 (Practical) Anatomy & Physiology

1. Study with the help of Charts and models of-
   a) Skin
   b) Hair
   c) Eye
   d) Tooth
2. Microscopic examination of Epithelial, Cardiac, Smooth Muscles, Skeletal muscles and other tissues.

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SEMESTER – II

BCT2T01 Cosmetic Chemistry

Theory - 80
Sessional – 20
Total - 100

1] Nernst eq. Calculation of std. Potential, oxi-red titrations, study of common oxidizing agents and reducing agents, oxi-red curves, ceric ammonium sulfate, titanous chloride, 2-6 dichlor phenol indo phenol titration, their theory and applications. (12 Periods)

2] Iodometry and iodimetry, Gravimetric analysis. Quantitative separation, solubility product. Fractional precipitation, CO - & post precipitation Practical aspects of gravimetry and applications.

(8 Periods)

3] Precipitation titration, Precipitation and complex forming reactions. Argentometric Titration, Gay-Iusac, Volhard's Mohr's and Fujan's Method. Mercuric nitrate titration. (8 Periods)

4] Complexometric titration, concepts of complexation and chelation, co-ordination number stability constant, titation curves, metal ion indicator, Masking and demasking agents, types of complexometic titration and applications (12 Periods)

5] Determination & significance of acid value, saponification value, iodine value, ester value. (6 Periods)

Reference Books:
1. Text book of Practical Pharmaceutical Chemistry by Beckette and Stentake.
2. Quantitative Inorganic analysis by I. Vogal.
3. Cosmetic Chemistry -1 by Dr. Sheela Kulkarni

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BCT2T02 Natural Cosmetic Agents

Theory - 80
Sessional – 20
Total - 100

1] Adulteration - types of adulteration, Method of adulteration and methods of detection of adulteration in Natural ingredient (9 Periods)

2] Resin and balsum -
a) Definition, classification and general identification tests.
b) Study of following - Balsum of Tolu, Balsum of Peru, Benzoin, Storax, Colophony, Asafoetida. (9 Periods)

3] Tannins – Definition, Classification and Identification test.
Study of the following – Black Catechu, Tannic Acid, Amla, Behra, Hirda, Arjun, Pale catechu, Ashok. (9 Periods)

4] Study of mineral ingredients. Kaolin, Bentonite, Talc., Fuller's earth, Mica, Calamine. (5 Periods)

5] Herbs description and morphology of organized and unorganized herbs. (4 Periods)

Books recommended:
1. Text book of Pharmacognosy – Trease and Evan's
2. Pharmacognosy – By Claus and Tayler.
3. Text Book of Pharmacognosy – T. E. Wallis.
4. Materia Medica – By Nadkarni.
5. Wealth of India – CSIR
6. Indian medical plants: by Kirtikar & Basu
7. Pharmacognosy – by Dr. Kokate
8. Naturals and Cosmetics – by Dr. Satish Sakharwade

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BCT2T03 Physical Chemistry

Theory - 40
Sessional – 10
Total- 50

1] Phase rule : Phase rule, the terms involved in it and applications to one component system, water and sulphur system. Introduction to two component systems. (8 periods)

2] Solutions,: Raoult's law, and it's application, molecular weight determination by measuring vapour pressure, Boiling Pt. & freezing point. (8 periods)

3] Law of mass action, Le-Chatelier's principle, homogeneous gaseous equilibria and homogeneous equilibra in liquid system. (8 periods)

4] Chemical kinetics: Introduction, molecularity, order and rate of reaction. Kinetics of
first and second order reaction, their characteristics and some methods of determination. (8 periods)

5] pH metry: pH and hydrogen ion concentration, pH calculation for weak acids and weak bases. Buffer solutions and types, mechanism of buffer action of acidic and basic buffers. Theories of acid base indicators. (8 periods)

Books recommended:
1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry
4. Vogel- Quantitative Inorganic Analysis.
5. Physical Chemistry by Bahl & Tuli.

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BCT2T04 Organic Chemistry

Theory - 40
Sessional – 10
Total - 50

1] Halohydrocarbon: Preparation and reaction of alkyl halide and Grignard reagents and chloroform. (6 periods)

2] Alcohols – Definition, classification, preparation, properties and chemical reaction of alcohols, fermentation, manufacture of ethyl alcohol, proof spirit, denatured alcohol, glycol and glycerol. (8 periods)

3] Benzene and other aromatic compounds:
i) Benzene Resonance and structure – o-p & meta directing effect.
ii) Aromatic nitro compound (Nitrobenzenes): preparation & properties,
iii) Aromatic amines (Aniline) – Prearation & Properties.
iv) Aromatic carboxylic acids (Benzoic and Cinnamic acid, Salicylic acid.)
(7 periods)

4] Fats & Oil : Definition, uses, properties. Analysis of fats and oils. Application of fats and oils in cosmetics. (7 periods)

5] I) Proteins and Amino Acid : Introduction, Peptides, amino Acids, definition, hydrolysis, polypeptides, qualitative test and colour reaction, essential amino acid. (7 periods)

II) Carbohydrates and Glucose : Classification and Qualitative test, structure of Glucose, Lactose (excluding derivation). (5 periods)

Books Recommended:
1. Text Book of Organic Chemistry by Morrison and Boyd.
2. L.M. Atherdon, Bentley and Driver's Text Books of Pharmaceutical Chemistry. Oxford University Press, London.
3. Text book of Organic Chemistry by Bahl & Bahl.

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BCT2T05 Dermatherapy and Beauty Culture

Theory 40
Sessional 10
Total 50

1. Eye Brows:
xi) Factors affecting eye brow shaping.
xii) Determination of correct length of eye brow.
2. Different methods for eyebrow shaping:
xiii) Threading.
xiv) Tweezing
3. Treatment for superfluous hair waxing.
a. Hot wax treatment
b. Cold wax treatment
i) Leg waxing
ii) Hand waxing

iii) Under arm waxing.
4. Nail Arts / Nail designing
5. Application of false nails

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BCT2T06 Anatomy & Physiology

Theory - 40
Sessional – 10
Total - 50

1] I) Cardiovascular system Anatomy of Heart, flow of blood through heart, blood pressure, structure of artery, vein and capillaries.
II) Blood –
i) Composition & Function ii) Blood groups
iii) Coagulation of blood (12 Periods)

2] Respiratory system –Anatomy of organs, mechanism of respiration,Introduction with respect to Aerosols and Aromatherapy (6 Periods)

3] Digestive system – Anatomy of digestive organs, Digestion of carbohydrate, protein and fat. (6 Periods)

4]. Hair- Detailed study of hair, Structure, types, Chemistry, Disorders such as Hair damage reasons and treatments equipments used to determine hair damage , Supplements for healthy hair.

5] Excretory system – organs of excretion, structure of kidney, Mechanism of urine formation , mechanism of excretion via skin (6 Periods)

6] Nervous system – CNS, Brain, anatomy in short, spinal cord, ganglion cranial nerves, reflex action and reflex arch. (6 Periods)
7]. Endocrine glands and Hormones. (8 Periods)

Books Recommended:

1. Best and Taylor – The Living Body.
2. Kimber and Gray – Human Physiology and Anatomy
3. Fransis – Introduction to Human Anatomy.
4. Pharmacology and Pharmacotherapeutics By R.S. Satoskar and S. Bhandarkar
5. Ross & Wilson – Anotomy and physiology in health and illness – Ross & Wilson
6. Anatomy and physiology for Nurse – Windwood R.S.

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BCT2T07 Fundamentals of Mathematics & Statistics

Theory - 80
Sessional – 20
Total - 100

1] Algerbra: - Profit and loss, percentage calculation, Logarithms (6 Periods)

2] Trigonometry: - Degrees and Radians trigonometric ratios. Identities for sum and difference of angles, multiple angles (8 Periods)

3] Statistics: - Frequency Distribution, Histogram, Representation of data in a curve, Mean, Median mode, Standard deviation, mean deviation from mean, Measures of Central tendency, Correlation, Coefficient of correlation only. (8 Periods)

4] Derivatives (6 Periods)

5] Application of Derivatives:
a) Maxima, Minima b) Rates and motion c) Velocity acceleration (8 Periods)

Books Recommended :

1. Higher Engineering Mathematics by B. S. Grewal (Unit I, II,V).
2. Higher Algebra by Hall and Knight (Unit I)
3. Plane Trigonometry Part I by S.L. Loney (Unit II)

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BVE2T02 Constitution of India

Theory - 80
Sessional – 20
Total - 100

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity
- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

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BIK2T02 Indian Knowledge System

Theory - 80
Sessional – 20
Total - 100

INDIAN ASTRONOMY

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, VedangJyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of BhaskarAcharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media

4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

BCC2P02 Health & Wellness

Total - 100

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BCT2P01 (Practical) Cosmetic Chemistry

1] Preparation and standardization of Cerric Ammonium Sulphate Potassium Iodate, Assays Based on use of above agents.

2] Preparation and standardization of Perchloric Acid and Sodium Methoxide. Assay based on above.

3] Preparation and standardization of Sodium EDTA. Assay based on EDTA.

4] Preparation and Standardization of Silver Nitrate and Amonium Thiocynate. Assay Based on above.

5] Gravimetric analysis: experiments based on gravimetric analysis

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BCT2P02 (Practical) Natural Cosmetic Agents

1] Organoleptic study and identification of
a. Tolu Balsum b. Peru Balsum
c. Benzion d. Storax
e. Colophony f. Asfoetida
2] Morphological study and identification of following tannin containing agents:
a. Black Catechu. b. Amls
c. Behra d. Hirada
e. Ashoka Bark f. Arjua Bark.
3] Organoleptic study of Kaolin, Bentonite, Talc., Fuller's earth, Mica, Calamine.
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BCT2P03 (Practical) Physical Chemistry

1] Study the phenol – water two phase system and determine the critical temperature of
the system.

2] Determine the molecular weight of a nonvolatile compound by the Rast's Camphor method.

3] Study of partition of iodine between Carbon Tetrachloride and water and determine

the partition coefficients of iodine between the two solvents.

4] Study the first order kinetics of the hydrolysis of Methyl Acetate in an acid medium.

5] Study the second order kinetics of the reaction of K2S2O8 with KI.

6] Study of Buffer solutions and hence determine the pH of buffer solution using a comparator

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BCT2P04 (Practical) Organic Chemistry

1] Systematic Organic analysis of unknown organic substance (i.e. preliminary tests, detection of elements, groups, determination of physical constants and specific tests and confirmation by derivatives preparation)

a) Acetic acid
b) Benzoic acid
c) Salicylic acid
d) Urea
e) Thiourea
f) Aniline
g) Glucose

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BCT2P05 (Practical) Dermatherapy and Beauty Culture

Practicals based on methods and practices as per the following contents

1. Eye Brows:
xv) Factors affecting eye brow shaping.
xvi) Determination of correct length of eye brow.
2. Different methods for eyebrow shaping:
xvii) Threading.
xviii) Tweezing
3. Treatment for superfluous hair waxing.
c. Hot wax treatment
d. Cold wax treatment
i) Leg waxing
ii) Hand waxing
iii) Under arm waxing.
4. Nail Arts / Nail designing
5. Application of false nails

****

BCT2P06 (Practical) **Anatomy & Physiology**

1] Determination of clotting time.
2] Determination of bleeding time
3] Determination of hemoglobin content.
4] Determination of R.B.C. count, D.L.C., T.L.C.
5] Study with the help of charts and models of
   a) Cardiovascular system
   b) Excretory system
   c) Digestive system
   d) Nervous system
6] Skin Patch Test with products
7] Recording of body temperature, Pulse and Heart rate and Blood Pressure.

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Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B. Sc. Interior Design

Submitted by

Board of Studies,

B.Sc. Bachelor of Interior Design

TEACHING AND EXAMINATION SCHEME

Interior Design
Four Year (Eight Semester Course)
Interior Design Sem. – I

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design I	BHD1T01	2	_	_	2	6*	100	-	40	_	_	_
2	DSC	Interior Design I	BHD1P01	_	_	4	2	_	_	_	_	50	50	50
3	DSC	Material & Construction Techniques I	BHD1T02	2	_	_	2	3	80	20	40	_	_	_
4	GE/OE	Graphics I	BHD1T03	_	_	4	2	_	_	_	_	50	50	50
5	GE/OE	Mathematics I	BHD1T04	2	_	_	2	3	80	20	40		_	_
6	VSC	Presentation Techniques I	BHD1T05	-	_	4	2	_	_	_	_	50	50	50
7	SEC	Workshop I	BHD1T06	_	_	4	2	_	_	_	_	50	50	50
8	AEC	Communication Skill I	BHD1T07	2	_	_	2	3	80	20	40	_	_	_
9	VEC	Environmental Science	BVE1T01	2	_	_	2	3	80	20	40	_	_	_
10	IKS	Vedic Mathematics	BIK1T01	2	_	_	2	3	80	20	40	_	_	_
11	CC	Refer CC Basket	BCC1P01	-	_	4	2	_	_	_	_	_	100	50
Total				**12**	**–**	**20**	**22**		**500**	**100**	**–**	**200**	**300**	

Total Marks 1100

* The exam duration for Interior Design I is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

TEACHING AND EXAMINATION SCHEME

Interior Design
Four Year (Eight Semester Course)
Interior Design Sem. – II

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design II	BHD2T01	2	_	-	2	6*	100	_	40	_	_	_
2	DSC	Interior Design II	BHD2P01	-	-	4	2					50	50	50
3	DSC	Material & Construction Techniques II	BHD2T02	2	_	_	2	3	80	20	40	_	_	_
4	GE/ OE	Graphics II	BHD2T03	_	_	4	2	_	_	_	_	50	50	50
5	GE/ OE	Mathematics II	BHD2T04	2	–	_	2	3	80	20	40	_	_	
6	VSC	Presentation Techniques II	BHD2T05	_	_	4	2	_	_	_	_	50	50	50
7	SEC	Workshop II	BHD2T06	_	_	4	2	_	_	_	_	50	50	50
8	AEC	Communication Skill II	BHD2T07	2	_	_	2	3	80	20	40	_	_	_
9	VEC	Constitution of India	BVE2T02	2	_	_	2	_	80	20	40	_	_	_
10	IKS	Indian Astronomy	BIK2T02	2	_	_	2	_	-	-	-	50	50	50
11	CC	Refer CC Basket	50	50	_	4	2	_	_	_	_	_	100	50
Total				**12**	**_**	**20**	**22**		**500**	**100**		**200**	**300**	

Total Marks 1100

* The exam duration for Interior Design II is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
Sem. – III

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design III	BHD3T01	2	–	-	2	12*	100	–	40	-	-	-
2	DSC	Interior Design III	BHD3P01	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Material & Construction Techniques III	BHD3T02	2	–	–	2	3	80	20	40	–	–	–
4	MINOR	Minor 1	BHD3T03	–		4	3	–	80	20	40	-	-	-
5	MINOR	Minor 1	BHD3P03					-	-	-	-	25	25	25
6	MINOR	Minor 2	BHD3T04	–	–	4	3	3	–	–	–	50	100	75
7	GE	History of Art and Architecture I	BHD3T05	2	–	–	2	3	80	20	40	–	–	–
8	VSC	Refer VSC Basket	BHD3T06	2	–	-	2	3	80	20	40	–	–	–
9	AEC	Interior Environment Control I	BHD3T07	2	–	–	2	3	80	20	40	–	–	–
10	AEC	Structure I	BHD3T08	2	–	–	2	3	80	20	40	–	–	–
11	GE	PROD WORKSHOP II	BHD3T09	–	–	2	1	3	–	–	–	25	25	25
12	CC	Refer CC Basket	BCC3P03	–	–	2	1	–	–	–	–	-	100	50
Total				**10**	**0**	**24**	**22**	**-**	**580**	**120**	**-**	**175**	**225**	

Total Marks : 1100

* The exam duration for Interior Design III is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
Sem. – IV

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme(hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design IV	BHD4T01	2	–	-	2	12*	100	-	40	-	-	-
2	DSC	Interior Design IV	BHD4P01	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Material & Construction Techniques IV	BHD4T02	2	–	–	2	3	80	20	40	–	–	–
4	Minor	Minor 3	BHD4T03	2	-	-	2	3	80	20	40	-	-	-
5	Minor	Minor 3	BHD4P03	-	-	2	1	-	-	-	-	**25**	**25**	**25**
6	Minor	Minor 4	BHD4T04	–	–	4	3	–	**–**	**–**	**–**	**50**	**100**	**75**
7	GE	History of Art and Architecture II	BHD4T05	2	–	–	2	3	**80**	**20**	**40**	**–**	**–**	**–**
8	VSC	Refer VSC Basket	BHD4T06	–	–	4	2	–	**80**	**20**	**40**	**–**	**–**	**–**
9	AEC	Interior Environment Control II	BHD4T07	2	–	–	2	3	**80**	**20**	**40**	**–**	**–**	**–**
10	AEC	Structure II	BHD4T08	2	–	–	2	3	**–**	**–**	**–**	**25**	**25**	**25**
11	CEP	Community Service	BCM4P01	–	–	2	1	–	**–**	**–**	**–**	**25**	**25**	**25**
12	CC	Refer CC Basket	BCC4P04	–	–	2	1	–	**–**	**–**	**–**	**-**	**100**	**50**
Total				**12**	**0**	**18**	**22**	**18**	**500**	**100**		100	-	40

Total Marks 1100

* The exam duration for Interior Design IV is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
Sem. – V

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design V	BHD5T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design V	BHD5P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Material & Construction Techniques V	BHD5T02	2	_	_	2	3	80	20	40	_	_	_
4	DSC	STRUCTURE III	BHD5T03	2	_	_	2	_	80	20	40	_	_	_
5	DSE	Elective 1	BHD5T04	2	_	_	2	3	80	20	40	_	_	_
6	Minor	Minor 5	BHD5T05	_	_	6	3	3	_	_	_	100	50	75
7	Minor	Minor 6	BHD5T06	2	_	-	2	3	80	20	40	_	_	_
8	Minor	Minor 6	BHD5P06	-	-	2		-	-	-	-	25	25	25
9	VSC	Refer VSC basket	BHD5T07	_	_	4	2	2	_	_	_	50	50	50
10	AEC	Estimation and Costing –I	BHD5T08	2	_	_	2	3	80	20	40	_	_	_
11	CEP	Community Service	BCM5P02	_	_	2	1	_	_	_	_	25	25	25
Total				**12**		**20**	**22**	-	500	100		300	200	

Total Marks 1100

* The exam duration for Interior Design V is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VI

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VI	BHD6T01	2	–	-	2	12*	100	–	40	–	–	–
2	DSC	Interior Design VI	BHD6P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Material & Construction Techniques VI	BHD6T02	2	–	–	2	3	80	20	40	–	–	–
4	DSC	Furniture Design IV	BHD6T03	–	–	4	2	–	80	20	40	–	–	–
5	DSE	Elective 2	BHD6T04	2	–	–	2	3	80	20	40	–	–	–
6	Minor	Minor 7	BHD6T05	2	–	2	3	3	–	–	–	100	50	75
7	VSC	Refer VSC basket	BHD6T06	–	–	4	2	–	80	20	40	–	–	–
8	AEC	**STRUCTURE IV**	BHD6T07	2	–	–	2	3	80	20	40	–	–	–
9	AEC	Estimation and Costing – II	BHD6T08	2	–	–	2	3	80	20	40	–	–	–
10	OJT	Internship (Related to DSC)	BHD6T09	–	–	4	2	–	–	–	–	50	50	50
Total				**12**		**20**	**22**	**-**	**500**	**100**	**-**	**300**	**200**	

Total Marks 1100

* The exam duration for Interior Design VI is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VII

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VII	BHD7T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design VII	BHD7P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Interior Detailing I	BHD7T02	_	_	4	2	_	_	_	_	50	50	50
4	DSC	Interior Landscape I	BHD7T03	2	_	_	2	3	80	20	40	_	_	_
5	DSC	Structure – V	BHD7T04	2	_	_	2	3	80	20	40	_	_	_
6	DSE	Elective 3	BHD7T05	2	_	_	2	3	80	20	40	_	_	_
7	RM	Research Methodology	BHD7T07	2	_	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BHD7P07	-	-	4	2	-	-	-	-	50	50	50
9	OJT	Internship Apprentice Training I	BHD7T08	_	_	10	5	_	_	_	_	150	100	125
Total				**12**		**24**	**22**	-	**420**	**80**	-	**350**	**250**	

Total Marks 1100

* The exam duration for Interior Design VII is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VIII

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VIII	BHD8T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design VIII	BHD8P01	-	-	6	3	-	-	-	-	100	50	100
3	DSC	Interior Landscape – II	BHD8T02	2	_	_	2	3	80	20	40	_	_	_
4	DSC	Structure – VI	BHD8T03	2	_	_	2	3	80	20	40	_	_	_
5	DSE	ELECTIVE 4	BHD8T04	2	_	_	2	3	80	20	40	_	_	_
6	AEC	GREEN BUILDING TECHNOLOGY	BHD8T05	2	_	_	2	3	80	20	40	_	_	_
7	AEC	ENVIRONMENTAL PSYCHOLOGY	BHD8T06	2	_	_	2	3	80	20	40	_	_	_
8	RP	Project	BHD8T07	_	_	14	7	_	_	_	_	175	175	175
Total				**12**	**-**	**20**	**22**	_	**500**	**100**		**275**	**225**	

Total Marks 1100

* The exam duration for Interior Design VIII is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

DSC -- Department Specific Core , AEC -- Ability Enhancement Course , GE-- Generic Elective V SEC -- Vocational Skill Enhancement Course, IKS –Indian Knowledge System.

VSC Basket (BID)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Presentation Techniques I	BID	**BVS1P01**
II	**VSC**	Presentation Techniques II	BID	**BVS2P03**
III	**VSC**	Cultural Anthropology I	BID	**BVS3P05**
V	**VSC**	Digital Application –I	BID	**BVS5P07**
VI	**VSC**	Digital Application II	BID	**BVS6P08**

Basket for ELECTIVE Category Courses (Interior Design)

Semester	Course Category	Name of Course	Course Code	credits
V	Elective 1	History of Art and Architecture III	BHD5T04	4
		Heritage Interiors I		
VI	Elective 2	History of Art and Architecture IV	BHD6T04	4
		Heritage Interiors II		
VII	Elective 3	Professional Practice I	BHD7T05	4
		Vaastu Shastra		
VIII	Elective 4	Professional Practice II	BHD8T04	4
		Critical Appreciation		

FYUGP-I-VIII Semester

Design (Honors/Research)

Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)

Scheme for Theory Examination

Duration for each theory Examination: **3 Hours**

Maximum Marks Allotted to each Theory: **80**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks, internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7.

Interior design I AND II:

The Examiner shall set a question on all units

* The exam duration for Interior Design II is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

Interior design III AND VIII:
The Examiner shall set one design project as a question

* the exam duration for interior design viii is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

INTERIOR DESIGN
SEMESTER I

BHD1T01 INTERIOR DESIGN I

PAPER - 100

Passing Marks - 40
Total Marks - 100

AIM: The aim of the subject is to understand the principles of design and its application to interior design. Visual perception through simple design elements and organization.

UNIT I

Understanding visual perception of forms analyzed through spatial elements like, line , plane and volume through graphic tools and 3D explorations. Understanding their combinational character.

UNIT II

Impact of variables like size, shape, colour, tone, texture and light on spatial elements of design. Compositions as symmetrical, asymmetrical, balanced/ unbalanced, steady/ dynamic etc. perception of forms through movement in space.

UNIT III

Understanding design issue though order, pattern, rhythm- ISSUES Composition. Synthesis of these elements evolves understanding of order in space and form, Variation, issues of geometry, principles of perception, proximity, closure similarity form in content, figure and ground relationships, static and dynamic aspects of spaces.

UNIT IV

Analysis of visual elements of design leading to establishment of design principles like Unity and Balance.

UNIT V

Geometrical character of design elements leading to principles like contrast, Harmony, Rhythm, Proportion, emphasis and subordination, repletion etc.

SESSIONAL WORK:

The exercises shall be based on:

1. Understanding and application of design elements and variables.
2. Understanding and application of design principles through 2D and 3D compositions.
3. Quantitative and qualitative aspects of space though design exercise.

REFERENCES:

1. Time Saver Standards
2. Visual Arts: A Basic Study by Bhagwat Desai
3. Form Space and Order by D. K. Ching

INTERIOR DESIGN
SEMESTER I
BHD1T02 MATERIAL AND CONSTRUCTION TECHNIQUES I
PAPER II

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

Aim: Understanding building as a system. Introduction to basic building material and construction methods. General idea about their chemical and physical properties leading to structural strength and aesthetic qualities. Emphasis should be given on developing understanding about making choice of appropriate building materials in a given situation.

UNIT I

Building Terminology, Building components, its characteristics and behavior. Relationship between building components& building material

UNIT II

Materials - Clay, brick, stone their physical and behavioral properties, process of manufacture, tools and techniques of application to built form and interiors

UNIT III

Openings in masonry, arches, lintels

UNIT IV

Material – Sand, cement, aggregate, mortar, concrete. Process of manufacture, in situ reinforced cement concrete construction, physical and behavioral properties, application in built forms and interiors, Cane and bamboo, tools and techniques of joinery, application to built forms and interiors

Sessional Work: Plates, Site visit reports, tutorials, notes, sketches and market surveys.

REFERENCES:

1. Building Construction by Sushil Kumar
2. Building Construction by Rangwala
3. Building Construction by Barry and Mckay

INTERIOR DESIGN
SEMESTER I
BHD1T03 GRAPHICS I
PAPER III

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM : To introduce students to technical drawing methods and equipment , language of graphics i.e. vocabulary and grammar enabling students to express simple three dimensional objects by developing their skill for communicating graphically objects so as to later adopt the same for depicting buildings and building components.

UNIT 1

Familiarization of equipment and recapitulation: Ability to handle and use various drawing instruments and media for technical drawing and sketching. Introduction to graphic language and its components viz. Line types; meaning and application, lettering , use of various metric scales, conventions ,standard annotations and format .Principles of plane geometry and geometrical constructions .systems of measurement MKS and FPS.

UNIT II

Understanding scales: study of scales, their use in practice and construction of plain and diagonal scale. Concept of enlargement and reduction of objects.

UNIT III

Introduction to orthographic projections : The concept of representing objects and elements of drawing such as point , line , planes and simple regular geometric forms / 3 dimensional objects as plan/s section/s and elevation/ learning the basics of drawing orthographic projections for simple combinations of point , line , planes and solids primarily as first angle projections and or third angle projections.

UNIT IV

Orthographic projections: Drawing Orthographic Projections of simple and complex solids based on geometrical constructions , either single or in combinations.

UNIT V

Understanding and drawing views: learning the basics of drawing isometric views and Axonometric projections for representing various simple and complex geometrical shapes and forms and rendering the same to understand materials .

SESSIONAL WORK:

- Exercises should be based on simple and complex geometrical shapes and cover all units in plate forms.
- Sessional work should be planned to cover all the units mentioned in course outline with thrust on skill development, accuracy and understanding of the topic.
- Maximum weight age of 10 percent in assessment should be given to the assignments of geometrical constructions.
- Manually drafted assignments to cover the course outline based on all units.

REFERENCES:

1. Ching Francis D.K.: Architectural Graphics
1. Leslie Martin: Architectural graphics:
2. Jolhe D A : Engineering Graphics , Tata McGraw Hill , New Delhi
3. Bhat N D, “Elementary Engineering Drawing-Plane and Solid Geometry”, Charotar Publishing House, Anand (1988)
4. M .S .Kumar : Engineering Drawing, DD publications, Chennai
5. I.H. Morris : Geometrical Drawing for Art Students, Orient Longman Chennai.

INTERIOR DESIGN
SEMESTER- I
BHD1T04 MATHEMATICS I
PAPER IV

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM:

- To understand elementary principles of mathematics.
- To apply mathematics in practical problems.
- To obtain accuracy in calculations and results of various mathematical experiments.

CONTENTS:

UNIT I

- Sets, Relations and Functions
    - Definition
    - Domain
    - Range
    - Cartesian Product
    - Even-Odd Functions
    - Inverse Functions

UNIT II

- Logarithms
    - Product
    - Division
    - Use of Log Tables
    - Simple Calculations using Log Tables

UNIT III

- Trigonometry
    - Trigonometric Ratios
    - Ratios of Sum and Differences of Angles
    - Multiple Angles and Half Angles

UNIT IV

- Plane Co-ordinate Geometry
    - Distance Formula
    - Equation to a Line
    - Section Formula and their applications

UNIT V

- Angle between the Lines
    - Parallel Lines
    - Perpendicular Lines
    - Length of Perpendicular

SESSIONAL WORK

Two unit tests per semester and assignments

REFERENCES

1. Algebra by K P Basu
2. Set Theory, Schaum Series
3. Trigonometry by S L Loney
4. Plane Co-ordinate Geometry by S L Loney

INTERIOR DESIGN
SEMESTER I
BHD1T05 PRESENRATION TECHNIQUES I
PAPER V

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM :-To improve drawing and sketching skills. To transfer the design ideas. With visual aid from designer to the client.

UNIT - I

Introduction to various tools used for sketching such as pencil, charcoal , crayons , water colour etc.

UNIT - II

Line drawing of nature by using various techniques as shades of pencil. Introduction of light and shade in nature drawing. Line drawing of exterior of building. Building drawing in perspective.

UNIT - III

Landscape elements by using various mediums. Introduction of colour in the same i.e. poster , pencil & water colour.

SESSIONAL WORK:

- Assignments based on sketching technique
- Assignments based on graphic representations of interior and exterior buildings.
- Assignments based on exterior & interior Landscapes.

REFERENCES:

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN

SEMESTER I

BHD1T06 PRODUCT WORKSHOP I

PAPER VI

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

UNIT - I CLAY WORKSHOP

- Introduction to mud and clay as a material. Process and techniques of forming and decorating using clay as a material. Having feel of materials and creating innovative products. Interior finishes with mud.

UNIT - II COLOUR WORKSHOP

Aim :- Colour as an important part of our environment and its importance in design and colour as a scientific base.

- Study of colour as science. Light and the spectrum. Different Wave lengths of coloured light.
- Colour as a system and its application.
- Colour perception. Harmony in vision and basic principles of Harmony.
- Colour and textures of various natural materials.
- Modifying factors to colours and their depiction; namely, light, depicting the ability of reflection / absorption of colours in different material, surface quality, distance and scale.
- Manifestation of colours in various cultures. Colours symbolism basic characteristic of various hues.

UNIT – III CERAMIC WORKSHOP

Aim :- Understanding of ceramic products by working with materials, having feel of material and creating innovative products.

- A brief study of ceramics of various cultures.
- Process and techniques of forming and decorating.
- Colour pigments and design qualities.
- Site visits to ceramic product factories, sample collection, documentation, display of creative work.

SESSIONAL WORK:

- Assignments based on colouring technique
- Assignments based on graphic representations of interior and exterior buildings
- Assignments based on exterior& interior Landscape.

REFERENCES:

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN
SEMESTER I
BHD1T07 COMMUNICATION SKILLS I
PAPER VII

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM: To provide an adequate mastery of technical and communicative English Language training primarily, reading and writing skills, secondarily listening and speaking skills. To develop all the four skills and nurture the personality of the students, to enable them to survive in the competitive world and become professionally competent. In Language acquisition four Skills plays a significant role.

UNIT I: LISTENING: a) Importance of Listening Skills, b)Developing Listening Skills, c)Seminar Presentation Techniques
UNIT II :SPEAKING : a)Voice training and expression b)Non verbal communication)Role Playing)Group Discussion)Report Presentation)Professional Manners and Etiquettes)Personal Interview Techniques.Hygiene1)Voice training and expression (*Effective Public Speaking*)2)Non verbal communication: Body Language
UNIT III: READING : a)Book review 'Reflections on Vital issues'
UNIT IV:WRITING : a)Paragraph writing)Correction of Errors)Précis Writing d)Unseen Passage)Technical report writing, Essay writing Letter writing Dialogue writing.
UNIT V :SOFT SKILL DEVELOPMENT : a) Effective Public Speaking, Goal Setting, Time Management)Team Building)Stress Management f) Health and
SESSIONAL WORK:

1. Activities related to Listening Skills, Telephonic conversation
2. Situational listening Skills (Meeting, Dialogue, Seminars etc.)
3. Essay writing ,Letter writing, Correction of Errors ,Précis Writing
4. Comprehension Passage, Paragraph writing (Related to structures building interiors or exteriors e.g. Interior of a Mall, Monument, etc.).
5. Goal Setting and Three- minute Presentation
6. Presentation of a Research Paper-Syllabus based topic

REFERENCES:

1. Professional Communication Skills : By Pravin, S.R. Bhatia, A.M Sheikh: S. Chand and company
2. English Grammar Composition and Effective Business Communication By M.A. Pink, S. E. Thomas : S. Chand
3. Contemporary English Grammar Structures and Compositions by David Green Macmillan Publication
4. Reflections on Vital issues Edited by P.J. George
5. Publication Orient Black Swan
6. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
7. Black Swan Fifty ways to improve your Presentation Skills in English By Bob Dignen Publication Orient

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

INTERIOR DESIGN
SEMESTER II
BHD2T01 INTERIOR DESIGN II
PAPER I

Theory- 80
Sessional: 20
Total Marks: 100
Passing Marks - 40

AIM: Space making in order to understand elements and organization. Visual perception of Interior spaces by creating Comfortable, functional and arithmetically appearing harmonious Interior Environment.

UNITI
Introduction to concept of space. Elements of enclosed form- Combinations, resultant configurations & Characters.

UNIT II
Man and his basic living activity. Relationship of space with that of function for basic living activity. Organizational types and their correlation to linkages, types of routes and movement.
UNIT III
Functional analysis, minimum space requirements, anthropometrics, space planning for living activity.
UNIT IV
Quantitative and qualitative aspects of space through case studies and design exercise. Functional efficiency and qualitative aspects of relation to space.
UNIT V
Analysis of existing spaces and built forms, materials and structural systems, built form and its expression. Lighting, air views & issue.
SESSIONAL WORK: The exercises shall be based on:

1) Analysis of space and in relation to function.
2) Data collection: Survey and analysis of existing space.

REFERENCES:

1. Time Saver Standards
2. Visual Arts: A Basic Study by Bhagwat Desai
3. Form Space and Order by D .K. Ching

INTERIOR DESIGN
SEMESTER II
BHD2T02 MATERIAL AND CONSTRUCTION TECHNIQUES – II
PAPER II

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM: Understanding timber and timber joinery and its application. Understanding wood products and derivatives.

UNIT I

Material –timber – classification of trees, characteristics of good timber, sawing methods, tools and techniques of basic timber joinery.

UNIT II

Application of timber to openings like doors and windows, Timber paneled, partly paneled and partly glazed and fully glazed doors including hardware, design standards and criteria of opening.

UNIT III

Application of timber to partition and paneling .

UNIT IV

Material –Reconstituted wood, plywood, block boards, particle boards, fiber boards, cement fiber board's etc- their properties, process of manufacturing, tools and techniques of joinery.

Surface finishes to reconstituted wood like laminates, veneer, and other proprietary material.

SESSIONAL WORK:

1. Plates, Site visit reports, tutorials, notes, sketches and market surveys.

REFERENCES:

4. Building Construction by Sushil Kumar
5. Building Construction by Rangwala
6. Building Construction by Barry and Mckay

INTERIOR DESIGN
SEMESTER II
BHD2T03 GRAPHICS II
PAPER III

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM: drawing skills as tools to design thinking and visualization to enable the students to understand and express Composite three-Dimensional objects as perspective views. to understand objects formed by additive and interpenetrated solids using various graphical projection systems including sections and rendering suitably to understand materials , tones and textures.

UNIT I:

Development of Surfaces: development of simple geometrical shapes, cut solids / complex forms using the conventional methods viz.. Unfold, unroll and radial.

UNIT II:

Orthographic projections: drawing orthographic projections of cut solids, true sections etc. of single or combination solids .simple and complex cuts i.e. single plane cutting an object and two planes cutting an object.

UNIT III:

Interpenetration of solids: using projections to derive lines, curves and planes formed by the intersection of planes with solids and solids with solids.

UNIT IV:

Geometrical Drawing of special and complex curves: Geometrical construction of Sine curve, Geometrical mean, Golden Section, Archimedean Spiral, Logarithmic Spiral. Geometrical construction of Ellipse.

UNIT V:

Introduction to perspective drawing: types of perspective drawing (Vanishing point, picture plane and eye level) , difference between isometric view and perspective view. Parallel and angular perspective views of objects

SESSIONAL WORK:

- Sessional work should be planned to cover all the units mentioned in course outline with thrust on skill development, accuracy and understanding of the topic.
- Maximum weightage in assessment should be given to the assignments and use of model making skills to understand methods taught.
- Manually drafted assignments to cover the course outline based on above units.

REFERENCE:

1. Ching Francis D.K.: Architectural Graphics
2. Leslie Martin: Architectural graphics:
3. Jolhe D A : Engineering Graphics , Tata McGraw Hill , New Delhi
4. Bhat N D, “Elementary Engineering Drawing-Plane and Solid Geometry”, Chartotar Publishing House, Anand (1988)
5. M.S. Kumar : Engineering Drawing, DD publications, Chennai
6. I.H. Morris : Geometrical Drawing for Art Students, Orient Longman Chennai

INTERIOR DESIGN
SEMESTER- II
BHD2T04 MATHEMATICS II
PAPER VI

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM

- To understand elementary principles of mathematics.
- To apply mathematics in practical problems.
- To obtain accuracy in calculations and results of various mathematical experiments.

UNIT I

- Limits
    - Definition
    - Standard forms
    - Special Cases as : Limit tends to Infinity

UNIT II

- Derivatives (I)
    - Derivatives from definition
    - Standard forms
    - Product rule, Quotient rule
    - Parameter form, Logarithmic derivatives
    - Implicit functions

UNIT III

- Derivatives (II)
    - Rate measuring
    - Maxima-minima

UNIT IV

- Integration (I)
    - Standard forms
    - Substitution Method, Integration by parts
    - Algebraic forms, Partial fractions

UNIT V

- Integration (II)
    - Definite Integrals
    - Area by definite integration

SESSIONAL WORK
Two unit tests per semester

REFERENCES

1. Differential Calculus by Gorakh Prasad
2. Integral Calculus by Gorakh Prasad

INTERIOR DESIGN
SEMESTER II
BHD2T05 PRESENTATION TECHNIQUES II
PAPER V

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM: To understand colour as a media of representation, conceptual and preoperational skills & techniques.

UNIT I :

Sketching of transport elements, Human figures studies in line, drawings, shade & sculptural mass.

UNIT II:

Conceptual sketches using different media. Application of rendering techniques suitable for architectural & interior drawings. Rendering of two dimensional representations for eg. Plans & elevations.

UNIT III:

Perspective of forms, geometric solids, spaces: formal and informal (sketch views)

Rendering techniques and use of colour.

REFERENCES

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN
SEMESTER II
BHD2T06 PRODUCT WORKSHOP II
PAPER VI

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

UNIT – I

PLASTER OF PARIS WORKSHOP

Aim: Introduction to Plaster of Paris material, having feel of material and by creating products for interior spaces.

- Introduction to plaster as material.
- Process of mixing and its use in reproduction.
- mould making and casting.
- Use for plaster with other materials like cloth, thread, wires etc.

UNIT – II

BAMBOO AND CANE WORSHOP

Aim :- Understanding of materials and preventive measures for bamboo and cane.

- The processing on bamboo (seasoning, treatment)
- Tools for working on bamboo
- Precautions for safety in workshops.
- Cutting, Joinery details, strength, finishes, Application to constriction and furniture Interior.

Assignments based on transfers elements

1. Assignments based on human figures
2. Assignments based on perspective of solids & spaces.

REFERENCES:

3. Rendering with Pen and Ink by Gill
4. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN

SEMESTER II
BHD2T07 COMMUNICATION SKILLS II
PAPER VII

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM : To prepare students for participation in seminars, group discussions, paper presentation and general personal interaction at the professional level

UNIT I : Book review

UNIT II :1)Technical report writing , Official Report Writing ,Progress Report , Industrial Visit Report , Travel Report , Workplace Report , Inventory Report , 2)Stress Management

UNIT III : Dialogue writing , Group Discussion , Role Playing , *Health and Hygiene*

UNIT IV : Seminar Presentation Techniques

UNIT V : Professional Manners and Etiquettes , Personal Interview Techniques ,Meeting Agendas and minutes writing

SESSIONAL WORK:

1. Presenting a seminar on a selected topic
2. Book Reading and Reviews (Discussing the various books read).
3. Mock personal interviews
4. Report Writing
5. Mock Professional situations
6. Dialogue writing
7. Group Discussion Role Playing

REFERENCES:

1. Professional Communication Skills : By Pravin S. R. Bhatia, A.M Sheikh: S. Chand and company
2. English Grammar Composition and Effective Business Communication By M.A. Pink, S .E. Thomas : S .Chand
3. Contemporary English Grammar Structures and Compositions by David Green Macmillan Publication
4. Reflections on Vital issues Edited by P.J. George ,Publication Orient Black Swan
5. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
6. Fifty ways to improve your Presentation Skills in English By Bob Dignen Publication Orient Black Swan

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao. Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B.Sc. Fashion Design

Submitted by

Board of Studies,

B.Sc. Fashion Design

FYUGP-Scheme I-VIII

Fashion Design (Honors/Research)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme
SEM-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Elements of Design	BFD1 T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Elements of Design	BFD1 P01	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Fundamentals of Textile-I	BFD1 T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-I	BFD1 P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1 T01	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1 P01	-	-	2	1	-	-	-	-	-	50	25
7	GE/OE	Refer GE/OE Basket	BGO1 T02	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Elements of clothing construction	BVS1 P01	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS1 P02	-	-	4	2	-	-	-	-	50	50	50
10	AEC	Functional English	BAE1 T01	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Environmental Science	BEV1 TO1	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-I)	BIK1 T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1 P01	-	-	4	2	-				-	100	50
Total				13	-	18	**22**		**520**	**130**		**100**	**350**	

Fashion Design SEM-II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Colour Composition	BFD2 T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Colour Composition	BFD2 P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Fundamentals of Textile-II	BFD2 T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-II	BFD2 P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2 T03	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2 P03	-	-	2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2 T04	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Fabric Craft	BVS2 P03	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS2 P04	-	-	4	2	-	-	-	-	50	50	50
10	AEC	English and communication Skills	BAE2 T02	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution of India	BEV2 T02	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-II)	BIK2 T02	2	-	-	2	3	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC2 P02	-	-	4	2	-	-	-	-	-	100	50
Total				13	-	18	22	-	520	**130**		**125**	**325**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Fashion Design **SEM III**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making -I	BFD3 T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making -I	BFD3 P05	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Construction Technique - I	BFD3 T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Construction Technique - I	BFD3 P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1					-	50	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1					-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3 T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3 P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Fashion Illustration	BAE3 P01	-	-	4	2	-	-	-	-	50	50	50
12	FP	Industrial Visits	BAE2 T03	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-		100	50
Total				10	-	24	**22**		**400**	**100**		**150**	**450**	

Fashion Design **SEM IV**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making - II	BFD4 T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making - II	BFD4 P07	-	-	2	1					25	25	25
3	DSC	Construction Technique - II	BFD4 T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Construction Technique - II	BFD4 P08	-	-	4	2					50	50	50
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 4 (Refer Minor Basket)		-	-	6	3	3	-	-	-	100	50	50
7	GE/OE	Refer GE/OE Basket	BGO4 T06	-	-	4	2	-	-	-	-	25	25	25
8	SEC	Refer SEC Basket	BVS4 P06	-	-	4	2	3	-	-	-	50	50	50
9	AEC	Creative writing	BAE4 T03	2	-	-	2	3	80	20	40	-	-	-
10	CEP	Craft Documentation	BCM4 P01	-	-	4	2	-	-	-	-	50	50	50
11	CC	Refer CC Basket	BCC3 P04	-	-	4	2	-	-	-	-	-	100	50
Total				8	-	28	**22**		**320**	**80**		**325**	**375**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Fashion Design **SEM V**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making – I	BFD5 T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making – I	BFD5 P09	-	-	4	2	-	-	-	-	-	100	50
2	DSC	Fundamental of Apparel Production – I	BFD5 T10	2	-	-	2	3	80	20	40	-	-	-
3	DSC	Leatherwear Designing	BFD5 T11	2	-		2	3	80	20	40			
	DSC	Leatherwear Designing	BFD5 P11	-	-	2	1					-	50	25
4	DSE	Elective 1 (Refer DSE Basket)	BFD5 T12	2	-		2	3	80	20	40			
	DSE	Elective 1 (Refer DSE Basket)	BFD5 P12	-	-	4	2					-	100	50
5	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1					-	50	25
6	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
7	VSC	Refer VSC Basket	BVS3 P07	-	-	4	2	-	-	-	-	50	50	50
8	CEP	Presentation Skills	BCM5 P02	-	-	4	2	-	-	-	-	50	50	50
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**100**	**400**	**-**

Fashion Design **SEM VI**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Pattern Making-II	BFD6 T13	2	-		2	3	80	20	40			
2	DSC	Pattern Making-II	BFD6 P13			4	2					50	50	50
3	DSC	Fundamentls of Apparel Production - II	BFD6 T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Grading - II	BFD6 T15	2	-		2	3	80	20	40			
5	DSC	Grading - II	BFD6 P15			4	2					50	50	50
6	DSE	Elective 2 (Refer DSE Basket)	BFD6 T16	2	-		2	3	80	20	40			
7	DSE	Elective 2 (Refer DSE Basket)	BFD6 P16			2	1					-	50	25
8	Minor	Minor 7 (Refer Minor Basket)		2	-		2	3	80	20	40			
9	Minor	Minor 7 (Refer Minor Basket)				2	1					-	50	25
10	VSC	Refer VSC Basket	BVS3 P08	-	-	4	2	-	-	-	-	50	50	50
11	OJT	Industrial Training	BOJ6 P01	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	24	**22**		**400**	**100**		**250**	**350**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Fashion Design **SEM VII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BFD7 T17	2	-	-	2	3	80	20	40			
2	DSC	Applied Statistics	BFD7 P17			2	1					-	50	25
3	DSC	Trend Forecasting	BFD7 T18	2	-	-	2	3	80	20	40			
4	DSC	Trend Forecasting	BFD7 P18			2	1					-	50	25
5	DSC	Red Carpet Design	BFD7 T19	2	-	-	2	3	80	20	40			
6	DSC	Red Carpet Design	BFD7 P19			4	2					50	50	50
7	DSC	Line Creation	BFD7 T20	2	-	-	2	3	80	20	40			
8	DSC	Line Creation	BFD7 P20			4	2					50	50	75
9	DSE	Elective 3 (Refer DSE Basket)	BFD7 T21	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BFD8 T22	2	-	-	2	3	80	20	40			
11	RM	Research Methodology	BFD8 P22			4	2					-	100	50
Total				12	-	16	**20**		**480**	**120**		**100**	**300**	

Fashion Design **SEM VIII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Stylized Fashion Illustration	BFD8 T23	2	-	-	2	3	80	20	40	-	-	-
	DSC	Stylized Fashion Illustration	BFD8 P23	-	-	6	3	-	-	-	-	100	50	75
2	DSC	Fashion Business	BFD8 T24	2	-	-	2	3	80	20	40	-	-	-
3	DSC	Human Resource and Management	BFD8 T25	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Research Project	BFD8 T26	2	-	-	2	3	80	20	40	-	-	-
	DSC	Research Project	BFD8 P26	-	-	4	2	-	-	-	-	50	50	50
5	DSE	Elective 4 (Refer DSE Basket)	BFD8 T27	2	-	-	2	3	80	20	40	-	-	-
	DSE	Elective 4 (Refer DSE Basket)	BFD8 P27	-	-	2	2	-	-	-	-	-	50	25
6	OJT	Internship (Boutique Study)	BOJ8 P02	-	-	8	4	-	-	-	-	100	100	100
Total				**10**	**-**	**20**	**20**		**400**	**100**		**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Fashion Design **SEM VII (Research)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BFD7 T17R	2	-	-	2	3	80	20	40			
2	DSC	Applied Statistics	BFD7 P17R	-	-	2	1					-	50	25
3	DSC	Natural Dyeing	BFD7 T18R	2	-	-	2	3	80	20	40			
4	DSC	Natural Dyeing	BFD7 P18R	-	-	2	1					-	50	25
5	DSC	Quality Assurance in Fashion Industry	BFD7 T19R	2	-	-	2	3	80	20	40			
6	DSC	Quality Assurance in Fashion Industry	BFD7 P19R	-	-	2	1					-	50	25
7	DSE	Elective 3 (Refer DSE Basket)	BFD7 T20R	2	-	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BFD7 T21R	2	-	-	2	3	80	20	40			
9	RM	Research Methodology	BFD7 P21R	-	-	4	2					-	100	50
10	RP	Dissertation	BRP7 P01	-	-	10	5	3	-	-	-	150	100	125
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Fashion Design SEM VIII (Research)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Fashion Art & Design	BFD8 T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fashion Art & Design	BFD8 P22R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Advanced Draping Techniques	BFD8 T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Draping Techniques	BFD8 P23R	-	-	4	2	-	-	-	-	50	50	50
5	DSC	Sustainable Textiles	BFD8 T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSE	Elective 4 (Refer DSE Basket)	BFD8 T25R	2	-	-	2	3	80	20	40			
7	DSE	Elective 4 (Refer DSE Basket)	BFD8 P25R	-	-	4	2					50	50	50
8	RP	Dissertation	BRP8 P02R	-	-	14	7 (4+2+1)	-	-	-	-	150	200	175
Total				8	-	24	**20**		**320**	**80**		**250**	**350**	

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Fashion Design**)**

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Elements of clothing construction	BFD	**BVS1P01**
II	**VSC**	Fabric Craft	BFD	**BVS2P03**
III	**VSC**	Embroidery Techniques-I	BFD	**BVS3P05**
V	**VSC**	Computer Aided Fashion Design	BFD	**BVS5P07**
VI	**VSC**	Advance Computer Aided Fashion Design	BFD	**BVS6P08**

Basket for ELECTIVE (DSE) **category courses (**Fashion Design**)**

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Leatherwear Design	BFD5 TO12
VI	Elective 3	Fashion Studies	BFD6 TO16
VII (Honors)	Elective 5	Line Creation	BFD7 TO21
VIII (Honors)	Elective 7	Research Project	BFD8 TO27
VII (Research)	Elective 5	Boutique Management	BFD7 TO20R
VIII (Research)	Elective 7	Fashion Art Designing	BFD8 TO25R

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
Elements of Design
DSC
BFD1 T01

Theory Marks : 100			**Practical**	**: 50**		**Total Credits**	**: 3**
80	SEE	: 25		Theory	: 2	SEE	:
CIE	: 20	CIE	: 25		Practical	: 1	

Time Required: 60Hours

Theory **(30 Hours)**

Objectives :

1.To study the basic elements and principles of design.
2.To study the different types of motifs.

Unit I : **(8 Hours)**

1.1 Design definition – Meaning &Importance
1.2 Importance and role of design elements –Point, Line, Shape, Size, Colour, Value, Texture
1.3 Introduction to Textile Design
1.4 Introduction to Fashion Design

Unit II : **(7 Hours)**

2.1 Classification of Motifs
2.2 Study of different motifs of textile design
- Natural
- Decorative
- Geometric
- Abstract

2.3 Principles of design – importance and role in designing
- Proportion
- Repetition
- Balance
- Variety
- Unity
- Gradation
- Emphasis
- Dominance & Sub dominance

Unit III : **(8 Hours)**

3.1 Illusion
3.2 Perception
3.3 After image
3.4 Optical Illusion

Unit IV: **(7 Hours)**

4.1Percentage of cover area in design
4.2Preparation of motifs using design elements

4.3Preparation for design Borders, all over designs, Bed sheet

Practical: **(30 Hours)**

1. Design of points and line
2. Advance exercises in basic designs and rendering of simple designs
3. Study of traditional motifs of natural, decorative, geometric
4. One sheet of formal and informal balance
5. Study of positive and negative spaces
6. Prepare dress materials
7. Prepare bed sheet
8. Border – natural, geometric – 2 sheets
9. Design – scarf, table cloth – 2 sheets

References:

1. Designer's Guide- Volume 1- James Stockton
2. Basic Design and Anthropometry- S.V. Bapat
3. Design Sanvad- Mihir Bhole
4. A Basic Study- Bhagwat Gajanan and Arvind Desai
5. Fundamentals of designing for textiles and other end uses – J.W.Parchure

Fashion Design
FourYear(EightSemesterDegreeCourse)
Semester – I
Fundamentals of Textile – I
DSC
BFD1 T02

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	: --	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1. To know about textile fibers.
2. To know about the types of yarns, their properties & end uses.
3. To understand the yarn numbering system.

Learning outcomes:

After undergoing the subject, the students will be able to deal with the different types of fibres and yarns for producing variety of textile fabrics. The students are expected to know the different materials of the textile.

Unit I: **(7 Hours)**

Textile fibres

1.1 Definitions of fibre, filament

1.2 Classification of textile fibres according to origin

1.3 Essential & desirable properties of textile fibres
1.4 Identification of different fibres

Unit II: **(8 Hours)**

Yarns
2.1 Introduction to cotton spinning and its processes
2.2 Carded Yarn Spinning
2.3 CombedYarn Spinning
2.4 Introduction to open end spinning

Unit III: **(7 Hours)**

Different types of yarn and their properties and end uses
3.1 Fancy and Novelty yarn
3.2 Textured yarn
3.3 Embroidery yarn
3.4 Sewing yarn
3.5 Blended yarn (PV, PC, PW, CV, CS)

Unit IV: **(8 Hours)**

Concept of Yarn Numbering system
4.1 Introduction to various yarns numbering system for various textile yarns
4.2 Importance of Yarn numbering system
4.3 Indirect yarn numbering system
4.4 Direct yarn numbering system

Practical: **(30 Hours)**

1. Collection of different textile fibres.
2. Identification of different fibres.
3. Collection of different types of yarn.
4. Understanding various yarn packages.

References:

1. Textiles Norma -Hollen
2. Weaving calculations -Sen Gupta
3. Watson’s Textile Design and Colour - Z Grosicki
4. Textiles Fiber to Fabric – Bernard Corbman
5. Textiles – Sara J. Kadolph

Fashion Design

Four Year (Eight Semester Degree Course)

Semester – I
Computer Basics
GE/OE
BGO1 TO1

Theory Marks	**: 50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	: 40	SEE	**: -**	Theory	: 1
CIE	: 10	CIE	**: 50**	Practical	: 1

Time Required: 45 Hours

Theory **(15 Hours)**

Objectives:

1. Students should understand the significance and utility of computer.
2. To describe basic computer architecture.
3. To understand the working of Networking.
4. To help student to learn basic presentation skills

Learning outcomes:

After undergoing the subject, the students will be able to understand the working of computers.
The students are expected to know the different parts and flow of data in computer and network.
Students are expected to develop their skills in application software.

Unit I: **(3 Hours)**

Computer Fundamentals

1.1 Basic component of computer system
1.2 Characteristics of computer
1.3 Classification of Computers

Unit II: **(4 Hours)**

Computer Memory

2.1 Primary Memory
2.2 Secondary Memory
2.3 Types of Primary Memory
2.4 Types of Secondary Memory

Unit III : **(4 Hours)**

Software

3.1 System Software
3.2 Operating System
3.3 Functions of Operating System
3.4 Multiprogramming, Multitasking OS

Unit IV: **(4 Hours)**

Networking

4.1 Network Types
4.2 LAN
4.3 WAN
4.4 MAN

Practical **(30 Hours)**

1. Introduction to Ms. Paint, Motif development for specific end use symmetrical/asymmetrical.
2. Introduction to MS Word, Menus, Working with Documents, Formatting, Setting Margins, Editing, Creating Tables, Table settings, Tools, Word Completion, Spell Checks, Drawing and printing Importing and Exporting, Sending files to others, Inserting and Deleting, Find, Search, Replace Commands

Reference:

1. Computer Fundamentals -Sinha P.K. -Vol I, II, III, IV
2. Introduction to Computers - Peter Nartons
3. Microsoft Windows 98 - Lery J.O. Linda, Leary
4. Micro soft Office 2000 - Lery J.O. Linda, Leary 10
5. Computer for Beginners - Arora Pawan,
6. Fundamentals of Computer -V.Rajaram.

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Chemical Processing – I
GE/OE
BGO1 TO2

Theory Marks : 100 | **Total Credits : 2**
SEE : 80 | Theory : 2
CIE : 20

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives
1. To study the chemical processing of textile Material.
2. To become aware about Textile Chemistry.

Unit I: **(8 Hours)**
1.1 Comparison of organic & Inorganic compounds
1.2 Water (Required for Textile Industry)
- Impurities in water
- Purification softening of water by using
- Lime soda Treatment
- Zeolite or Base Exchange plant.

Unit II: **(7 Hours)**
2.1 Fiber Classification according to Chemical group
2.2 Textile fibres: Physical and Chemical properties of following fibers-
i.Cottonii. iiwool iii. Silk iv. Viscose v. polyester
vi. Nylon vii. Acrylic viii. polypropylene

Unit III: **(8 Hours)**
1.1 Cotton Fabric processing sequence
1.2 Shearing & cropping
1.3 Singeing & Desizing
1.4 Scouring

Unit IV: **(7 Hours)**
1.1 Souring
1.2 Bleaching: (i) Hypochlorite(ii) Peroxide

1.3 Mercerizing – Fabric & Yarn &Barium number test

References:

1 Technology of Textile Processing - Vol 1(Textile Fiber) - Dr. V.A. Shenoi

2 Technology of Textile Processing - Vol III (Technology of Bleaching) - V.A. Shenoi

3 Technology of Textile Processing - Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi

4 Chemical technology of Fibre materials - F. Sadav

5 Textile scouring &Bleaching - E.R. Trotman

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
ELEMENTS OF CLOTHING CONSTRUCTION
VSC
BVS1 PO1

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES

- To develop skills in clothing construction
- To Equip the students with various stitching techniques

UNIT 1 **(15 Hours)**

1.1 Tools and equipments required for sewing
1.2 Taking body measurements.
1.3 Introduction to domestic sewing machine : Sewing machine parts and their functions

UNIT 2 **(15 Hours)**

2.1 Temporary Hand stitches

- Pin basting
- Even basting
- Uneven basting
- Diagonal basting

2.2 Permanent stitches

- Machine basting
- Running stitch

2.3 Edge Finishing

- overlock
- Hemmimg
- Pico

UNIT 3 **(15 Hours)**

Shaping Devices

3.1 Darts

- Single Dart
- Double Dart

3.2 Tucks

- Pin tucks
- Cross tucks
- Shell tucks
- Released tucks.

UNIT 4 **(15 Hours)**

4.1 Pleats

- Knife pleat
- Box Pleat
- Inverted Box Pleat

4.2 Ruffles

- Single Ruffle
- Double Ruffle

4.3 Gathers

Practical
Prepare a Portfolio of all the samples mentioned in syllabus

Refernce

1. Complete Guide To Sewing – Reader's Digest
2. Encyclopedia Of Dress Making – Raul Jewel
3. Basics of Fashion Design Construction – Annette Fischer

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
Hand Painting I
VSEC
BVS1 PO2

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours .

Practical **(60 Hours)**

Objectives -

- To become familiar with the basic methods, techniques and tools ofdrawing.
- Identify different tones made with different value or textures.

UNIT I **(15 Hours)**

1.1 Basic Brush Handling Techniques for Painting.

1.2 Understanding edges, spaces, light and shadow relations, these basicskills of drawing make up the components of finished works of art.

UNIT II **(15 Hours)**

2.1 How to hold brush (Hard brush, soft brush and dry brush)

2.2 The most basic stoke is the line. It is also one of the most versatile.

2.3 How to use a water brush and handle any given paint brush (washbrush, flat brush, round brush, liner brush)

UNIT III **(15 Hours)**

3.1 Shading techniques for drawing

3.2 Rendering, hatching, random line, stripling

3.3 Shading is the process of adding value to create the illusion of form,space and light in a drawing.

UNIT IV **(15 Hours)**

4.1 Observe and record 10 texture patterns in pen, color and ink.

4.2 Figurative gestures

4.3 2D and 3D perspective. Create a sense of depth and perspective.

Portfolio :

This will make up the majority of your work in the class.

Practice above mentioned techniques.

Sketchbook-

Students will be responsible for keeping a sketchbook throughout thesemester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Functional English
AEC
BAE1T01

Theory Marks : 100
SEE : 80
CIE : 20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives: 1) To help students in developing speaking and writing proficiency in English language.

Unit 1: **(8 Hours)**
-Remedial grammar
1.1Articles & determiners.
1.2 Forms & functions of nouns, pronouns, prepositions.
1.3 Verbs,adverbs and adjectives
1.4 Tenses

Unit 2: **(7 Hours)**
Functional grammar
2.1 Transformation of sentences
2.2 Figures of speech: - Simile, Metaphor, Irony, Personification, Hyperbole & Alliteration

Unit 3: **(8 Hours)**
3.1 Introduction to Phonetics
3.2 Understanding sociolinguistics:-
Langue, parole, pidgin, creol and dialect

Unit 4: **(7 Hours)**
Creative writing
4.1 Use of Idioms and phrases
4.2 Report writing
4.3 Formal letter & Application writing
4.4 Composing advertisements

Students are expected to practice effective oral and written communication
i. Paper reading session (presented by the students)
ii. Practice of face to face conversation
iii. Listening & summarizing (listening carefully to passage & summarizing the important points)
iv. Letter writing
Continuous assessment of the above mentioned assignment & one presentation on any given topic.

Reference:

1. Secrets of face to face communication -Peter urs Bender (Mecmillan Publications)
2 Learning to learn by Kenneth a Kiewra Nelson F. Dubros Publishers -Allyn & Bacon.
3 English for practical purpose - Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant (Macmillan Publications)
4 Teaching Material
5 Business communication - Dr. Urmila Rai
6 Professional Communication skills - A.K. Jain, S.R. Bhatia, A.M. Sheikh

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
ENVIRONMENTAL SCIENCE
VEC
BEV1 T01

Theory Marks : 100
SEE : 80
CIE : 20

Total Credits : 2
Theory : 2

Time Required: 30 Hours

Theory **(30 Hours)**

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere-Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Traditional Indian Textiles – I
IKS
BIK1 TO1

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives

1. To learn about traditional Indian Textiles
2. To understand various ornamentation techniques

Unit I: **(8 Hours)**

Evolution of Textile Design

1.1 History of Indian textile design
1.2 Importance of study of Textile Design
1.3 Journey of designing skills since ages
1.4 Influence of Religion, Art and Royalty on Textile Design
1.5 Influence of trade and media on textile design

Unit II: **(7 Hours)**

Textile design

2.1 Design -Definition & classification
2.2 Methods of creating design on fabric

- Structural ornamentation
- Surface ornamentation

Unit III: **(8 Hours)**

Textiles woven on pit loom

3.1 Meaning and introduction of sari weaving – parts of sari
3.2 Pit – loom weaving
  3.2.1 Chanderi Sari (with reference to its motifs, techniques and color combination etc.)
  3.2.2. Maheshwari Sari (with reference to its motifs, techniques and color combination etc.)
  3.2.3 Mau sari
  3.2.4 Shantipur Sari

Unit IV: **(7 Credit)**

Hand woven Textiles

4.1 Limitation and scope of hand loom weaving
  4.1.1 Bhandara Karvat Kathi Sari
  4.1.2 Nagpuri Sari
  4.1.3 Jamdani Sari
  4.1.4 Balrampuri Sari with refrence to its motif, technique, colour combination and products

References:

1. The sari styles – patterns – History – Techniques Linda Lynton
2. Textile Arts of India Kokyo Hatanaka
3 Indian Saris Traditions Perspectives, Design – Vijai Singh Katiyar
4 Decorative Design History In India Textiles & Costumes Parul Bhatnagar
5 Handcrafted Indian Textiles (Tradition And Beyond) Martand Singh Rta Kapur Chisti Rahul Jain
6 Traditional Textiles ShakeelaShaik
7 Costume, Textile and Jewellery of India Tradition in Rajasthan Vandana Bhandari
8 Traditional Indian Textiles John Gillow and Nicholas Barnard
9. Traditonal Indian Constumes& Textiles Parul Bhatnagar

Fashion Design

Four Year (Eight Semester Degree Course)

Semester – I
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC1 PO1

Practical Marks: 100
SEE : --
CIE : 100

Total Credits : 2
Practical : 2

Time Required: 60 Hours

Practical: 60 Hours

As per university Rules

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – II
Colour Composition
DSC
BFD2 T03

Theory Marks : 100		**Practical: 50**		**Total Credits : 3**	
SEE	: 80	SEE:--25		Theory	: 2
CIE	: 20	CIE: 25		Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1 Students should know the basics of color theories& their role in designing.
2 To make students understand color combinations and textures.

Unit I : **(7 Hours)**

1.1 Definition of color
1.2 The meaning of color
1.3 Theories of color [light & pigment]
1.4 Chromatic circle
1.5 Complementary colors
1.6 After Image of colors

Unit II : **(8 Hours)**

2.1 Role of color in designing
2.2 Color modification
2.3 Value Scale
2.4 Qualities of color [Hue, Value, chrome]
2.5 Color Measurement

Unit III : **(7 Hours)**

3.1 Color Schemes
3.2 Basic Techniques for creating color schemes
3.3 Color Contrast

Unit IV : **(8 Hours)**

4.1 Psychological impact of color- style and colour
4.2 Role of color to create mood - Powerful, Romantic, Vital, Earthy, Friendly, Soft, Elegant, Trendy
4.3 Understanding of texture effects

Practical : **(30 Hours)**

Chromatic circle
Grey Scale
Colour Modification
Key System
Color Wheel
Colour Harmonies
Different Color Schemes
Prepare linear drawing with colored inks or poster colors
Prepare design related to 3 dimensional effects
Prepare different motifs with various tonal effects in different color media

Reference:

1. Color Harmony a Guide to creative color combinations-Bride M. Whelan
2. Designer guide to color-Volume - 1 - 5 -James Stockton
3. A Basic Study- Bhagwat Gajanan
4. Basic Design & Anthropometry-S.V. Bapat
5. Colour Harmony -A Guide to creative colour combinations by Hideaki Ghijirwa,
6. Fundamentals of designing for Textiles and other end uses – J.W.Parchure

Fashion Design
FourYear(EightSemesterDegreeCourse)
Semester – II
Fundamentals of Textile – II
DSC
BFD2 T04

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	:	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours
Theory **(30 Hours)**

Objectives: Students should be able to
1. Differentiate between different types of fabrics.
2. Understand the process of weaving.
3. Understand Loom and its attachments.
4. Know the Relation between Design, Draft & lifting plan.
5. Develop the simple weaves on point paper.
6. To understand the classification of standard fabrics

Learning outcomes:
After undergoing the subject, the students will be able to deal with the different types of designs over variety of textile fabrics. Before going through the design aspect one must know about the different types of Machines used in fabric manufacture.

Unit I: **(7 Hours)**
Fabrics
1.1 Fabric - Definition
1.2 Definition of weaving, properties and end uses of woven fabrics
1.3 Definition of knitting, types of knitting, properties and end uses of knitted fabrics
1.4 Definition on non-woven, properties and end uses of non-woven.
1.5 Flowchart for manufacturing and input, output objectives and machinery used for
- Simple fabrics
- Striped fabrics
- Checks fabrics

Unit II: **(8 Hours)**
Weaving preparatory processes
2.1 Introduction to Winding - Passage of material
2.2 Introduction to Warping - passage of material through beam warping and sectional warping
2.3 Introduction to Sizing - passage of material through sizing machine
2.4 Introduction to Drawing - in & denting
2.5 Introduction to Tying - in

Unit III: **(7 Hours)**
Loom
3.1 Classification of loom
3.2 Passage material through loom
3.3 Motions of loom

Unit IV: **(8 Hours)**
4.1 Definition of design, draft and lifting plan
4.2 Weave representation methods
4.3Simple weaves, (Plain, Twill, and Satin)
4.4 Characteristics and end uses of simple weaves

Practical: **(30 Hours)**

1. Collection of standard fabrics such as muslin, poplin, organdie, cambric, mulmul,

   Crepe, georgette, satin, denim, flannel, felt, fur, woolen, worsted.
2. Collection of Woven, knitted and non-woven fabrics.
3. Collection of Simple, Stripes and Checks fabrics.
4. Collection of figured fabrics.
5. Preparation of simple weave samples (Plain, Twill, and Satin) using various materials.

References:

1. Textiles -Norma Hollen
2. Textile Science -E.P.G.Gohl - L.D. Vilensky
3. Weaving Mechanism - N. N. Banerjee
4. Weaving Mechanism- N. N. Banerjee
5. Watson's Textile Design and Colour-Z.Grosicki
6. Plain Weaving Motions - K. T. Aswani

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Computer Application in Design
GE/OE
BGO2 TO3

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours
Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: (3 Hours)

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : (4 Hours)

Out Put Device

2.1 Printers
2.2 Classification of Printers
2.3 Plotters

Unit III: (4 Hours)

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: (4 Hours)

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: **(30 Hours)**

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation,

Consolidation, Subtotal

2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video.

Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

Fashion Design
Four Year (Eight Semester Degree Course)

Semester - II
Chemical Processing – II
GE/OE
BGO2 TO4

Theory Marks : 100 **Total Credits : 2** SEE : 80 Theory : 2
CIE : 20

Time Required: 30Hours
Theory **(30 Hours)**
Objectives
1. To study the chemical processing of
2. To make students aware about Textile Chemistry

Unit I: **(8 Hours)**
1.1 Flow chart for manufacturing process of manmade fibre by
- Dry spinning – Acrylic
- Wet spinning – Viscose
- Melt spinning – Polyester and polypropylene
- Introduction and terms used in the POY, FDY and Texturing process

Unit II : **(7 Hours)**
Introduction to finishing of Fabric & Garment
2.1 Object of Finishing
2.2 Classification of Finishing
2.3 Mechanical Finishing
- Calendar Finishing
- Dimensional Stability Finishing

Unit III: **(7 Hours)**
3.1 Hot Air Stanter Finishing
3.2 Chemical Finishing
- Resin Finishing
- Water Repellent Finishing

Unit IV: **(8 Hours)**
Chemical Finishing
4.1 Fire Retardant Finishing
4.2 Enzyme Finishing
4.3 Back filling
4.4 Types of softner used in Finishing

References:

1. Technology of Textile Processing -Vol 1(Textile Fiber)-Dr. V.A. Shenoi
2. Technology of Textile Processing -Vol III (Technology of Bleaching)-V.A. Shenoi
3. Technology of Textile Processing -Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi
4. Chemical technology of Fibre materials - F. Sadav
5. Textile scouring & Bleaching-E.R. Trotman

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
FABRIC CRAFT
VSEC
BVS2 PO3

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES: To impart ability of creating art pieces made up of fabric.
To understand suitability of fabric for art pieces

UNIT I:
1.1 Understanding nature of fabric
1.2 Understanding Geometry of different art pieces- Estimation for bulk production
1.3 Designing of fabric art pieces
1.4 Appliques

UNIT II:
2.1 Flower
2.2 Buttons
2.3 Bows
2.4 Belts
2.5 Cords
2.6 Braids
2.7 Tassels

UNIT III:
3.1 Home Décor Items:
3.2 Table mats
3.3 Doormats
3.4 Wall Hangings
3.5 Wall Pieces
3.6 Lamp Shade
3.7 Cushion covers

UNIT IV:
4.1 Mask
4.2 Jewellery
4.3 Specs Cover
4.4 Wardrobe organiser
4.5 Bottle Covers
4.6 Shoe Cover
4.7 Saree Cover
4.8 Kitchens

References:
Complete Guide to Sewing- Readers Digest
Fabric Blooms Megan Hunt

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – II
Hand Painting II
VSEC
BVS2 PO4

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

Objectives -

- Identify the appropriate different types of folk art of different states in India.
- Practice different techniques, mediums and styles of folk art.
- Develop the skills and aesthetic sense to appreciate folk art.
- Decorate their floors, walls, clothes, etc.

UNIT I

1.1 Introduction to folk and Tribal art
1.2 Forms of folk and tribal art
1.3 Medium, techniques and styles

UNIT II

2.1 Role of Proportion in drawing
2.2 Warli
2.3 Gond

UNIT III

3.1 Miniature painting
3.2 Madhubani art
3.3 Mandala art

UNIT IV

4.1 Floor painting (Chawk) festivals and ceremonies (different types of states)
4.2 Dhokra

Portfolio :
Fundamental painting techniques. Students need to get creating their own masterpiece.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Fashion Design
Four Year (Eight Semester Degree Course)
Semester - II
English and Communication Skills
AEC
BAE2 T02

Theory Marks : 100
SEE : 80
CIE : 20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives

1. To improve Communication skills of students.
2. TIP: This subject should be taught in English only

UNIT I : **(8 Hours)**
Communication

1.1 Meaning and definition of communication
1.2 Process, elements, objectives and methods of communication
1.3 Principles of effective communication
1.4 Channels of Communication
1.5 Barriers of communication

Unit-II: **(7 Hours)**
2.1 Verbal vs non-verbal communication

- Oral Communication
- Conversation at a bank, at office, at a bus-stop and at a shop
- Telephonic Conversation: formal and informal
- Written Communication
- Content Writing: style and structure
- Resume writing

Unit III : **(8 Hours)**
Listening

3.1 Principles and Importance of Listening
3.2 Social etiquettes and manners
3.3 Areas of self development
3.4 Motivation

Unit IV: **(7 Hours)**
4.1Presentation skills : To acquire convincing presentation skills

- Leadership Skills
- Group Discussions
- Team work building
- Interview Technique

Reference :

1. Secrets of face to face communication - Peter Bender
2. Learning to learn by Kenneth a Kiewra Nelson F. Dubros
3. English for practical purpose by Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant
4. Teaching Material
5. Business Communication - Dr. Urmila Rai

6. Professional Communication Skills - A.K Jain, S.R. Bhatia
7. Managerial Communication – Urmila Rao, S.M.Rai – Himalaya Publishing House
8. Communication Skills – Mrs.Jaya Kulkarni Moholkar – Central Techno Publication

Fashion Design
Four Year (Eight Semester Degree Course)

Semester - II
Constitution of India
VEC
BEV2 T02

Theory Marks : 100
SEE : 80
CIE :20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Traditional Indian Textiles – II
IKS
BIK2 TO2

Theory Marks : 100
SEE : 80
CIE : 20

Total Credit : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives

1. To learn about the traditional Indian textiles
2. To understand the culture of India pertaining to the different states

Unit I : **(8 Hours)**
Tribal Weaving
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
1.1 Backstrap loom weaving
1.2 Assam – Mekhala
1.3 Meghalaya Garo

Unit II : **(7 Hours)**
Tribal Weaving
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
2.1 Manipuri Phanek
2.2 Innaphi
2.3 Nagaland Blanket

Unit III : **(8 Hours)**
Shawls of India
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
3.1 Kullu Shawl
3.2 Kanikar
3.3 Gujarat Shawl
3.4 Do rukha

Unit IV : **(7 Hours)**
Floor Coverings
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
4.1 Namda
4.2 Dharri
4.3 Kashmiri Galicha

Reference:

1. The sari styles - patterns - History - Techniques Linda Lynton
2. Dhurrie Flat woven Rugs Of India Shyam Ahuja
3. Textiles and crafts of India (Arunachal Pradesh Assam. Manipur) Dr. Vardona Bhandari NIFT Pub. Division
4. Textile Arts of India KokyoHatanaka

5. Indian Sarees Traditions Perspectives, Design Vijai Singh Katiyar
6. Decorative Design History In India Textiles & Costumes PorulBhatnagar
7. (Tradition And Beyond) Handcrafted Indian Textiles Martand Singh RtaKapurChisti Rahul Jain
8. Traditional TextilesShakeelaShaik
9. Costume, textile and Jewelry of India Tradition S/n Rajasthan Vandanabhandari
10. Traditional Indian Textiles John Gillow and Nicholas Bornard
11. Traditonal Indian Constumes& Textiles ParulBhatnagar

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC2 PO2

Practical Marks: 100		**Total Credits**	**: 2**
SEE	: --	Practical	: 2
CIE	: 100		

Time Required: 30 Hours
Practical **(30 Hours)**

As per University rules

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B.Sc. Textile Science

Submitted by

Board of Studies,

B.Sc. Textile Science

FYUGP-Scheme I-VIII Semester

Textile Science (Honors/Research)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme
SEM-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Elements of Design	BTS1 T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Elements of Design	BTS1 P01	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Fundamentals of Textile-I	BTS1 T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-I	BTS1 P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1 T01	1	-		1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1 P01			2	1	-	-	-	-	-	50	25
7	GE/OE	Refer GE/OE Basket	BGO1 T02	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Elements of clothing construction	BVS1 P01	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS1 P02	-	-	4	2	-	-	-	-	50	50	50
10	AEC	Functional English	BAE1 T01	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Environmental Science	BEV1 T01	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-I)	BIK1 T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1 P01	-	-	4	2	-				-	100	50
Total				13	-	18	**22**		**520**	**130**		**100**	**350**	

Textile Science **SEM-II**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Colour Composition	BTS2 T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Colour Composition	BTS2 P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Fundamentals of Textile-II	BTS2 T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-II	BTS2 P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2 T01	1	-		1	2	40	10	20			
6	GE/OE	Refer GE/OE Basket	BGO2 P01			2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2 T04	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Fabric Craft	BVS2 P03	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS2 P04	-	-	4	2	-	-	-	-	50	50	50
10	AEC	English and communication Skills	BAE2 T02	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution of India	BEV2 TO2	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-II)	BIK2 T02	2	-	-	2	3	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC2 P02	-	-	4	2	-				-	100	50
Total				13	-	18	22	-	520	**130**		**125**	**325**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Textile Science **SEM III**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basic WovenStructure – I	BTS3 T05	2	-	-	2	3	80	20	40			
2	DSC	Basic WovenStructure – I	BTS3 P05	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Applied Textile Design – I	BTS3 T06	2	-	-	2	3	80	20	40			
4	DSC	Applied Textile Design – I	BTS3 P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BTGO3 T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3 P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Hand Printing Technology	BAE3 T03	-	-	4	2	-	-	-	-	50	50	50
12	FP	Industrial Visit	BAE3 T03	-	-	4	2	-	-	-	-	-	100	50-
13	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-	-	100	50
Total				10	-	24	**22**		**400**	**100**		**100**	**500**	

Textile Science **SEM IV**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basic Woven Structure – II	BTS4 T07	2	-		2	3	80	20	40	-	-	-
2	DSC	Basic Woven Structure – II	BTS4 P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Textile Design – II	BTS4 T08	2	-		2	3	80	20	40	-	-	-
4	DSC	Applied Textile Design – II	BTS4 P08	-	-	2	1	-	-	-	-	25	25	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4 TO6	2	-	-	2	-	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4 P06	-	-	4	2	3	-	-	-	50	50	50
11	AEC	Creative writing	BAE4 T04	2	-	-	2	-	80	20	-	-	-	50
12	CEP	Craft Documentation	BCM4 P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4 P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**150**	**350**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Textile Science **SEM V**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Woven Structure-I	BTS5 T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Woven Structure-I	BTS5 P09	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Technical Textiles	BTS5 T010	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Intricate Traditional Textile-I	BTS5 T011	2	-	-	2	3	80	20	40	-	-	-
5	DSE	Elective 1 (Refer DSE Basket)	BTS5 T012	2	-	-	2	3	80	20	40	-	-	-
6	DSE	Elective 1 (Refer DSE Basket)	BTS5 P012			2	1	-	-	-	-	-	50	25
7	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 5 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 6 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
11	VSC	Refer VSC Basket	BVS5 P07	-	-	4	2	-	-	-	-	50	50	50
12	CEP	Presentation Skills	BCM5 P02	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**175**	**325**	**-**

Textile Science **SEM VI**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Woven Structure - II	BTS6 T013	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Woven Structure - II	BTS6 P013	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Weaving Calculations	BTS6 T014	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Weaving Calculations	BTS6 P014	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Intricate TraditionalTextile-II	BTS6 T015	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Intricate TraditionalTextile-II	BTS6 P015	-	-	2	1	-	-	-	-	-	50	25
7	DSE	Elective 2 (Refer DSE Basket)	BTS6 T016	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Elective 2 (Refer DSE Basket)	BTS6 P016	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
11	VSC	Refer VSC Basket	BVS6 PO8	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Industrial Training	BOJ6 P01	-	-	6	3	-	-	-	-	75	75	75
Total				10	-	24	**22**		**400**	**100**		**225**	**375**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Textile Science **SEM VII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BTS7 T017	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Applied Statistics	BTS7 P017	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Trend Forecasting	BTS7 T018	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Trend Forecasting	BTS7 P018	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Theme Based Designing	BTS7 T019	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Theme Based Designing	BTS7 P019	-	-	4	2	-	-	-	-	50	50	75
7	DSC	Brand Management	BTS7 T020	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Elective 3 (Refer DSE Basket)	BTS7 T021	2	-	-	2	3	80	20	40	-	-	-
9	DSE	Elective 3 (Refer DSE Basket)	BTS7 P021	-	-	4	2	-	-	-	-	50	50	75
10	RM	Research Methodology	BTS7 T022	2	-	-	2	3	80	20	40	-	-	-
11	RM	Research Methodology	BTS7 P022	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	16	**20**		**480**	**120**		**100**	**300**	

Textile Science **SEM VIII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Intricate weaving Techniques	BTS8 T023	2	-	-	4	3	80	20	40			
2	DSC	Intricate weaving Techniques	BTS8 P023	-	-	4		-	-	-	-	-	100	50
3	DSC	Elements of fabrics Costing	BTS8 T024	2	-	-	3	3	80	20	40			
4	DSC	Elements of fabrics Costing	BTS8 P024	-	-	2		-	-	-	-	-	50	25
5	DSC	Human Resource and Management	BTS8 T025	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Recycling of Textiles	BTS8 T026	2	-	-	3	3	80	20	40			
7	DSC	Recycling of Textiles	BTS8 P026	-	-	2		-	-	-	-	-	50	25
8	DSE	Elective 4 (Refer DSE Basket)	BTS8 T027	2	-	-	4	3	80	20	40			
9	DSE	Elective 4 (Refer DSE Basket)	BTS8 P027	-	-	4		-	-	-	-	50	50	50
10	OJT	Internship	BOJ8 P02	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Textile Science **SEM VII (Research)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BTS7 T017R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Applied Statistics	BTS7 P017R	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Natural Dyeing	BTS7 T018R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Natural Dyeing	BTS7 P018R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Quality Assurance in Textile Industry	BTS7 T019R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Quality Assurance in Textile Industry	BTS7 P019R	-	-	2	1	-	-	-	-	-	50	25
7	DSE	Elective 3 (Refer DSE Basket)	BTS7 T020R	2	-	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BTS7 T021R	2	-	-	2	3	80	20	40	-	-	-
9	RM	Research Methodology	BTS7 P021R	-	-	4	2	-	-	-	-	-	100	50
10	RP	Dissertation	BRP7 P01R	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Textile Science SEM VIII (Research)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Hand crafts and textiles	BTS8 T022R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Hand crafts and textiles	BTS8 P022R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Designing of Non apparel and Upholstery	BTS8 T023R	2	-	-	2	3	80	20	40	-	-	-
	DSC	Designing of Non apparel and Upholstery	BTS8 P023R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Sustainable Textiles	BTS8 T024R	2	-	-	2	3	80	20	40	-	-	-
4	DSE	Elective 4 (Refer DSE Basket)	BTS8 T025R	2	-	-	2	3	80	20	40	-	-	-
	DSE	Elective 4 (Refer DSE Basket)	BTS8 P025R			4	2	-	-	-	-	50	50	50
5	RP	Dissertation	BRP8 P02R	-	-	16	8 (4+2+2)	-	-	-	-	200	200	200
Total				8	-	24	**20**		**320**	**80**		**250**	**350**	

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS,Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Textile Science**)**

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Elements of clothing construction	BTS	**BVS1P01**
II	**VSC**	Fabric Craft	BTS	**BVS2P03**
III	**VSC**	Computer Aided Textile Design	BTS	**BVS3P05**
V	**VSC**	Home Linen Design	BTS	**BVS5P07**
VI	**VSC**	Design Development	BTS	**BVS6P08**

Basket for ELECTIVE (DSE) category courses (Textile Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Printing Technology-I	BTS5 TO12
VI	Elective 3	Printing Technology-II	BTS6 TO16
VII (Honors)	Elective 5	Applied Art on Textiles	BTS7 TO21
VIII (Honors)	Elective 7	Research Project	BTS8 TO27
VII (Research)	Elective 5	Non Wovens	BTS7 TO20R
VIII (Research)	Elective 7	Handicrafts and Textiles	BTS8 TO25R

Textile Science
Four Year (Eight Semester Degree Course)
Semester – I
Elements of Design
DSC
BTS1 T01

Theory Marks	**: 100**		**Practical**	**: 50**	**Total**
Credits	**: 3**	SEE	: 80	SEE	: 25
		Theory	: 2		
CIE	: 20		CIE	: 25	Practical : 1

Time Required: 60Hours
Theory
(30 Hours)
Objectives :
1.To study the basic elements and principles of design.
2.To study the different types of motifs.

Unit I :
(8 Hours)
1.1 Design definition – Meaning &Importance
1.2 Importance and role of design elements –Point, Line, Shape, Size, Colour, Value, Texture
1.3 Introduction to Textile Design
1.4 Introduction to Fashion Design

Unit II :
(7 Hours)
2.1 Classification of Motifs
2.2 Study of different motifs of textile design

- Natural
- Decorative
- Geometric
- Abstract

2.3 Principles of design – importance and role in designing

- Proportion
- Repetition
- Balance
- Variety
- Unity
- Gradation
- Emphasis
- Dominance & Sub dominance

Unit III :
(8 Hours)
3.1 Illusion
3.2 Perception
3.3 After image
3.4 Optical Illusion

Unit IV:
(7 Hours)
4.1Percentage of cover area in design
4.2Preparation of motifs using design elements
4.3Preparation for design Borders, all over designs, Bed sheet

Practical:

(30 Hours)

1. Design of points and line
2. Advance exercises in basic designs and rendering of simple designs
3. Study of traditional motifs of natural, decorative, geometric
4. One sheet of formal and informal balance
5. Study of positive and negative spaces
6. Prepare dress materials
7. Prepare bed sheet
8. Border – natural, geometric – 2 sheets
9. Design – scarf, table cloth – 2 sheets

References:

1. Designer's Guide- Volume 1- James Stockton
2. Basic Design and Anthropometry- S.V. Bapat
3. Design Sanvad- Mihir Bhole
4. A Basic Study- Bhagwat Gajanan and Arvind Desai
5. Fundamentals of designing for textiles and other end uses – J.W.Parchure

Textile Science
FourYear(EightSemesterDegreeCourse)
Semester – I
Fundamentals of Textile – I
DSC
BTS1 T02

Theory Marks	**: 100**	**Practical**	**: 50**	**Total**
Credits	**: 3**			
SEE	: 80	SEE	: --	Theory : 2
CIE	: 20	CIE	: 50	Practical : 1

Time Required: 60 Hours

Theory **(**
30 Hours)

Objectives:

1. To know about textile fibers.
2. To know about the types of yarns, their properties & end uses.
3. To understand the yarn numbering system.

Learning outcomes:

After undergoing the subject, the students will be able to deal with the different types of fibres and yarns for producing variety of textile fabrics. The students are expected to know the different materials of the textile.

Unit I:

(7 Hours)

Textile fibres

1.1 Definitions of fibre, filament
1.2 Classification of textile fibres according to origin
1.3 Essential & desirable properties of textile fibres
1.4 Identification of different fibres

Unit II:

(8 Hours)

Yarns

2.1 Introduction to cotton spinning and its processes
2.2 Carded Yarn Spinning
2.3 CombedYarn Spinning
2.4 Introduction to open end spinning

Unit III:

(7 Hours)

Different types of yarn and their properties and end uses

3.1 Fancy and Novelty yarn
3.2 Textured yarn
3.3 Embroidery yarn
3.4 Sewing yarn
3.5 Blended yarn (PV, PC, PW, CV, CS)

Unit IV:

(8 Hours)

Concept of Yarn Numbering system

4.1 Introduction to various yarns numbering system for various textile yarns
4.2 Importance of Yarn numbering system
4.3 Indirect yarn numbering system
4.4 Direct yarn numbering system

Practical:

(30 Hours)

1. Collection of different textile fibres.
2. Identification of different fibres.
3. Collection of different types of yarn.
4. Understanding various yarn packages.

References:

1. Textiles Norma -Hollen
2. Weaving calculations -Sen Gupta
3. Watson's Textile Design and Colour - Z Grosicki
4. Textiles Fiber to Fabric – Bernard Corbman
5. Textiles – Sara J. Kadolph

Textile Science

Four Year (Eight Semester Degree Course)

Semester – I
Computer Basics
GE/OE
BGO1 TO1

Theory Marks	**: 50**	**Practical**	**: 50**	**Total**
Credits	**: 2**			
SEE	: 40	SEE	**: -**	Theory : 1
CIE	: 10	CIE	**: 50**	Practical : 1

Time Required: 45 Hours

Theory
(15 Hours)

Objectives:

1. Students should understand the significance and utility of computer.
2. To describe basic computer architecture.
3. To understand the working of Networking.
4. To help student to learn basic presentation skills

Learning outcomes:

After undergoing the subject, the students will be able to understand the working of computers.

The students are expected to know the different parts and flow of data in computer and network.

Students are expected to develop their skills in application software.

Unit I:
(3 Hours)

Computer Fundamentals

1.1 Basic component of computer system
1.2 Characteristics of computer
1.3 Classification of Computers

Unit II:
(4 Hours)

Computer Memory

2.1 Primary Memory

2.2 Secondary Memory

2.3 Types of Primary Memory

2.4 Types of Secondary Memory

Unit III :

(4 Hours)

Software

3.1 System Software

3.2 Operating System

3.3 Functions of Operating System

3.4 Multiprogramming, Multitasking OS

Unit IV:

(4 Hours)

Networking

4.1 Network Types

4.2 LAN

4.3 WAN

4.4 MAN

Practical

(30 Hours)

1. Introduction to Ms. Paint, Motif development for specific end use symmetrical/asymmetrical.

2. Introduction to MS Word, Menus, Working with Documents, Formatting, Setting Margins,

Editing, Creating Tables, Table settings, Tools, Word Completion, Spell Checks,

Drawing and printing Importing and Exporting, Sending files to others, Inserting and

Deleting, Find, Search, Replace Commands

Reference:

1. Computer Fundamentals -Sinha P.K. -Vol I, II, III, IV
2. Introduction to Computers - Peter Nartons
3. Microsoft Windows 98 - Lery J.O. Linda, Leary
4. Micro soft Office 2000 - Lery J.O. Linda, Leary 10
5. Computer for Beginners - Arora Pawan,
6. Fundamentals of Computer -V.Rajaram.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Chemical Processing – I
GE/OE
BGO1 TO2

Theory Marks : 100 **Total**
Credits : 2
SEE : 80 Theory : 2
CIE : 20

Time Required: 30 Hours
Theory
(30 Hours)

Objectives

1. To study the chemical processing of textile Material.
2. To become aware about Textile Chemistry.

Unit I:
(8 Hours)

1.1 Comparison of organic & Inorganic compounds
1.2 Water (Required for Textile Industry)

- Impurities in water
- Purification softening of water by using
- Lime soda Treatment
- Zeolite or Base Exchange plant.

Unit II:
(7 Hours)

2.1 Fiber Classification according to Chemical group
2.2 Textile fibres: Physical and Chemical properties of following fibers-
i.Cotton ii. iiwool iii. Silk iv. Viscose v. polyester
vi. Nylon vii. Acrylic viii. polypropylene

Unit III:
(8 Hours)

1.1 Cotton Fabric processing sequence
1.2 Shearing & cropping
1.3 Singeing & Desizing
1.4 Scouring

Unit IV:
(7 Hours)

1.1 Souring
1.2 Bleaching: (i) Hypochlorite(ii) Peroxide
1.3 Mercerizing – Fabric & Yarn &Barium number test

References:

1 Technology of Textile Processing - Vol 1(Textile Fiber) - Dr. V.A. Shenoi

2 Technology of Textile Processing - Vol III (Technology of Bleaching) - V.A. Shenoi

3 Technology of Textile Processing - Vol IX (Fundamental Principal of Textile

Processing) -

V.A. Shenoi

4 Chemical technology of Fibre materials - F. Sadav

5 Textile scouring &Bleaching - E.R. Trotman

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
ELEMENTS OF CLOTHING CONSTRUCTION
VSEC
BVS1 PO1

Theory Marks	**: --**	**Practical**	**: 100**	**Total**
Credits	**: 2**			
SEE	: --	SEE	: 50	Theory : -
CIE	: --	CIE	: 50	Practical : 2

Time Required: 60Hours

Practical
(60Hours)

OBJECTIVES

- To develop skills in clothing construction
- To Equip the students with various stitching techniques

UNIT 1
(15 Hours)

1.1 Tools and equipments required for sewing
1.2 Taking body measurements.
1.3 Introduction to domestic sewing machine : Sewing machine parts and their functions

UNIT 2
(15 Hours)

2.1 Temporary Hand stitches

- Pin basting
- Even basting
- Uneven basting
- Diagonal basting

2.2 Permanent stitches

- Machine basting
- Running stitch

2.3 Edge Finishing

- overlock
- Hemmimg
- Pico

UNIT 3
(15 Hours)

Shaping Devices

3.1 Darts

- Single Dart
- Double Dart

3.2 Tucks

- Pin tucks
- Cross tucks
- Shell tucks
- Released tucks.

UNIT 4
(15 Hours)

4.1 Pleats

- Knife pleat
- Box Pleat
- Inverted Box Pleat

4.2 Ruffles

- Single Ruffle
- Double Ruffle

4.3 Gathers

Practical
Prepare a Portfolio of all the samples mentioned in syllabus

Refernce

1. Complete Guide To Sewing – Reader's Digest
2. Encyclopedia Of Dress Making – Raul Jewel
3. Basics of Fashion Design Construction – Annette Fischer

Textile Science
Four Year (Eight Semester Degree Course)
Semester – I
Hand Painting I
VSEC
BVS1 PO2

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours .

Practical
(60 Hours)

Objectives -

- To become familiar with the basic methods, techniques and tools ofdrawing.
- Identify different tones made with different value or textures.

UNIT I
(15 Hours)

1.1 Basic Brush Handling Techniques for Painting.

1.2 Understanding edges, spaces, light and shadow relations, these basicskills of drawing

make up the components of finished works of art.

UNIT II
(15 Hours)

2.1 How to hold brush (Hard brush, soft brush and dry brush)
2.2 The most basic stoke is the line. It is also one of the most versatile.
2.3 How to use a water brush and handle any given paint brush (washbrush, flat brush, round brush, liner brush)

UNIT III
(15 Hours)

3.1 Shading techniques for drawing
3.2 Rendering, hatching, random line, stripling
3.3 Shading is the process of adding value to create the illusion of form,space and light in a drawing.

UNIT IV
(15 Hours)

4.1 Observe and record 10 texture patterns in pen, color and ink.
4.2 Figurative gestures
4.3 2D and 3D perspective. Create a sense of depth and perspective.

Portfolio :
This will make up the majority of your work in the class.
Practice above mentioned techniques.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Functional English
AEC
BAE1T01

Theory Marks	**: 100**	**Total**
Credits	**: 2**	
SEE	: 80	Theory
: 2		
CIE	: 20	

Time Required: 30 Hours
Theory
(30 Hours)

Objectives: 1) To help students in developing speaking and writing proficiency in English language.

Unit 1:
(8 Hours)

-Remedial grammar
1.1Articles & determiners.
1.2 Forms & functions of nouns, pronouns, prepositions.
1.3 Verbs,adverbs and adjectives
1.4 Tenses

Unit 2:
(7 Hours)
Functional grammar
2.1 Transformation of sentences
2.2 Figures of speech: - Simile, Metaphor, Irony, Personification, Hyperbole & Alliteration

Unit 3:
(8 Hours)
3.1 Introduction to Phonetics
3.2 Understanding sociolinguistics:-
Langue, parole, pidgin, creol and dialect

Unit 4:
(7 Hours)
Creative writing
4.1 Use of Idioms and phrases
4.2 Report writing
4.3 Formal letter & Application writing
4.4 Composing advertisements

Students are expected to practice effective oral and written communication

i. Paper reading session (presented by the students)
ii. Practice of face to face conversation
iii. Listening & summarizing (listening carefully to passage & summarizing the important points)

iv. Letter writing

Continuous assessment of the above mentioned assignment & one presentation on any given topic.

Reference:

1. Secrets of face to face communication -Peter urs Bender (Mecmillan Publications)
2 Learning to learn by Kenneth a Kiewra Nelson F. Dubros Publishers -Allyn & Bacon.
3 English for practical purpose - Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant (Macmillan Publications)
4 Teaching Material
5 Business communication - Dr. Urmila Rai
6 Professional Communication skills - A.K. Jain, S.R. Bhatia, A.M. Sheikh

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
ENVIRONMENTAL SCIENCE
VEC
BEV1 T01

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours

Theory **(30 Hours)**

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Traditional Indian Textiles – I
IKS
BIK1 TO1

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives

1. To learn about traditional Indian Textiles
2. To understand various ornamentation techniques

Unit I: **(8 Hours)**

Evolution of Textile Design

1.1 History of Indian textile design
1.2 Importance of study of Textile Design
1.3 Journey of designing skills since ages
1.4 Influence of Religion, Art and Royalty on Textile Design
1.5 Influence of trade and media on textile design

Unit II: **(7 Hours)**

Textile design

2.1 Design -Definition & classification
2.2 Methods of creating design on fabric

- Structural ornamentation
- Surface ornamentation

Unit III: **(8 Hours)**

Textiles woven on pit loom

3.1 Meaning and introduction of sari weaving – parts of sari
3.2 Pit – loom weaving
3.2.1 Chanderi Sari (with reference to its motifs, techniques and color combination etc.)
3.2.2. Maheshwari Sari (with reference to its motifs, techniques and color combination etc.)
3.2.3 Mau sari
3.2.4 Shantipur Sari

Unit IV: **(7 Credit)**

Hand woven Textiles

4.1 Limitation and scope of hand loom weaving
4.1.1 Bhandara Karvat Kathi Sari
4.1.2 Nagpuri Sari
4.1.3 Jamdani Sari
4.1.4 Balrampuri Sari with refrence to its motif, technique, colour combination and products

References:

1. The sari styles – patterns – History – Techniques Linda Lynton
2. Textile Arts of India Kokyo Hatanaka
3 Indian Saris Traditions Perspectives, Design – Vijai Singh Katiyar
4 Decorative Design History In India Textiles & Costumes Parul Bhatnagar
5 Handcrafted Indian Textiles (Tradition And Beyond) Martand Singh Rta Kapur Chisti Rahul Jain
6 Traditional Textiles ShakeelaShaik
7 Costume, Textile and Jewellery of India Tradition in Rajasthan Vandana Bhandari
8 Traditional Indian Textiles John Gillow and Nicholas Barnard
9. Traditonal Indian Constumes& Textiles Parul Bhatnagar

Textile Science

Four Year (Eight Semester Degree Course)

Semester – I
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC1 PO1

Practical Marks: 100 **Total Credits : 2**

SEE : -- Practical : 2

CIE : 100

Time Required: 60 Hours

Practical: 60 Hours

As per university Rules

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
Colour Composition
DSC
BTS2 T03

Theory Marks : 100		**Practical: 50**		**Total Credits**	**: 3**
SEE	: 80	SEE:--25		Theory	: 2
CIE	: 20	CIE: 25		Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1 Students should know the basics of color theories& their role in designing.
2 To make students understand color combinations and textures.

Unit I : **(7 Hours)**

1.1 Definition of color
1.2 The meaning of color
1.3 Theories of color [light & pigment]
1.4 Chromatic circle
1.5 Complementary colors
1.6 After Image of colors

Unit II : **(8 Hours)**

2.1 Role of color in designing
2.2 Color modification
2.3 Value Scale
2.4 Qualities of color [Hue, Value, chrome]
2.5 Color Measurement

Unit III : **(7 Hours)**

3.1 Color Schemes
3.2 Basic Techniques for creating color schemes
3.3 Color Contrast

Unit IV : **(8 Hours)**

4.1 Psychological impact of color- style and colour
4.2 Role of color to create mood - Powerful, Romantic, Vital, Earthy, Friendly, Soft, Elegant, Trendy
4.3 Understanding of texture effects

Practical : **(30 Hours)**

Chromatic circle
Grey Scale
Colour Modification
Key System
Color Wheel
Colour Harmonies
Different Color Schemes
Prepare linear drawing with colored inks or poster colors
Prepare design related to 3 dimensional effects
Prepare different motifs with various tonal effects in different color media

Reference:

1. Color Harmony a Guide to creative color combinations-Bride M. Whelan
2. Designer guide to color-Volume - 1 - 5 -James Stockton
3. A Basic Study- Bhagwat Gajanan
4. Basic Design & Anthropometry-S.V. Bapat
5. Colour Harmony -A Guide to creative colour combinations by Hideaki Ghijirwa,
6. Fundamentals of designing for Textiles and other end uses – J.W.Parchure

Textile Science
FourYear(EightSemesterDegreeCourse)
Semester – II
Fundamentals of Textile – II
DSC
BTS2 T04

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	:	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours
Theory **(30 Hours)**

Objectives: Students should be able to
1. Differentiate between different types of fabrics.
2. Understand the process of weaving.
3. Understand Loom and its attachments.
4. Know the Relation between Design, Draft & lifting plan.
5. Develop the simple weaves on point paper.
6. To understand the classification of standard fabrics

Learning outcomes:
After undergoing the subject, the students will be able to deal with the different types of designs over variety of textile fabrics. Before going through the design aspect one must know about the different types of Machines used in fabric manufacture.

Unit I: **(7 Hours)**
Fabrics
1.1 Fabric - Definition
1.2 Definition of weaving, properties and end uses of woven fabrics
1.3 Definition of knitting, types of knitting, properties and end uses of knitted fabrics
1.4 Definition on non-woven, properties and end uses of non-woven.
1.5 Flowchart for manufacturing and input, output objectives and machinery used for
- Simple fabrics
- Striped fabrics
- Checks fabrics

Unit II: **(8 Hours)**
Weaving preparatory processes
2.1 Introduction to Winding - Passage of material
2.2 Introduction to Warping - passage of material through beam warping and sectional warping
2.3 Introduction to Sizing - passage of material through sizing machine
2.4 Introduction to Drawing - in & denting
2.5 Introduction to Tying - in

Unit III: **(7 Hours)**
Loom
3.1 Classification of loom
3.2 Passage material through loom
3.3 Motions of loom

Unit IV: **(8 Hours)**
4.1 Definition of design, draft and lifting plan
4.2 Weave representation methods
4.3Simple weaves, (Plain, Twill, and Satin)
4.4 Characteristics and end uses of simple weaves

Practical: **(30 Hours)**

1. Collection of standard fabrics such as muslin, poplin, organdie, cambric, mulmul,

   Crepe, georgette, satin, denim, flannel, felt, fur, woolen, worsted.
2. Collection of Woven, knitted and non-woven fabrics.
3. Collection of Simple, Stripes and Checks fabrics.
4. Collection of figured fabrics.
5. Preparation of simple weave samples (Plain, Twill, and Satin) using various materials.

References:

1. Textiles -Norma Hollen
2. Textile Science -E.P.G.Gohl - L.D. Vilensky
3. Weaving Mechanism - N. N. Banerjee
4. Weaving Mechanism- N. N. Banerjee
5. Watson's Textile Design and Colour-Z.Grosicki
6. Plain Weaving Motions - K. T. Aswani

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Computer Application in Design
GE/OE
BGO2 TO3

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours

Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: (3 Hours)

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : (4 Hours)

Out Put Device

2.1 Printers

2.2 Classification of Printers
2.3 Plotters

Unit III: (4 Hours)

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: (4 Hours)

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: (30 Hours)

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation, Consolidation, Subtotal
2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video.
   Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Chemical Processing – II
GE/OE
BGO2 TO4

Theory Marks : 100 **Total Credits : 2** SEE : 80 Theory : 2
CIE : 20

Time Required: 30Hours

Theory (30 Hours)

Objectives

1. To study the chemical processing of
2. To make students aware about Textile Chemistry

Unit I: **(8 Hours)**

1.1 Flow chart for manufacturing process of manmade fibre by

- Dry spinning – Acrylic
- Wet spinning – Viscose
- Melt spinning – Polyester and polypropylene
- Introduction and terms used in the POY, FDY and Texturing process

Unit II : **(7 Hours)**

Introduction to finishing of Fabric & Garment

2.1 Object of Finishing
2.2 Classification of Finishing
2.3 Mechanical Finishing

- Calendar Finishing
- Dimensional Stability Finishing

Unit III: **(7 Hours)**

3.1 Hot Air Stanter Finishing
3.2 Chemical Finishing

- Resin Finishing
- Water Repellent Finishing

Unit IV: **(8 Hours)**

Chemical Finishing

4.1 Fire Retardant Finishing
4.2 Enzyme Finishing
4.3 Back filling
4.4 Types of softner used in Finishing

References:

1. Technology of Textile Processing -Vol 1(Textile Fiber)-Dr. V.A. Shenoi
2. Technology of Textile Processing -Vol III (Technology of Bleaching)-V.A. Shenoi
3. Technology of Textile Processing -Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi
4. Chemical technology of Fibre materials - F. Sadav
5. Textile scouring & Bleaching-E.R. Trotman

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
FABRIC CRAFT
VSC
BVS2 PO3

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES: To impart ability of creating art pieces made up of fabric.
To understand suitability of fabric for art pieces

UNIT I:

1.1 Understanding nature of fabric
1.2 Understanding Geometry of different art pieces- Estimation for bulk production
1.3 Designing of fabric art pieces
1.4 Appliques

UNIT II:

2.1 Flower
2.2 Buttons
2.3 Bows
2.4 Belts
2.5 Cords
2.6 Braids
2.7 Tassels

UNIT III:

3.1 Home Décor Items:
3.2 Table mats
3.3 Doormats
3.4 Wall Hangings
3.5 Wall Pieces
3.6 Lamp Shade
3.7 Cushion covers

UNIT IV:

4.1 Mask
4.2 Jewellery
4.3 Spects Cover
4.4 Wardrobe organiser
4.5 Bottle Covers
4.6 Shoe Cover
4.7 Saree Cover
4.8 Kitchens

References:

Complete Guide to Sewing- Readers Digest
Fabric Blooms Megan Hunt

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
Hand Painting II
SEC
BVS2 PO4

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

Objectives -

- Identify the appropriate different types of folk art of different states in India.
- Practice different techniques, mediums and styles of folk art.
- Develop the skills and aesthetic sense to appreciate folk art.
- Decorate their floors, walls, clothes, etc.

UNIT I

1.1 Introduction to folk and Tribal art
1.2 Forms of folk and tribal art
1.3 Medium, techniques and styles

UNIT II
2.1 Role of Proportion in drawing
2.2 Warli
2.3 Gond

UNIT III
3.1 Miniature painting
3.2 Madhubani art
3.3 Mandala art

UNIT IV
4.1 Floor painting (Chawk) festivals and ceremonies (different types of states)
4.2 Dhokra

Portfolio :
Fundamental painting techniques. Students need to get creating their own masterpiece.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
English and Communication Skills
AEC
BAE2 T02

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives
1. To improve Communication skills of students.
2. TIP: This subject should be taught in English only

UNIT I : **(8 Hours)**

Communication
1.1 Meaning and definition of communication
1.2 Process, elements, objectives and methods of communication
1.3 Principles of effective communication
1.4 Channels of Communication
1.5 Barriers of communication

Unit-II: **(7 Hours)**

2.1 Verbal vs non-verbal communication

- Oral Communication
- Conversation at a bank, at office, at a bus-stop and at a shop
- Telephonic Conversation: formal and informal
- Written Communication
- Content Writing: style and structure
- Resume writing

Unit III : **(8 Hours)**

Listening

3.1 Principles and Importance of Listening
3.2 Social etiquettes and manners
3.3 Areas of self development
3.4 Motivation

Unit IV: **(7 Hours)**

4.1Presentation skills : To acquire convincing presentation skills

- Leadership Skills
- Group Discussions
- Team work building
- Interview Technique

Reference :

1. Secrets of face to face communication - Peter Bender
2. Learning to learn by Kenneth a Kiewra Nelson F. Dubros
3. English for practical purpose by Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant
4. Teaching Material
5. Business Communication - Dr. Urmila Rai
6. Professional Communication Skills - A.K Jain, S.R. Bhatia
7. Managerial Communication – Urmila Rao, S.M.Rai – Himalaya Publishing House
8. Communication Skills – Mrs.Jaya Kulkarni Moholkar – Central Techno Publication

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Constitution Of India
VEC
BEV2 T02

Theory Marks : 100
SEE : 80
CIE :20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Traditional Indian Textiles – II
IKS
BIK2 TO2

Theory Marks	**: 100**	**Total Credit**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours

Theory **(30 Hours)**

Objectives

1. To learn about the traditional Indian textiles
2. To understand the culture of India pertaining to the different states

Unit I : **(8 Hours)**

Tribal Weaving

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

1.1 Backstrap loom weaving
1.2 Assam – Mekhala
1.3 Meghalaya Garo

Unit II : **(7 Hours)**

Tribal Weaving

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

2.1 Manipuri Phanek
2.2 Innaphi
2.3 Nagaland Blanket

Unit III : **(8 Hours)**

Shawls of India

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

3.1 Kullu Shawl
3.2 Kanikar
3.3 Gujarat Shawl
3.4 Do rukha

Unit IV : **(7 Hours)**

Floor Coverings

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

4.1 Namda
4.2 Dharri
4.3 Kashmiri Galicha

Reference:

1. The sari styles - patterns - History - Techniques Linda Lynton
2. Dhurrie Flat woven Rugs Of India Shyam Ahuja
3. Textiles and crafts of India (Arunachal Pradesh Assam. Manipur) Dr. Vardona Bhandari NIFT Pub. Division
4. Textile Arts of India KokyoHatanaka
5. Indian Sarees Traditions Perspectives, Design Vijai Singh Katiyar
6. Decorative Design History In India Textiles & Costumes PorulBhatnagar
7. (Tradition And Beyond) Handcrafted Indian Textiles Martand Singh RtaKapurChisti Rahul Jain

8. Traditional Textiles ShakeelaShaik
9. Costume, textile and Jewelry of India Tradition S/n Rajasthan Vandanabhandari
10. Traditional Indian Textiles John Gillow and Nicholas Bornard
11. Traditonal Indian Constumes& Textiles ParulBhatnagar

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC2 PO2

Practical Marks: 100		**Total Credits**	**: 2**
SEE	: --	Practical	: 2
CIE	: 100		

Time Required: 30 Hours
Practical **(30 Hours)**

As per University rules

Annexure – III
Basket of Minor Courses

Faculty of Science and Technology

1. Basket for Minor Category Courses - BOTANY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Algae, Fungi, Lichen &Plant Pathology	BBO1T01	BBO1P01
	Minor 2	Fossil Angiosperms &Angiosperm Taxonomy	BBO1T02	BBO1P02
IV	Minor 3	Genetics, Plant breeding, Biostatistics & Evolution	BBO2T03	BBO2P03
	Minor 4	Plant Development, Anatomy& Embryology	BBO2T04	BBO2P04
V	Minor 5	Biochemistry & Plant Physiology	BBO3T05	BBO3P05
	Minor 6	Economic botany, Ethnobotany & Phytogeography.	BBO3T06	BBO3P06
VI	Minor 7	Ecology & Laboratory Instrumentation	BBO4T07	BBO4P07

2. Basket for Minor Category Courses - BIOCHEMISTRY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Biomolecules & Nutritional Biochemistry	BBC1T01	BBC1P01
	Minor 2	Microbial Biochemistry	BBC1T02	BBC1P02
IV	Minor 3	Human Physiology & Clinical Biochemistry	BBC2T03	BBC2P03
	Minor 4	Techniques in Biochemistry	BBC2T04	BBC2P04
V	Minor 5	Agriculture Biochemistry	BBC3T05	BBC3P05
	Minor 6	Enzymes and Enzyme Technology	BBC3T06	BBC3P06
VI	Minor 7	Metabolism	BBC4T07	BBC4P07

3. Basket for Minor Category Courses - BIOTECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Introductory Microbial Biotechnology	BBT1T01	BBT1P01
	Minor 2	Cellular Macromolecules	BBT1T02	BBT1P02
IV	Minor 3	Techniques in Biotechnology	BBT2T03	BBT2P03
	Minor 4	Enzyme Technology	BBT2T04	BBT2P04
V	Minor 5	Molecular Biology–I	BBT3T05	BBT3P05
	Minor 6	Molecular Biology-II	BBT3T06	BBT3P06
VI	Minor 7	Fundamentals of Genetic Engineering	BBT4T07	BBT4P07

4. Basket for Minor Category Courses - CHEMISTRY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Inorganic Chemisty-1 (Atomic structure, bonding and main group elements)	BCH1T01	BCH1P01
	Minor 2	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1T02	BCH1P02
IV	Minor 3	Organic Chemistry-2 (Functional group chemistry)	BCH2T03	BCH2P03
	Minor 4	Physical Chemistry-1 (Thermodynamics, gaseous and liquid state)	BCH2T04	BCH2P04
V	Minor 5	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3T05	BCH3P05
	Minor 6	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3T06	BCH3P06
VI	Minor 7	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4T07	BCH4P07

5. Basket for Minor Category Courses - COMPUTER SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Programming in 'C'	BCS1T01	BCS1P01
	Minor 2	Computer Fundamentals	BCS1T02	BCS1P02
IV	Minor 3	Object Oriented Programming using 'C ++'	BCS2T03	BCS2P03
	Minor 4	Operating Systems	BCS2T04	BCS2P04
V	Minor 5	Data Structures	BCS3T05	BCS3P05
	Minor 6	Linux Operating System	BCS3T06	BCS3P06
VI	Minor 7	Java Programming	BCS4T07	BCS4P07

6. Basket for Minor Category Courses - COMPUTER APPLICATION

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Programming in 'C'	BCA1T01	BCA1P01
	Minor 2	Computer Fundamentals	BCA1T02	BCA1P02
IV	Minor 3	Object Oriented Programming using 'C ++'	BCA2T03	BCA2P03
	Minor 4	Operating Systems and Linux	BCA2T04	BCA2P04
V	Minor 5	Data Structures	BCA3T05	BCA3P05
	Minor 6	Java Programming	BCA3T06	BCA3P06
VI	Minor 7	Advanced Java Programming	BCA4T07	BCA4P07

7. Basket for Minor Category Courses - DATA SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Linear Algebra	BDS1T01	BDS1P01
	Minor 2	Programming with 'C++'	BDS1T02	BDS1P02
IV	**Minor 3**	Data Structure	BDS2T03	BDS2P03
	Minor 4	Probability and Statistics	BDS2T04	BDS2P04
V	**Minor 5**	JAVA Programming	BDS3T05	BDS3P05
	Minor 6	Digital Electronics and Microprocessor	BDS3T06	BDS3P06
VI	**Minor 7**	Operating System and Linux	BDS4T07	BDS4P07

8. Basket for Minor Category Courses – ELECTRONICS

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Analog Electronic Circuits	BEN3T05	BEN3P05
	Minor 2	Micro-controller 8051 Family	BEN3T06	BEN3P06
IV	**Minor 3**	Linear Integrated Circuits	BEN4T07	BEN4P07
	Minor 4	Signals and Systems	BEN4T08	BEN4P08
V	**Minor 5**	Instrumentation system	BEN5T09	BEN5P09
	Minor 6	Communication System	BEN5T10	BEN5P10
VI	**Minor 7**	Industrial Instrumentation	BEN6T14	BEN6P14

9. Basket for Minor Category Courses - ENVIRONMENTAL SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Environmental Science	BES1T01	BES1P01
	Minor 2	Environmental Biology	BES1T02	BES1P02
IV	Minor 3	Basics of Environmental Pollution	BES2T03	BES2P03
	Minor 4	Forest, Wildlife and Biodiversity and it's Conservation	BES2T04	BES2P04
V	Minor 5	Atmospheric Science, Meteorology and Climatology	BES3T05	BES3P05
	Minor 6	Natural Resources and Management	BES3T06	BES3P06
VI	Minor 7	Solid and Hazardous Waste management	BES4T07	BES4P07

10. Basket for Minor Category Courses - FORENSIC SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Forensic Science-I	BFS1T01	BFS1P01
	Minor 2	Digital & Cyber Forensic	BFS1T02	BFS1P02
IV	Minor 3	Forensic Chemistry	BFS2T03	BFS2P03
	Minor 4	Forensic Physics	BFS2T04	BFS2P04
V	Minor 5	Forensic Psychology	BFS3T05	BFS3P05
	Minor 6	Forensic Biology	BFS3T06	BFS3P06
VI	Minor 7	Forensic Science-II	BFS4T07	BFS4P07

11. Basket for Minor Category Courses - GEOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Introduction to Geology	BGE1T01	BGE1P01
	Minor 2	Mineralogy	BGE1T02	BGE1P02
IV	Minor 3	Physical Geology and General Geology	BGE2T03	BGE2P03
	Minor 4	Optical Mineralogy and Crystallography	BGE2T04	BGE2P04
V	Minor 5	Igneous Petrology	BGE3T05	BGE3P05
	Minor 6	Sedimentary Petrology	BGE3T06	BGE3P06
VI	Minor 7	Metamorphic Petrology	BGE4T07	BGE4P07

12. Basket for Minor Category Courses - HOME SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Early Childhood Education	BHS1T01	BHS1P01
	Minor 2	Fabric Design	BHS1T02	BHS1P02
IV	Minor 3	Colour Scheme	BHS2T03	BHS2P03
	Minor 4	Community Nutrition	BHS2T04	BHS2P04
V	Minor 5	Public Health/ Nutritional Biochemistry	BHS3T05	BHS3P05
	Minor 6	Marriage and Family Relations	BHS3T06	BHS3P06
VI	Minor 7	Public Health/ Nutritional Biochemistry	BHS4T07	BHS4P07

13. Basket for Minor Category Courses - INFORMATION TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Programming in C	BIT1T01	BIT1P01
	Minor 2	IT Support Technologies	BIT1T02	BIT1P02
IV	Minor 3	Object Oriented Programming using C++	BIT2T03	BIT2P03
	Minor 4	Operating System and Linux	BIT2T04	BIT2P04
V	Minor 5	Data Structure	BIT3T05	BIT3P05
	Minor 6	Java Programming	BIT3T06	BIT3P06
VI	Minor 7	Advanced Java Programming	BIT4T07	BIT4P07

14. Basket for Minor Category Courses – MATHEMATICS

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Algebra and Trigonometry	BMT1T01	BMT1P01
	Minor 2	Differential Calculus	BMT1T02	BMT1P02
IV	Minor 3	Integral Calculus and Ordinary Differential Equations	BMT2T03	BMT2P03
	Minor 4	Vector Analysis	BMT2T04	BMT2P04
V	Minor 5	Partial Differential Equations	BMT3T05	BMT3P05
	Minor 6	Analytical Solid Geometry	BMT3T06	BMT3P06
VI	Minor 7	Mathematical Methods	BMT4T07	BMT4P07

15. Basket for Minor Category Courses - MICROBIOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Microbiology	BMI1T01	BMI1P01
	Minor 2	Basic Techniques in Microbiology	BMI1T02	BMI1P02
IV	Minor 3	Microbial Diversity	BMI2T03	BMI2P03
	Minor 4	Chemistry of Biomolecules	BMI2T04	BMI2P04
V	Minor 5	Metabolism	BMI3T05	BMI3P05
	Minor 6	Environmental Microbiology	BMI3T06	BMI3P06
VI	Minor 7	Dairy Microbiology	BMI4T07	BMI4P07

16. Basket for Minor Category Courses - PHYSICS

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Measurement, Mechanics, and Properties of Matter	BPH1T01	BPH1P01
	Minor 2	Kinetic Theory of Gases and Thermodynamics	BPH1T02	BPH1P02
IV	Minor 3	Acoustics and Ultrasonics	BPH2T03	BPH2P03
	Minor 4	Oscillations and Blackbody radiations	BPH2T04	BPH2P04
V	Minor 5	Solid State Physics	BPH3T05	BPH3P05
	Minor 6	Optics	BPH3T06	BPH3P06
VI	Minor 7	Lasers and Optical Fibres	BPH4T07	BPH4P07

17. Basket for Minor Category Courses - STATISTICS

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Probability Theory	BST3T01	BST3P01
	Minor 2	Descriptive Statistics	BST3T02	BST3P02
IV	Minor 3	Probability distributions	BST4T03	BST4P03
	Minor 4	Economic Statistics	BST4T04	BST4P04
V	Minor 5	Statistical Methods	BST5T05	BST5P05
	Minor 6	Applied Statistics	BST5T06	BST5P06
VI	Minor 7	Statistical Inference	BST6T07	BST6P07

18. Basket for Minor Category Courses - ZOOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Life and Diversity of Animals- Nonchordates (Protozoa to Annelida)	BZO1T01	BZO1P01
	Minor 2	Cell Biology and Genetics	BZO1T02	BZO1P02
IV	Minor 3	Life and Diversity of Animals- Nonchordates (Arthropoda to Hemichordata)	BZO2T03	BZO2P03
	Minor 4	Developmental Biology	BZO2T04	BZO2P04
V	Minor 5	Chordata	BZO3T05	BZO3P05
	Minor 6	General Mammalian Physiology	BZO3T06	BZO3P06
VI	Minor 7	Applied Zoology	BZO4T07	BZO4P07

19. Basket for Minor Category Courses– APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
I	Minor 1	Applied Physics	BET1T03	BET1P03
	Minor 2	Applied Chemistry	BET1T04	BET1P04
II	Minor 3	Applied Physics	BET2T03	BET2P03
	Minor 4	Applied Chemistry	BET2T04	BET2P04
III	Minor 5	Electron Devices & Circuits	BET3T03	BET3P03
	Minor 6	Linear Network Analysis	BET3T04	BET3P04

20. Basket for Minor Category Courses - COSMETIC TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Cosmetic Engineering	BCT3T03	BCT3P03
	Minor 2	Instrumental Methods of Analysis	BCT3T04	BCT3P04
IV	Minor 3	Cosmetic Engineering	BCT4T03	BCT4P03
	Minor 4	Instrumental Methods of Analysis	BCT4T04	BCT4P04
V	Minor 5	Cosmetic Engineering	BCT5T04	BCT5P04
	Minor 6	Instrumental Methods of Analysis	BCT5T05	BCT5P05
VI	Minor 7	Drug & Cosmetic Laws	BCT6T05	BCT6P05

21. Basket for Minor Category Courses - INTERIOR DESIGN

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Furniture Design I	BHD3T03	BHD3P03
	Minor 2	GRAPHICS III	BHD3T04	BHD3P04
IV	Minor 3	Furniture Design II	BHD4T03	BHD4P03
	Minor 4	GRAPHICS IV	BHD4T04	BHD4P04
V	Minor 5	Furniture Design III	BHD5T05	BHD5P05
	Minor 6	INTERIOR SERVICES I	BHD5T06	BHD5P06
VI	Minor 7	Furniture Design IV	BHD6T05	BHD6P05

22. Basket for Minor category courses – FASHION DESIGN

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Study of Indian Costumes		
	Minor 2	Draping Techniques-I		
IV	Minor 3	Study of Western Costumes		
	Minor 4	Draping Techniques-II		
V	Minor 5	Marketing		
	Minor 6	Entrepreneurship Development		
VI	Minor 7	Merchandising		

23. Basket for Minor category courses – TEXTILE SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Knitting-I		
	Minor 2	Dyeing Technology-I		
IV	Minor 3	Fundamentals of Knitting-II		
	Minor 4	Dyeing Technology-II		
V	Minor 5	Marketing		
	Minor 6	Entrepreneurship Development		
VI	Minor 7	Merchandising		

Annexure – IV
Basket of Open Electives (OE)

GE/OE Basket Semester I
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
I	**GE/OE**	1	Bio fertilisers, bio-pesticides and compositing	Botany	**BGO1 T01**
		2	Food Biochemistry	Biochemistry	
		3	Biotechnology and Human Welfare	Biotechnology	
		4	Computer fundamentals	Computer Science	
		5	Basic Electronics Components & Instruments	Electronics	
		6	Environmental Conservation Movements	Environmental Science	
		7	A. Introduction to Sports Forensics / B. Toxicology in Everyday Life / C. Optics and Optical Instruments / D. General Instruments in Forensic Biology / E. Psychology of Health & Well Being-I (Psychology)/ F. Computer Fundamentals/ G. Crime and Criminal Behaviour (Law)	Forensic Science	
		8	Topographic Map Reading	Geology	
		9	Basic Physics and Basic Computer -I	Home Science	
		10	Quantitative aptitude	Mathematics	
		11	Introduction and scope of Microbiology	Microbiology	
		12	Space Science	Physics	
		13	Elementary Descriptive Statistics	Statistics	
		14	Human anatomy and physiology	Zoology	
			Indian birds	Zoology	
		15	Physical Chemistry	Cosmetic Technology	
		16	Computer Basics	Fashion Design	
		17	Computer Basics	Textile Science	

B. Sc. Semester-I
GE / OE-1 Botany (BGO1T01)
Bio-fertilizers, Bio-pesticides and Composting

GE/OE-I Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. **Biofertilizers:** Definition, scope and importance 2. Classification of Biofertilizers on basis of organisms 3. Biological Nitrogen Fixation 4. Plant Growth Promoting Rhizobacteria (PGPR)	7.5 Hrs.
Unit-II	
1. **Microbes:** Various microbes used as Biofertilizers *2.* Commercial production of Biofertilizers: *Rhizobium*, *Azotobactor*, *Nostoc* and, *Azolla* *3.* Phosphate Solubilizer Bacteria (PSB), e.g. *Bacillus polymyxa* *4.* Phosphate Solubilizer Fungi (PSF), e.g. *Aspergillus awamori*	7.5 Hrs.
Unit-III	
1. **Biopesticides:** History and concept, Definitions, scope and importance 2. Classification of Biopesticides 3. Role of Biopesticides in Ecofriendly agriculture and Organic farming. 4. Production of Biopesticides (Microorganism and Plant based) 5. Methods of applications of Biopesticides	7.5 Hrs.
Unit-IV	
1. **Composting:** Definition, scope and importance 2. Science of composting, Classification of composting 3. Methods for composting: Indore method; 4. Methods to improve process of Composting. 5. Vermicomposting 6. Agricultural waste composting 7. Uses of Weed in composting	7.5 Hrs.

Suggested Readings:

1. Maheshwari D.K. (2012) Bacteria in Agrobiology: Plant Probiotics; Springer Berlin, Heidelberg, New York.
2. Rai M.K. (2006) Handbook of Microbial Biofertilizers; Food Product Press, An Inprint of the Haworth Press, Inc. New York.
3. Reddy Shankara, R. (2012) Biofertilizer Technology; Akhand Publishing House Sadatpur, Dehli.

4. Sharma A.K. (2007) Biofertilizers for Sustainable Agriculture; Agrobios, Jodhpur.
5. Siddiqui, Zaki & Anwar (2012) PGPR: Biocontrol and Biofertilization; Springer Heidelberg,New York.
6. Tivedi P.C. (2008) Biofertilizer; Pointer Publishers Jaipur
7. Leo, M.L. Nollet, Hamirsingh Rathore (2015). Bio Pesticide Handbook. CRC Press Tayler &Francis group, New York. 1-29.
8. Md. Arshad Anwer (2017). Bio Pesticides and Bio Agents e book CRC Press Taylor & Francisgroup New York. 1-365.
9. Dwijendra Singh. (2014), Advances in Plant Bio Pesticides. Publisher Springer 1-401.
10. Vaishali Kandpal 2014. Bio Pesticides. International Journal of Environmental Research and Development. 4(2), 191-196.
11. Jamie Mc Sweeney (2019), Community Scale Composting systems: A Comprehensive Practical Guide for closing the Food system Loop solving our waste crisis Chelsea Green Publishing, USA.
12. Grace Gershuny (1992), The Rodale Book of Composting, Rodale Press, Penssylvania.
13. Michelle Balz and Anna Stockton (2017), Composting for a New Generation: Latest Techniques for the Bin and Beyond, Cool Springs Press.

GE/OE Basket (Biochemistry) Semester-I

FOOD BIOCHEMISTRY

Course Objectives:The specific objectives of the course are:

- This course will help you to enrich your knowledge on how energy generates from foods, namely carbohydrate, proteins and fat molecules, in human body
- How molecules breakdown or rebuild in your body, what other molecules (like, enzymes, minerals, vitamins) needed for the utilization of these molecules.
- You will also be able to get a detail picture of formation DNA, RNA and hormones and their functions in living organisms.
- You will be able to describe methods for food processing and underlying safety aspects.

PREREQUISITES : *Basic Training in Chemical and Biological Concepts at the level of Higher Secondary.*

Unit 1

Biochemical Changes in Carbohydrates in Food Systems, Changes in Carbohydrates during Seed Germination, Basics of Metabolism of Carbohydrates; Biochemical Changes of Proteins and Amino Acids in Foods, Proteolysis in Animal Tissues, Proteolysis in Geminating Seeds;

Unit 2

Biochemical Changes of Lipids in Foods, Changes in Lipids in Food Systems, Changes in Lipids during Cheese Fermentation, Lipid Degradation in Seed Germination, Biochemical Degradation and Biosynthesis of Plant Pigments, Degradation of Chlorophyll in Fruit Maturation

Unit 3

Foundations of Food Processing: Transglutaminase Activity in Seafood Processing, Proteolysis during Cheese Fermentation ,Removal of Glucose in Egg Powder Production, Production of Starch Sugars and Syrups; Proteases in Chill-Haze Reduction in Beer Production; Biogeneration of Fresh-Fish Odor, Biochemically Induced Food Flavors

Unit 4

Selected Biochemical Changes Important in the Handling and Processing of Foods, Production of Ammonia and Formaldehyde from Trimethylamine and Its N-Oxide, Production of Biogenic Amines, Production of Ammonia from Urea, Adenosine Triphosphate Degradation, Polyphenol Oxidase Browning, Ethylene Production in Fruit Ripening, Reduction of Phytate in Cereals.

Text Books and References:

1. Ashie IA, Lanier TC. 2000. Transglutaminases in seafood processing. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 147–166.
2. Berger M. 1994. Flour aging. In: B Godon, C Willm, editors. Primary Cereal Processing. New York: VCH Publishers, Inc. Pp. 439–452.
3. Bewley JD. 1997. Seed germination and dormancy. Plant Cell 9:1055–1066.
4. Bewley JD, Black M. 1994. Physiology of Development and Germination, 2nd ed. New York: Plenum Press. Pp. 293–344.
5. Bryce JH, Hill SA. 1999. Energy production and plant cells. In: PJ Lea, RC Leegood, editors, Plant Biochemistry and Molecular Biology Chichester: John Wiley and Sons. Pp. 1–28.
6. Cadwallader KR. 2000. Enzymes and flavor biogenesis. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 365–383.
7. Chin HW, Lindsay RC. 1994. Modulation of volatile surfur compounds in cruciferous vegtebles. In: CJ Mussinan, ME Keelan, editors, Sulfur Compounds in Foods. Washington, DC: American Chemical Society. Pp. 90–104.
8. Croteau R, Kutchan TM, Lewis NG. 2000. Natural products (secondary metabolites). In: BB Buchenan, W Grussem, RL Jones, editors, Biochemistry and Molecular Biology of Plants. Rockwell, Maryland: American Society of Plant Physiologists. Pp. 1250–1318.
9. Gill T. 2000. Nucleotide-degrading enzymes. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 37–68.
10. Gopakumar K. 2000. Enzymes and enzyme products as quality indices. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 337–363.
11. Grappin R, Rank TC, Olson NF. 1985. Primary proteolysis of cheese proteins during ripening. J. Dairy Science 68:531–540.
12. Greaser M. 2001. Postmortem muscle Chemistry. In: YH Hui, WK Nip, RW Rogers, OA Young, editors, Meat Science and Applications. New York: Marcel Dekker, Inc. Pp. 21–37.
13. Gripon JC. 1987. Mould-ripened cheeses. In: PF Fox, editor, Cheese: Chemistry, Physics and Microbiology. London: Elsevier Applied Science. Pp. 121– 149.
14. Haard CE, Flick GJ, Martin RE. 1982. Occurrence and significance of trimethylamine oxide and its derivatives in fish and shellfish. In: RE Martin, GJ Flick, CE Haard, DR Ward, editors, Chemistry and Biochemistry of Marine Food Products, Westport, Connecticut: AVI Publishing Company. Pp. 149– 304.
15. Haard NF. 1990. Biochemical reactions in fish muscle during frozen storage. In: EG Bligh, editor, Seafood Science and Technology. London: Fishing News Books (Blackwell Scientific Publications, Ltd.) Pp. 176–209.

Open Elective Courses

SEMESTER – I

BIOTECHNOLOGY FOR HUMAN WELFARE

Course Code: BGO1T01 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Understand the biotechnological applications in the industry
CO 2. Appreciate application of biotechnology in environmental management
CO 3. Describe application of biotechnology to forensic science
CO 4. Comprehend contributions of biotechnology to biomedical fields, such as diagnostics, genomics and therapeutics
CO 5. Understand the biotechnological applications in the agriculture and livestock management

Unit I **8 hrs**
Environment: Application of biotechnology in environmental aspects: Degradation of organic pollutants – chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes; Biodegradable plastics & Biofuels- production and its futuristic applications; Bioremediation, Biomining

Unit II **7 hrs**
Industry: Important enzymes used in Industries, Biotechnological intervention in enzyme engineering; Industrial production of alcoholic beverages (wine), antibiotics (Penicillin), enzymes (lipase), food supplements (Single Cell Protein), Vitamin (B12). Food processing- Production of cheese and yoghurt

Unit III **8 hrs**
Forensic science: Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques

Health: Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project.

Unit IV **7 hrs**
Agriculture: N_2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; biofertilizers & biopesticides.

Livestock: Transgenic animals, animal vaccine production, increased milk production, artificial insemination- poultry, fisheries

References:

• Bhasin M.K. and Nath, S. (2002). Role of Forensic Science in the New Millennium, University of Delhi, Delhi

• Crueger W. and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Ed., Panima Publishing Co. New Delhi.

• Eckert W.G. (1997) Introduction to Forensic Sciences, 2nd Ed., CRC Press, Boca Raton

• James S.H. and Nordby, J.J. (2005). Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton

• Mohapatra, P.K. (2006) Textbook of Environmental Biotechnology, I.K. International Publishing House Pvt. Ltd., New Delhi

• Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

• Stanbury P.F, Whitaker A and Hall S.J. (2006). Principles of Fermentation Technology. 2nd Ed., Elsevier Science Ltd.

• Nanda B.B. and Tiwari R.K. (2001). Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi

• Joerdening H.-J. and Winter J. (2005). Environmental Biotechnology – Concepts and Applications

B.Sc. Sem-I (Computer Science)
BGO1T01
COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **Output Devices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN.Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server

Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon [Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

Electronics BoS : Semester – 1: OE1:

Basic Electronic Components and Instruments (BGO1T01)

Course outcome:

At the end of this course students will have ability to

1. Identify various electronic components understand their role
2. Make series and parallel combinations of components.
3. Understand working & replacement

Syllabus

1. Electrical Signal and parameters Current Voltage Wattage AC DC Components Identification: Resistor, Capacitor, Inductor, Transformer, Switches, Semiconductors
2. Serial and parallel connection of Resistor, capacitor, inductor, Lead & Lag Concepts.
3. Study of Voltmeter & Ammeter, concept of Range, Resolution, Impedance, Loading effect, Multi-meter.
4. Visualization of electrical signal, Introduction to Oscilloscope, Application in general

Books:

1. Charles Platt, Make: Electronics, O'Reilly Publications
2. Paul Scherz, Practical Electronics for Invertors, McGraw-Hills Publications
3. J. M. Hughes, Practical Electronics, O'Reilly Publications
4. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company

GE/OE-1: Environmental Conservation Movements (BGO1T01)

Unit-I: Civilization and Environmental Pollution:

Environment: Definition, role of environment in shaping civilizations. Inter-relation between civilization and environment- Ecological economic and socio-cultural.

Industrialization revolution and environmental pollution, Globalization and environmental pollution, Modern agriculture and environmental degradation.

Unit-II: Development and Environment:

Development: Definition, population growth and its impact on natural resources, modernization and population, causes for industrialization, impact of industrialization on quality of human life, negative impact of industrialization and urbanization.

Environmental Management: Definition, objectives, components, principle and importance of Environmental management; **Development and Environment:** Types of development, sustainable development- need and relevance in contemporary society.

Unit-III: Sustainable Development:

Sustainable Development: Definition, concept, principle and planning for sustainable development, Environmental issues and crises, Preventive Environmental Policy (PEP), desertification, invasive species, wildlife depletion and social insecurity.

United Nation Sustainable Development Goals, Strategies for implementing eco-development programmes, sustainable development through- trade, economic growth, carrying capacity and public participation.

Unit-IV: Environmental Movements:

Environmental Movements: Concept of environmental movements, the local grassroots movement level, United Nations Conference on Environment,1972-'Limits to Growth'. The Brundtland Commission, 1987-'Our Common Future'. The United Nations Conference on Environment and Development, 1972.

Environmental Movements in India: Bishnoi Movements, The Chipko Movements, Appiko Movements, Silent Valley Movements, Narmada Bachao Andolan, Beej Bachao Andolan and Tehri Dam Conflicts,

References:

1. Bindra, P.S.(2017). The Vanishing: India's Wildlife Crisis. Penguin Random HouseIndia.
2. Climate Change: Science and Politics.(2021). Centre Science and Environment, New Delhi.
3. Edwards, Andres R. (2005). The Sustainability Revolution: Portrait of a Paradigm Shift. New Society Publishers.
4. Flanders, L. (1997). The United Nations Department for Policy Co-ordination and Sustainable Development (DPCSD), Global Environmental Change, 7 (4), 391-394.
5. McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
6. Nagendra, H., and Mundoli, S. (2009). Cities and canopies: Trees in Indian cities,Penguin Random House India Private Limited.
7. Nepal, Padam. (2009). Environmental Movements in India: Politics of Dynamism and Transformation, Author Press, Delhi.
8. Rachel Carson. (2002). Silent Spring. Houghton Mifflin Harcourt.
9. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centres Science and Environment.
10. Sustainable Development in India: Stocktaking in the run up to Rio + 20. (2011) TERI for MoEF and CC.

Semester I

GE/OE (Forensic Science)

GE 1 (BGO1T01): Introduction to Sports Forensics

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the concept of sports forensic, sports doping its history n prevalence along with its forensic investigation.
2. Evaluate and analyze different anti-doping organizations and the acts related to it, and also understand the concept of e-doping and e-sporting.
3. Understand the concepts of doping of drugs in sports their classification and effects on human body.
4. Apply the knowledge of analytical chemistry to use preliminary and confirmatory analytical techniques for drug testing in sport.
5. By the end of the course students will have knowledge and understanding about detection of drugs of abuse in sports and its role in forensic science.

Unit-I Basics of Sports Forensics

Introduction to Sports Forensics, History and Prevalence, Sports doping, why do athletes' resort to doping, investigation of deaths in sports, Forensic investigation in sport malpractices, case studies related to sports forensics.

Unit II Legal Provisions for Drugs Abuse in Sports

Anti-doping organization; World Anti-Doping Organizations (WADA) and NADA. National Anti-Doping Act 2022. Concept of e-sports and e-doping. Understanding E-doping and need for fair competition in E-Sports.

Unit-III Drug doping in sports

Drug doping in sports, Classification of prohibited substances in sports: Stimulants, Amphetamines, Cocaine, Sympathomimetic Amines, Narcotic Analgesic, Anabolic steroids. Notable abused drugs in sports-performance enhancing drugs; effects of drugs on the human body;

Unit IV Analytical techniques for drug testing

Use of preliminary and confirmatory analytical techniques for drug testing in sports: Gas Chromatography- Mass Spectrometry, Liquid Chromatography- Mass Spectrometry, HPLC- UV Immuno- Assays. Detection of drugs of abuse: Steroids, Narcotics, Stimulants, Masking agents, contaminants of other dietary supplements and other substances on WADA prohibited list. Detection of doping in sports and role of forensic science.

Semester I

GE/OE (Forensic Chemistry)

GE 1 (BGO1T01): Toxicology in Everyday Life

Course Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to poisons, fatal dose and fatal period, classification of poison, types of poisoning, mode of action, sources of poison, signs and symptoms of poison along with their antidotes.
2. Understand the classification of cometic products and certain poisonous substances present in them along with their side effects and precautions.
3. Analyze some common poisonous agents present in household cleaning agents along with their classification, side effects and precautions.
4. Evaluate the effects of some commonly used insecticides and pesticides along with their precautions.

Unit I: Introduction to Toxicology

Introduction, definition of poison, classification of poisons, modes of action of poisons, types of poisoning, fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes. Sources of poisons in everyday life.

Unit II: Cosmetic Products

Introduction, Classification, common poisonous substances found in cosmetics products like – lipsticks, fairness creams, facewash, lotions, nail paints, hair colours and hair care products, talcum powders, deodorants, etc. their side effects and precautions related to use of cosmetics.

Unit III: Household Cleaning Agents

Introduction, Classification, common poisonous substances found in household cleaning agents like – Floor cleaners, toilet and bathroom cleaners, electronic gadgets cleaners, sanitizers, soaps, detergents, etc. their side effects and precautions related to use of cleaning agents.

Unit IV: Pesticides and Insecticides

Introduction, classification, commonly used pesticides and insecticides in house like – mosquito and cockroach repellents, rat kills, termiticides, fungicides, herbicides, agrochemicals, safety measure and precautions related to use of Pesticides and Insecticides.

Semester I

GE/OE (Forensic Physics)

GE 1 (BGO1T01): Optics and Optical Instruments

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the introduction of lenses, equations of lenses, and formulae of optical systems.
2. Understand the types and their reduction of chromatic and achromatic aberration.
3. Analyze the working principles of microscope telescope eyepiece spectrometer interferometer.
4. Remember the working concept of optical and advanced microscope.

Unit I: Geometric Optics

Introduction, Thin and Thick Lenses, Lens Equation, Lens Maker's Formula, Cardinal Points of an Optical System, Combination of Two Thin Lenses (Equivalent Lenses) (Including Derivation for Focal Length and Cardinal Points).

Unit II: Aberrations

Achromatic and Chromatic Aberration, Types of Achromatic Aberration and their Reduction: Spherical Aberration, Coma, Astigmatism, Curvature of Field, Distortion, Types of Chromatic Aberration: Achromatism (Lenses in Contact and Separated by Finite Distance).

Unit III: Optical Instruments

Simple Microscope and Compound Microscope, Telescopes, Reflection and Transmission Type of Telescope, Eyepieces: Huygens's Eyepiece, Ramsden's Eyepiece, Gauss's Eyepiece, Constant Deviation Spectrometer, Michelson Interferometer, Resolving Power and Magnifying Power of Microscope and Telescope.

Unit IV: Microscopes

Optical Microscopes: Stereomicroscope, Polarizing Microscope, Phase Contrast Microscope and Comparison Microscope.

Advanced Microscopes: Scanning Electron Microscopes (SEM), Transmission Electron Microscope (TEM), X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF).

Semester I

GE/OE (Forensic Biology)

GE 1 (BGO1T01): General Instrumentation in Forensic Biology

Course Outcome: By the end of this Course, the learners will be able to:

1. Analyze the function of pH and buffer along with its mechanism and action relevant to forensic science.
2. Understand and examine the titration curve of weak acids and amino acids.
3. To gain hands-on experience in various laboratory techniques and immunoassay methods.
4. Understand the principles, working mechanism and forensic application of certain techniques and assay related to forensic biology.

Unit-I : pH and Buffer

pH and Buffer- Biochemical buffers, measurement of pH; Mechanism of buffer action; Henderson-Hasselbalch equation; Isoelectric pH, Titration curve of weak acids; Titration curve of amino acids.

Unit-II: Spectroscopy

Spectroscopy- Principle of spectroscopy, Concepts of electromagnetic radiation, Concept of chromophores; Beer- Lambert's law and deviations, Extinction coefficient; Principle and working of Spectrophotometer (UV-Visible); Applications of spectrophotometry in forensic biology.

Unit-III: Chromatography

Chromatography- Types of chromatography, Principle and working of Planar chromatography (Paper and Thin layer); Column chromatography (Preparation of column, Sample loading, Elution, and Detection); Ion exchange chromatography (Principle, working and applications); Applications of chromatography in forensic biology.

Unit-IV: Electrophoresis

Electrophoresis- Theory of electrophoresis, Methods of electrophoresis; Principle, working and applications of (Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Immunoelectrophoretic) with reference to forensic biology.

B.Sc. Sem-I (Forensic Science - Major)

Semester I

GE/OE (Psychology)

GE 1 (BGO1T01): Psychology of Health and Wellbeing-I

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the spectrum of health and illness for better health management
2. Identify stresses in one's life and how to manage them
3. Understand a variety of health announcing health protective and health compromising behaviour and to be able to know their application in illness management

Unit I: Illness, Health, and Wellbeing

Illness, Health and Wellbeing, Health continuum; models of health and illness: Medical, Bio psychosocial; Holistic Health.

Unit II: Stress and Coping:

Nature and Sources of Stress; Personal and Social Mediators of Stress; Effects of Stress on Physical and Mental Health; Coping and Stress management.

Unit III: Health Management

Health enhancing behaviours: Exercise, Nutrition, Meditation, Yoga; Health compromising behaviours (alcoholism, smoking, internet addiction); Health Protective behaviours, Illness Management.

Unit IV: Promoting Human Strengths and Life Enhancing virtues

Strength: Meaning; Realizing strength; Maximizing Unrealized Strength. Weakness – meaning, measures towards identifying & overcoming weaknesses. Strategies for improving hope and optimism.

Semester I

GE/OE (Digital and Cyber Forensics)
GE 1 (BGO1T01): Computer Fundamentals

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the meaning of basic components of digital computers and remembering the different types of storage devices, translators etc used in digital computers.
2. Understand how data is stored and retrieved from different types of storage media.
3. Understand the conversion process between different number systems (e.g., binary to decimal, decimal to hexadecimal, etc.).
4. Remember the basic properties of each number system, including their base values and corresponding digit symbols and the logical operations performed by basic logic gates.
5. Apply knowledge of networking protocols to analyze network traffic and identify potential security threats or anomalies.

Unit I: Basic Components of Digital Computers

Basic Components of Digital Computers: Block Diagram. CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU. Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology. Bus: Data, Control and Address Bus, Bus Organization. Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language. Translators: Compiler, Interpreter and Assembler, Source and Object Program.

Unit II: Storage, Input and Output Devices

Storage Devices: Hard Disk, Optical Disk, Pen Drive, SD Card, and Cloud as storage. Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet, Plotters: Drum, Flat-Bed and Inkjet.

Unit III: Number Systems, Logic Gates and Binary Arithmetic

Number Systems: Binary, Octal, Decimal, Hexadecimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC. Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gate. Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

Unit IV: Network Topology and Internet Protocols

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN and MAN, Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between PC's, Wi-Fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server. Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, and Internet Addressing: IP Address, Domain Name, URL.

B.Sc. Sem-I (Forensic Science - Major)

Semester I

GE/OE (Law)

GE 1 (BGO1T01): Crime and Criminal Behaviour

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of the basic concepts, theories, and terminology related to crime, criminal behaviour, and the criminal justice system in India.
2. Apply their knowledge and understanding of crime and criminal behaviour to practical scenarios.
3. Develop the ability to analyze crime-related information, including crime scenes, criminal profiles, and legal documents.
4. Develop critical thinking skills to evaluate the effectiveness and fairness of the criminal justice system in India. They will assess the application of forensic techniques, legal procedures, and ethical considerations in the investigation and punishment of crimes.

Unit I: Introduction to Crime

Nature and Concept of crime, Essential elements of crime, Types of crime, Causes of crime: Social Causes of Crime, Economic Causes of Crime, Physical and Psychological causes of crime, Geographical Causes of Crime. Organized Crimes, Environmental Crimes, Crime and Politics, Economic Crimes, White Collar Crimes, Juvenile Delinquency and Female Delinquency, Terrorism, Cyber Crimes.

Unit II: Crime and Criminal Behaviour

Definition, Scope and Nature of Criminology. Interrelationship between Criminology, Penology and Criminal Law. Schools of Criminology. Pre-Classical, Classical and Neo-Classical Schools. Lombroso Theory/Positive School. Typological School. Sociological School. Psychological School.

Unit III: Crime and Punishment

Introduction and History**,** Theories of Punishment**,** Kinds of Punishment**.** Historical development from punishment to Correction and Reformation**.** Prevention and control mechanism**.** Prison system: Traditional prison, Open air prison, Pennsylvanian system etc. Prison Reforms in India**.** Correctional Administration**.** Probation and Parole.

Unit IV: Criminal Justice System in India

History and evolution of the criminal justice system. Overview of Indian Criminal Justice System. Wings of Criminal Justice System. Police: History, Structure and Functions. Accountability of Police towards Law Enforcement Agencies and Society. Role of Investigating Officer in crime investigation. Other Specialized Agencies in India: CBI, CID, RAW, ED, NCB etc. Police Reforms in India. International Investigation Agencies: FBI, INTERPOL etc. Introduction of Prison Administration.

BACHELOR OF SCIENCE (HONORS/RESEARCH)

(Geology - Major) 2023-24

SYLLABUS (GE/OE)

SEMESTER - I

Paper I: Topographic Map Reading (BGO1T01)

Unit I

History of cartography; modern cartography; introduction to toposheets and aerial photography; maps and globe; map projections - conical, cylindrical, azimuthal; general information on regional maps - (physical, political thematic) - India, Asia, Europe, Africa, North America, South Ameriaca, Oceans and Antarctica.

Unit II

Types of geological maps; toposheet numbering- national and international; quadrants in toposheets; scale of toposheet - representative fraction, written statement scale, graphical scale; topographic maps and their numbering by Survey of India; types of maps- large scale map, small scale maps; general purpose maps- physical maps

Unit III

Objectives of geological mapping - institutional interest, government mandate, academic purpose; precision required in geological mapping; base maps for geological mapping; outcrop maps and sections; geological symbols in maps; contours and landforms - conical hills, plateau, spur and valley, col and pass, gorge, cliff, knoll, convex slope, concave slope.

Unit IV

General principles of geological mapping; mapping methods in sedimentary, igneous and metamorphic terrains; maps of India - political maps, physical map, rainfall trends, wind maps, drainage maps, soil and land-use maps, mineral deposits, food – crop maps, irrigation maps, agro-climatic zone maps, road and inland maps, railway maps, population maps, natural hazard maps.

Books Recommended:

1. Macmillan Publishers India Private Limited (2021)
2. Survey of India toposheets
3. Compton, R.R. (1962) Manual of Field Geology, John Wiley and Sons, Inc.
4. Forrester, J.D. (1957) Principles of Field Geology and Mining Geology, John Wiley.
5. Lahi, F.H. (1987) Field Geology, CBS Publishers.
6. Mathur, S.M. (2001) Guide to Field Geology, Prentice-Hall, New Delhi

SEMESTER I

1. QUANTITATIVE APTITUDE

Course Outcomes: This course will enable the students to

1. Have a strong base in the fundamental mathematical concepts.
2. Grasp the approaches and strategies to solve problems with speed and accuracy
3. Gain appropriate skills to succeed in preliminary selection process for recruitment

UNITS	TOPICS	HOURS
Unit 1	Number System • H.C.F. and L.C.M. of Numbers • Decimal Fractions • Simplification • Square Roots and Cube Roots • Average • Problems on Numbers • Problems on Ages • Surds and Indices • Logarithms	**8**
Unit 2	Percentage • Profit and Loss • Ratio and Proportion • Partnership • Chain Rule • Pipes and Cisterns • Time and Work • Time and Distance • Boats and Streams • Problems on Trains • Alligation or Mixture • Simple Interest • Compound Interest	**8**
Unit 3	Area • Volume and Surface Area • Races and Games of Skill • Calendar • Clocks • Stocks and Shares • Permutations and Combinations • Heights and Distances	**7**
Unit 4	Data Interpretation • Tabulation • Bar Graphs • Pie Chart • Line Graphs	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

INTRODUCTION AND SCOPE OF MICROBIOLOGY **Course Code: BGO1T01**			
GE / OE	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Bacteria	Discovery of Microorganism, Differences between prokaryotes and eukaryotes cell Bacteria: General characteristics of different groups. Important archaeal and eubacterial groups. Bacterial Cell size, shape and arrangement, Typical bacterial cell structure & their function		**7.5 Hrs**
Unit-II			
Fungi	General characteristics of fungi including habit, habitat, nutritional requirements, thallus organization and aggregation, Asexual reproduction, sexual reproduction, heterokaryosis and parasexual mechanism. Slide culture techniques.		**7.5 Hrs**
Unit III			
Algae	General characters and industrially important algal cells, Asexual & sexual reproduction Cyanobacteria: occurence and structure of the following: Spirulinaand Anabaena. Application of Algae		**7.5 Hrs**
Unit IV			
Scope of Microbiology	a] Medical microbiology, b] Biotechnology, c] Agriculture microbiology d] Environmental microbiology e] Geomicrobiology,		**7.5 Hrs**

Reference books -

1. Atlas RM. (1997).Principles of Microbiology.2nd edition.WM.T.BrownPublishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition.PrenticeHall
3. Madigan MT, and Martinko JM.(2014). Brock Biology of Micro-organisms.14th edition.Parker J. Prentice Hall International,Inc.
4. PelczarJr MJ, Chan ECS, and Krieg NR.(2004). Microbiology.5th edition Tata McGrawHill.
5. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand diversity of microorganisms
2.	Students will be aware of prokaryotic & eukaryotic cellular organization
3.	Justify various scopes of microbiology.

FYUGP Semester-I Generic Elective / Open Elective Course (GE/OE-1) (BGO1T01) **(Space Science)**			
GE/OE-1 THEORY	**Hours: 04 Hours /Week**	**Marks: 80 + 2- = 100**	**Credit: 02**
Unit-I			
Solar system and measurements	Solar System, Kepler's Laws, Earth-Moon System, Solar and Lunar eclipses, Exploration of Solar System by Telescopes, Rockets and Satellites. Exploration of Mars and Moon. Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit, light year and parsec.		**7.5 Hrs**
Unit-II			
Telescopes and their principles	Optical telescopes, (Refractor, Galilean, Newtonian or Dobsonian, Cassegrainian & Hubble Space Telescope), Magnifying power & Resolving power of telescopes, UV, X-ray, IR, Radio & Gravitational Astronomy, Spectroscope.		**7.5 Hrs**
Unit III			
Observational and Experimental Tools for Space Science	Rockets and Satellite Payloads. Rocket principle and types. Detectors for optical and infrared regions, Application of CCD's and CMOS to stellar imaging, Techniques of observations of astronomical sources.		**7.5 Hrs**
Unit IV			
Fundamental Particles and Basic Forces	Particles originated from space, cosmic rays, Protons, Electrons, Neutrons, Neutrinos, Mesons, leptons, and quarks. The concept of Basic forces viz., strong, weak, electromagnetic, and gravitational forces. Basic ideas about galaxy, black hole, neutron star, red giant, black matter and pulsars, nebula, white dwarfs etc.		**7.5 Hrs**

Reference Books:

1. Ionospheric Radio Propagation by Kenneth Davis. National Bureau of Standards Monograph 80 (1965), US Government Printing office, Washington D.C.
2. Physics of the Upper Atmosphere edited by J, A. Ratcliffe, Cavendish Laboratory, University of Cambridge. Academic Press New York and London (1960)
3. Research in Geophysics: Vol.1- Sun, Upper Atmosphere and space edited by Hugh Odishaw, National Academy of Sciences. Washington D.C.
4. Source book on the Space Sciences - Samuel Glasstone, Princeton, New Jersey.
5. The Upper Atmosphere - S K Mitra

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Get acquainted with the space related events
2.	Get knowledge about solar system and planets
3.	Determine the average distance and sizes of heavenly bodies
4.	Understand the concept of black hole and other giants
5.	Know the measurement related to large distance
6.	Understand the communication time requirement for longer distances

Generic Elective Courses/ Open Elective Courses (GE/OE)

For Statistics major

	Semester I (GE/OE)
	Name of the Paper - Elementary Descriptive Statistics
	Paper code – (BGO1T0I) 2 Credits (2 hrs Theory per week)
	Total 30 Hrs
	OBJECTIVES
	Students acquire knowledge about how to classify and tabulate data . They also learn various methods of graphical and diagrammatic representations of data.
	OUTCOMES
	Students acquire knowledge about: Construction of tables with many factors of classification. They also learn analysis of categorical data.
	Unit-I (15 Hrs)
(A)	**Types of data**: Concepts of a statistical population and sample from a population; qualitative and quantitative data; nominal and ordinal data; cross sectional and time series data; discrete and continuous data; frequency and non-frequency data.
(B)	**Different types of scales**— nominal, ordinal, ratio and interval. Primary data and Secondary data, Methods of data collection: Interview method, Questionnaire method, Personal Observation method, designing a questionnaire and a schedule; checking their consistency, Pilot survey Instruction
(C)	**Controlled experiments**: Observational studies and Scrutiny of data for internal consistency and detection of errors of recording.
(D)	**Sample surveys and Population Census**: methods of conducting population census with special reference to Census in India. Analysis of Categorical data: Consistency of categorical data. Independence and association of attributes. Various measures of association for two- way classification, Odds ratio.
	Unit-II (15 Hrs)
(A)	**Presentation of data**: Construction of tables with one or more factors of classification,
(B)	**Classification:** Geographical, chronological, qualitative and quantitative. Formation of frequency distribution of discrete and continuous type, relative frequency, frequency density and cumulative frequencies. Construction of Stem and leaf chart
(C)	**Diagrammatic representation of data:** Construction of Simple bar diagram, multiple bar diagram, subdivided bar diagram, percentage bar diagram, pie- diagram and pictogram.
(D)	**Graphical representation of grouped data:** Construction of Frequency bar diagram, frequency polygon, histogram, cumulative frequency diagrams and ogives
	REFERENCES
1	Bhat B.R,Srivenkataramana T And RaoMadhava K.S(1997): STATISTICS: A BEGINNER'S TEXT,VOL I,NEW AGE INTERNATIONAL (P) LTD.
2	Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLD PRESS, CALCUTTA.
3	CroxtonF.E,Cowden D.J And Kelin S(1973): APPLIED GENERAL STATISTICS, PRENTICE HALL OF INDIA
4	Agrawal B. L: BASIC STATISTICS (New Age International Publishers)
5	SudhaPurohit, GoreS.D., Deshmukh S. R.: Statistics Using R (Narosa)
6	Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft

General Elective (GE)/ Open Elective (OE) for FYUGP

GE/OE for B.Sc. I Human anatomy and Physiology (BGO1T01)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Learn, describe and explain structure and histology of human digestive system.
- Learn, describe and explain structure and physiology of excretion and muscles.
- Learn, describe and explain structure and physiology of respiration and circulation.
- Learn, describe and explain structure and physiology of nervous system.

UNIT-I

1.1 Digestion – Structure and function of digestive system.

1.2 Histology stomach, Intestine, pancreas, liver, large intestine.

1.3 Digestion of carbohydrates, proteins and lipids.

1.4 Composition and function of Saliva, Gastric juice, Bile juice, Pancreatic juice, Intestinal juice.

UNI T-II

2.1 Excretory system –Excretory organs, structure of kidney.

2.2 Juxtaglomerular apparatus, formation of urine.

2.3 Muscles – E.M. structure of muscles, contraction of muscle.

2.4 Single muscle twitch, tetanus, summation, fatigue, tonus.

UNIT-III

3.1Respiratory system- Structure of respiratory system, mechanism of respiration (breathing).

3.2 Histology of lungs and trachea, Transport of O_2 and CO_2 through alveoli

3.3 Circulatory system – Structure of heart, cardiac cycle, Composition of blood

3.4 Mechanism of clotting of blood.

UNIT-IV

4.1 Nervous system – structure of brain.

4.2 Structure and histology of spinal cord.

4.3 Structure and types of neuron.

4.4 Transmission of impulse through neuromuscular junction.

Suggested reading:

Garg K, Joshi M, Kundu S (2022). Human anatomy and physiology theory and practical 2 edition. CBS Publishers and Distributors Pvt. Ltd. pp. 352.

Murugesh N. (2021). Human anatomy and physiology. Sathya publishers, pp. 286.

GE/OE for B.Sc. I Indian Birds (BGO1T01)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain importance of birds.
- Learn how to record and study the birds.
- Identify and recognized certain Indian birds.

Unit - I

1.1 Methods of identification of birds.
1.2 Terms used in the description of birds plumage and body parts.
1.3 Bird study techniques: eqpuipments, field data recording, Bird sanctuaries in India.
1.4 Role of birds in ecosystem: pollination, seed dispersal, insect control.

Unit- II

2.1 Morphological features, distribution, feeding habit and habitat of Sarus crane (*Grus antigone*); purple moorhen (*Porphyrio* porphyrio); black Ibis (*Pseudibis papillosa*); Indian coot (*Fulica atra*).

2.2 Morphological features, distribution, feeding habit and habitat of Indian spot billed duck (*Anas poecilorhyncha*); Lesser whistling teal (*Dendrocygna javanica*); ruddy *shelduck* (*Tadorna ferruginea*); bronze-winged jacana (*Metopidius indicus*).

2.3 Morphological features, distribution, feeding habit and habitat of black-winged kite or oriental honey buzzard (*Elanus caeruleus*); black kite (*Milvus migrans*); shikra (*Accipiter badius*); Indian white backed vulture (*Gyps bengalensis*).

2.4 Morphological features, distribution, feeding habit and habitat of peacock (*Pavo cristatus*); common quail (*Coturnix coturnix*);grey jungle fowl (*Gallus sonneratii*); black patridge *(Francolinus francolinus*).

Unit- III

3.1 Morphological features, distribution, feeding habit and habitat of red-wattled lapwing (*Vanellus indicus*); common sandpiper (*Tringa hypoleucos*); little ringed plover (Charadrius dubius); *black-winged stilt* (*Himantopus himantopus*).

3.2 Morphological features, distribution, feeding habit and habitat of common green pigeon (*Treon phoenicoptera*); rock pigeon (*Columbia livia*); spotted dove (*Streptopelia chinensis*); red turtle dove (*Streptopelia tranquebarica*).

3.3. Morphological features, distribution, feeding habit and habitat of koyal (*Eudynamys scolopacea*); Coucal (*Centropus sinensis*); spotted owlet (*Athene brama*); house swift (*Apus affinis*).

3.4 Morphological features, distribution, feeding habit and habitat of little blue kingfisher (*Alcedo atthis*); pied kingfisher (*Ceryle rudis*); green bee eater (*Meropsorientalis*); hopoe (*Upupa epops*).

Unit- IV

4.1 Morphological features, distribution, feeding habit and habitat of roller (*Coracias benghalensis*); Indian grey hornbill (*Ocyceros birostris*); coppersmith barbet (*Psilopogon haemacephalus*); black drongo (*Dicrurus adsimilis*).

4.2 Morphological features, distribution, feeding habit and habitat of jungle babber (*Argya striata*); pied bushchat (*Saxicola caprata*); oriental magpie robin (*Copsychus saularis*); scarlet minivet (*Pericrocotus speciosus*).

4.3 Morphological features, distribution, feeding habit and habitat of tree pie (*Dendrocitta vagabunda*); redvented bulbul (*Pycnonotus cafer*); paradise flycatcher (*Terpsiphone paradise*); tailor bird (*Orthotomus sutorius*).

4.4 Morphological features, distribution, feeding habit and habitat of *ashy* wren-*warbler* (*Prinia socialis*); *grey wagtail* (*Motacilla cinerea*); baya or common weaver bird (*Ploceus philippinus*); purple sunbird (*Nectarinia asiatica*).

Suggested reading:

Salim Ali and Futehally L. (1968). Common Indian Birds: A picture album. National Book Trust, India, pp. 51.

Salim Ali (2003). The book of Indian birds. 13th edition, Oxford publication, pp. 326.

Grewal B, Sen S, Singh S, Devasar N and Bhatia G. (2016). Birds of India - A Pictorial Field Guide. Om Books International, pp. 792.

GE/OE Basket Semester I
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
I	**GE/OE**	1	Indoor gardening and landscaping	Botany	**BGO1T02**
		2	Health & Wellness	Biochemistry	
		3	Fermented Foods	Biotechnology	
		4	Office Automation	Computer Science	
		5	Communication & Broadcasting	Electronics	
		6	Environmental and Public Health	Environmental Science	
		7	A. Introduction to Forensic Journalism/ B. Basic Analytical Chemistry/ C. Basic Analog and Digital Electronics / D. Basics of Enzymology / E. Psychology of Health & Well Being-II (Psychology)/ F. Programming with C /	Forensic Science	
		8	Geostatistics in Geology	Geology	
		9	Basic Chemistry- I	Home Science	
		10	Basic Statistics	Mathematics	
		11	Statistics for Competitive examinations	Statistics	
		12	Reproductive biology	Zoology	
			Attractive insects	Zoology	
		13	Organic Chemistry	Cosmetic Technology	
		14	Chemical Processing-I	Fashion Design	
		15	Chemical Processing-I	Textile Science	

B. Sc. Semester-I
GE / OE-2 Botany (BGO1T02)
Indoor Gardening and Landscaping

GE/OE-II Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I

1. **Indoor Gardening:** Introduction, objectives, and scope. — 7.5 Hrs.
2. Essential Factors to grow indoor plants.
3. Establishment of the indoor garden.
4. Decoration of conference hall, living room & dining hall by indoor plants.
5. Common problems of indoor plants and their management.

Unit-II

1. **Selection of indoor plants:** Potted plants, hanging baskets, bonsai, bromeliad tree terrarium, bottle garden and dish garden. — 7.5 Hrs.
2. **Importance as popular indoor plants:**
   a) **Foliage plants:** *Begonia* sp., *Coleus* sp.
   b) **Ferns:** *Adiantum* sp., *Nephrolepis* sp.
   c) **Flowering plants*:*** *Anthurium* sp., *Bromeliads*
   d) **Orchids:** *Miltoniopsis* sp., *Dendrobium* Sp.
   e) **Palms*:*** *Areca palm, Ravenea rivularis*

Unit-III

3. **Landscaping:** Introduction, objectives, and scope. — 7.5 Hrs.
   a) Landscape architecture
   b) Tools and equipment used
   c) Lawn and lawn maintenance
   d) Fertilizing, weed control, pruning & disease and insect pest control for plants used in landscaping.

Unit-IV

4. Landscape management and conservation. — 7.5 Hrs.
   a) Heritage and cultural landscape, Urban open space systems, Rural landscape
   b) Different elements used in construction and designing of landscape
   c) Landscaping elements in residential, commercial, bungalow, public area, hotel educational institute and religious places.
   d) Selection of plants for landscaping
   e) Computer applications in landscaping.

Note: Field visits are compulsory.

SUGGESTED READINGS

1. Agarwal, V. K. and Bhargava P. (2017), Home Gardening, Pustak Mahal, Allahabad (India)
2. Bose T. K. and Mukharjee D. (1977) Gardening in India. Oxford & IBH Publishing Co. Pvt. Ltd.,Calcutta.
3. Gopal Swamy Iyengar (1990). Complete Gardening in India, IBH, India.
4. Grewall H. S. and Singh P. (2014), Landscape designing and ornamental plants, KalyaniPublication, New Delhi
5. Nambison, K.M.P. (1992). Design elements of landscape gardening. Oxford and IBHPublications, New Delhi.
6. Randhawa G. S. (1973). Ornamental Horticulture in India, Today and Tomorrow's printers and Publishers, New Delhi.
7. Vishnu Swarup (1993), Publication and information-Division ICAR, New Delhi
8. Vishnu Swarup (2002). Indoor Gardening, ICAR, New Delhi.
9. Walker D. T. (1983). Planting Designs, PDA Publishers Corporation, USA.

WEBSITES:

1. www.dgt.gov.in
2. www.baratskills.gov.in
3. www.andhrauniversity.edu.in
4. www.sevenmentor.com
5. www.jsscacs.edu.in

GE/OE Basket (BOS Biochemistry Major)

Health and Wellness (BG01T02)

Course Outcomes:

1. Students will know about importance of healthy lifestyle.
2. Students will know about physical and mental health.
3. Students will aware about various lifestyle diseases and how to modulate them.
4. Students will aware about stress management techniques.
5. Students will know about importance of yoga and pranayama.

Unit -I: General awareness.

Definition of health and wellness. Factors affecting health and wellness (Social, economic, emotional, occupational, intellectual, physical). Types of Physical Fitness and its Health benefits. Sedentary lifestyle and its risk of disease. Modern lifestyle and hypo-kinetic diseases; prevention and management. Benefits of exercise in adulthoods. Use of Health Management Information System (HMIS) in hospitals.

Unit -II: Physiological aspects.

Brief idea about different parts of kidney, heart, brain. Structure and function of Hemoglobin. LDL in plaque formation. Importance of HDL. International classification of adults underweight, overweight and obesity according to BMI. Parts of respiratory system. Breathing pattern. Stages of breathing in yoga pranayama. Health benefits of Kapalbhati and Anuloma Viloma pranayama.

Unit -III: Mental aspects.

What is mental health? Types of mental health disorders. Factors affecting mental health. What is anxiety? Types, causes, symptoms and treatment of anxiety. What is depression? Symptoms, factors affecting, and treatment of depression. Causes and treatment of migraine. Brief idea about stress and it's management. Identification of suicidal tendencies.

Unit- IV: Nutritional aspects.

Diet and nutrition for health & wellness. Essential components of balanced diet (carbohydrates, proteins, fats, vitamins & minerals) for healthy lifestyle. Malnutrition, under nutrition and over nutrition. Healthy foods for prevention and progression of Obesity, Diabetes, Polycystic Ovarian Syndrome, Cancer, Cardiovascular diseases and Hypertension. WHO recommendations of healthy diet for adults, infants and young children.

Reference Books:

1. Jesse Peoring Williams “The Principles of Physical Education” Published by College Book House, Shivaji Road, Meerut.
2. William D McArdle, Frank I Katch and Vitor I Katch, Essential of Exercise Physiology, Second edition, New York: LipincoffWelliams and wilkins, 2000.
3. Scott K. Powers and Stephen L. Dodd. Total Fitness: Exercise, Nutrition and wellness, Boston: Allyn and Bacon, 1999.
4. P Sembulingam, K Sembulingam. Essentials of medical physiology. 8 th edition. Jaypee Brothers Medical Publishers.
5. Vladimir Gordin. Nutrition and diet The Triangle of health: Chemical components Book 2). Gordin Medical Centre publication.
6. Arvind Upadhyay. Mental health problems. 2nd edition. Notion press publication.
7. James Hewitt. The Complete Yoga Book: The Yoga of Breathing, Posture and Meditation. Ebury Publication.

Open Elective Courses

SEMESTER – I

FERMENTED FOODS

Course Code:BGO1T02 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Understand the importance of fermented foods, probiotics, prebiotics and nutraceuticals.
CO 2. Make the students aware of the different types of beverages.
CO 3. Understand the importance of fermented meat and fish products.
CO 4. Understand the importance of fermented dairy and vegetable products.

Unit I **7 Hours**
History of food fermentations; Types of fermented foods, Nutritional Values, Advantages and Health Benefits; Prebiotics- Sources of prebiotics, Probiotics- Characteristic features, Sources and Microorganisms used as Probiotics; Synbiotics and Nutraceutical Foods; Oriental fermented foods-Soy sauce, Miso, Tempeh, Tofu, Natto; Traditional fermented foods – Idli, Dosa, Khaman

Unit – II **8 Hours**
Beverages- Introduction, Health Importance of Beverages; Ingredients of beverages: Water, fruit pulps, juices, concentrates, sweeteners and preservatives; Alcoholic Beverages- Undistilled Alcoholic Beverages, Beer- commercial production of beer, Elements of brewing process; Types of beer; Wines- commercial production, Types of wine, Distilled alcoholic beverages- Whisky, Rum, Gin, Brandy, Vodka, Non-Alcoholic Beverages- Coffee, Tea, Carbonated beverages, Mocktails, Quality- control in beverage industry

Unit III **7 Hours**
Fermented Meat product Sausages- History of fermented meats industry, Meat composition, Fermentation principles, Meat starter cultures, Manufacture of fermented sausage- Cutting and mixing, Stuffing, Casing materials, Fermentation, Cooking, drying, and smoking, Mold-ripening, Flavour of fermented meats, Defects and spoilage of fermented meats. Fermented fish products- Fish sauces, Fish paste- Manufacturing steps, Storage and Shelf-life of products.

Unit IV *8 Hours*
Fermented Dairy products- Introduction, Cultured dairy products- Yogurt, Cultured buttermilk, Sour cream, Kefir, Other cultured dairy products. Cheese-Introduction, Manufacturing principles, General steps in cheese making, Types of cheese, Cheese ripening, Recent technological advances in cultured dairy products technology. Fermented Vegetable products-Introduction, Production principles, Manufacture of Sauerkraut, Principles of pickle production, fermented olives, Kimchi and Fermented vegetables.

References:

- Hutkins, Robert W. *Microbiology and technology of fermented foods*. John Wiley & Sons, 2008.
- Joshi, V. K. "Biotechnology Food Fermentation" Volume 1. Educational Publishers &Distributors, 2004.
- Hui Y. H "Handbook of Food and Beverage Fermentation Technology". Marcel Dekker, 2004.
- Wood, Brian J. B. "Microbiology of Fermented Foods" Volume 1 and 2. II Edition. BlackieAcademic and Professional, 1998.
- Ramesh C. Ray and Didier Montet, "Fermented Foods, Part- II Technological Interventions",CRC Press, 2017.
- Kosikowski, F.V. 1997. Cheese and fermented milk foods. Frank Kosikowski and Vikram Mistry, Brooktondale, N. Y.
- Feiner, G. 2006. Meat products handbook. ISBN 978-1-84569-050-2
- Industrial Fermentations- Leland, N. Y. Chemical Publishers.
- Prescott and Dunn's- Industrial Microbiology, 4 th, ed.
- Bamforth, C.W. 2004. Beer: Health and Nutrition. Blackwell Science Ltd., Oxford, United Kingdom.

B.Sc. Sem-I (Computer Science)

BGO1T02

OFFICE AUTOMATION

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.

2.To understand the working with the user interface.

3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document

4.To understand Worksheet creation, inserting and editing data in cells.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System

Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows, new features in windows XP/Vista versions.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books:

1. MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2. MS-Office 2000(for Windows) By Steve Sagman
3. A First Course in Computers – Sanjay Saxena

Semester – 1; OE2: Communication & Broad Casting (BGO1TO2)

Course outcome:

At the end of this course students will have ability to

1. Historical understanding about evolution of Electronics CommunicationTechnology
2. Appreciate transformation and Geo-reach concept in Broad casting
3. Define purpose of present day communication & Broad Cast Technology, Entertainment, information Education, Alerts, Agricultural
4. Conversant with modern digital systems

Syllabus

1. Concept of Communication, One-one, One to Many, One way, Two way Distance & media wise, communication applications
2. Global & National History about evolution & growth, Akashwani, Vividh Bharti, FM service, HAM radio web based Radio, Doordarshan, Gyan Vani & other.
3. Contemporise Communication & Broad Casting system, working features, Sub module of communication system, Regulatory bodies, Law, Standards
4. Advances in Communication & Broad Casting Human-Machine communication, Machine-Machine communication, Integration of AI

GE/OE-2: Environment and Public Health (BGO1TO2)

Unit-I:

Environment and Public Health: Definition of health and diseases, Perspective on individual health: Nutritional, Socio-cultural and developmental aspects, Dietary diversity for good health; Human developmental indices for public health, Effect of quality of air, water and soil on human health.

Diseases in Contemporary Society: Need for good health – factors affecting health, Types of diseases – deficiency, infection, pollution diseases – allergies, respiratory, cardio-vascular and cancer, Personal hygiene: food- balanced diet, Health effects of smoking, drugs and alcohol consumption.

Unit-II:

Malnutrition: Vitamin deficiency diseases and Mineral deficiency diseases, Folic acid requirement during pregnancy; Food safety- adulterants and preservatives, pesticides toxicity, endosulfan and DDT, genetically modified food.

Non-communicable diseases and life style diseases: Diabetes and Hypertension; Communicable diseases: Definition, mode of transmission- pandemic, epidemic and endemic diseases.

Unit-III:

Vector Borne Diseases : Plauge and Malaria, emerging diseases: Dengue, Chikungunia. Ebola, Zika, Swine flu, Bird flu, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), Zoonosis-Leptospirosis.

Water and Air Borne Diseases: Water borne diseases (Cholera, diarrhea. Typhoid, ameobiasis, hepatitis, gastroenteritis and giardiasis. Air borne diseases (Pneumonia, tuberculosis, Anthrax, COVID-19 and Acute Flaccid Myelitis (AFM).

Unit-IV:

Occupational Health: Sick building Syndrome, Noise and Radiation; Ergonomoics – Stress and fatigue, Carpal Tunnel Syndrome (CTS), Methyl mercury and cerebral palsy, Synergistic effect, Irritable bowel syndrome, Crohn’s diseases.

Environmental Sanitation and Hygiene : Safe disposal of human excreta, solid waste disposal, sanitation value chain. Drug safeties – Thalidomide Tragedy, Antibiotic stewardship, New Delhi Antibiotic – Resistant superbug.

References:

1. Aktar, R. (Ed.). (2019). Extreme weather events and human health: International casestudies. Springer Nature.
2. Bedi and Yashpal. (1971). Handbook of Hygienic and Public Health. Atma Ram & Sons,Delhi.
3. Kessel, A. (2006). Air, the environment and public health. Cambridge University Press.
4. Lopez, R.P. (2012). The built environment and public health (Vol.16). John Wiley &Sons.
5. Nandini N. (2018). Environment and public Health. Sapna Book House, Bengaluru,
6. Q'Carroll, P.W., Yansnoff, W.A., Ward, M.E., Ripp, L.H., & MartinE.L. (Eds.).(2003). Public health informatics and information systems.
7. Park, K (2009). Park's Textbook and Preventive and Social Medicine, 20th Edition. Misc Publication
8. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment, New Delhi.
9. Van den Bosch, M., & Bird, W. (Eds.). (2018). Oxford textbook of nature and public health: The role of nature in improving the health of a population. Oxford University Press.
10. Walton, M (2017). One planet, One Health. Sydney University Press.

GE/OE (Forensic Science)

GE 2(BGO1T02): Introduction to Forensic Journalism

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to forensic journalism, including investigative reporting, forensic journalist, types of news reporting, news editing, and ethical practices.
2. Understand the principles, practices, and challenges of forensic journalism in contemporary society.
3. Apply the techniques, methods, and skills required for effective forensic journalism, including researching, reporting, writing, and editing.
4. Analyze the role and impact of forensic journalism in uncovering the truth, promoting justice, and addressing social issues, as well as the challenges and limitations of forensic journalism.
5. Evaluate the effectiveness and ethics of forensic journalism in different contexts, including reporting on crime, human rights abuses, disasters, and crises, as well as assessing the future directions and innovations in forensic journalism.

Unit-I Writing and Editing of News

Introduction to News, Types of News, Sources of News, Writing News, The Leads, Types of Leads, Method of Writing Leads, Tips for Writing News, Function of News, News Editing, Nature and Need for Editing, Editors, Method of Editing, Proof Reading, Preparation of Copy for Press.

Unit-II: Introduction to Forensic Journalism

Definition of forensic journalism and its importance: What is forensic journalism and how is it different from regular journalism? The importance of forensic journalism in uncovering the truth and promoting justice, The origins of forensic journalism in investigative reporting. Ethics and best practices in forensic journalism: The importance of accuracy, fairness, and balance in forensic journalism

Unit-III: Basics of Forensic Journalism

Forensic Journalism, Investigative Journalism, Forensic Journalist, Scope and Need of Forensic Journalist. 5W1H, Reporting, Reporter, Type of News Reporting such as Straight News Report, Beat Reporting, Investigative News Reports, Role and Responsibilities of Forensic Journalist, Research methods and tools for investigative reporting, Ten Golden Rules for Forensic Journalist, Qualities of Good Forensic Journalist.

Unit IV: Applications of Forensic Journalism

Covering crime and courts. Investigating human rights abuses and social justice issues. Reporting on disasters and crises. The challenges and limitations of reporting on disasters and crises. Challenges and limitations of forensic journalism. The potential future directions and innovations in forensic journalism.

GE/OE (Forensic Chemistry)

GE 2(BGO1T02): Basic Analytical Chemistry

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to SI units, methods of expressing concentrations, calculations, solutions and their concentration.
2. Understand the principles, descriptions, handling, calibration and use common laboratory apparatus.
3. Apply the knowledge and skills of volumetric analysis to classify different volumetric methods and understand the concept of different types of titrations.
4. Analyze the principles, theory, types of gravimetric analysis their application and limitations.

Unit I: SI Units

Definitions of the Seven Basic Units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity). Methods of expressing concentrations - Mole, molar mass, Molarity, Calculations in grams and moles, Solutions and their concentrations, Molar concentration b) Percent concentration, Parts per million/billion (ppm, ppb)

Unit II: Description and use of common laboratory apparatus

Volumetric flasks, burettes, pipettes, meniscus readers, weighing bottles, different types of funnels chromatographic columns, chromatographic jars, desiccators, drying ovens, filter crucibles, rubber policeman. Calibration and use of volumetric glassware.

Unit III: Volumetric Analysis A

Definitions: Volumetric Titration, Gravimetric Titration, Coulometric Titration. B. The equivalence point, the end point; Classification of volumetric methods, theory of indicators and buffers Equilibria Principles-Aqueous and non-aqueous acid-base titration- Redox titrations-Complexometric titrations – Precipitation titrations

Unit IV: Volumetric Analysis B

Principle, theory and types of Gravimetric analysis, properties of precipitates and precipitating agents, application and limitations of gravimetric methods

GE/OE (Forensic Physics)

GE 2(BGO1T02): Basic Analog and Digital Electronics

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to basic electronics, including active and passive components, identification techniques of components, and rectifier circuits.
2. Understand the principles, practices, and challenges of analog and digital electronics, including the working principle of oscillators and waveform generators, and the applications of logic gates, flip-flops, and shift registers.
3. Apply the knowledge and skills required to properly design and analyze analog and digital electronic circuits, including the use of filters, waveform generators, and signal converters.
4. Analyze the characteristics and properties of electronic components, including resistors, capacitors, inductors, diodes, and transistors, and their applications in electronic circuits.
5. Evaluate the performance and limitations of electronic circuits, including waveform shaping circuits and signal processing techniques, and the ethical considerations surrounding the use of electronic devices.

Unit I: Basic Electronics

Active and Passive Components (Resistors, Capacitors, Inductors, Diodes, Transistors), Field Effect Transistors, IC's and IC packages, Identification Techniques of Components, Rectifier Circuits, Introduction to OPAMP (Inverting & Non-inverting Amplifier) and Applications.

Unit II: Analog Electronics

LR, CR, LCR Circuits, Timer Circuits (using IC 555 &UJT). Active Filters: Low Pass, High Pass, Band Pass. Waveform Generators: Working Principle of Oscillators, Waveform Generators; Sine (Phase-shift, Wien Bridge, Colpitts and Hartley), Square, Triangular, Sawtooth.

Unit III: Digital Electronics

Logic Gates and Their Applications, Flip Flops, Shift Registers and Counters (Asynchronous, Synchronous and Decade).

Unit IV: Signal Processing

Signal Converters: Analog to Digital Converters (Dual Slope &Successive Approximation), Digital to Analog Converters (Weighted Resistors &R-2R Ladder). Wave Shaping Circuits: Wave Clipping, Clamping Circuits.

GE/OE (Forensic Biology)

GE 2(BGO1T02): Basics of Enzymology

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify key terms, historical developments, and classification of enzymes.
2. Understand the specificity of enzyme action, mechanisms of enzyme catalysis, and the role of regulatory enzymes.
3. Apply knowledge of enzyme mechanisms to predict and explain enzyme-substrate interactions.
4. Analyze enzyme kinetics, including the measurement of initial velocities and interpretation of graphs.
5. Evaluate the effects of enzyme concentration, temperature, and pH on enzyme activity.

Unit-I: Fundamentals of Enzymology and Enzyme Catalysis

History and Terminology; Classification & nomenclature of enzymes; Specificity of enzyme action (Lock & key model & Induced fit model); Introduction to Enzyme catalysis: Proximity and Orientation effect; covalent catalysis; acid-base catalysis; metal ion catalysis; Introduction to regulatory enzymes.

Unit-II: Enzyme Mechanisms, Coenzymes, and Factors Affecting Enzyme Activity

Mechanism of action of Chymotrypsin; Role of vitamins as coenzyme precursors (Niacin, Biotin); Effect of enzyme concentration; Effect of temperature on enzyme activity & temperature quotient.

Unit-III: Enzyme Kinetics

Enzyme kinetics: Importance of measuring initial velocities; Michaelis-Menten equation; Single & double reciprocal plots; Graphical representation of various inhibitors (Competitive, Non-competitive & Uncompetitive) on Lineweaver-Burke plots.

Unit-IV: Advanced Enzyme Kinetics and Assay Techniques

Definition and importance of Kcat / Km; Introduction to Bisubstrate reactions, sequential and ping-pong mechanisms with examples; Effect of pH, General pH profile diagram; Concept of enzyme assay & its importance, Enzyme activity units (Katal & Specific activity).

GE/OE (Psychology)

GE 2(BGO1T02): Psychology of Health and Wellbeing-II

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Understand the spectrum of health and illness for better health management
2. Identify stresses in one's life and how to manage them
3. Understand a variety of health announcing health protective and health compromising behaviours and to be able to know their application in illness management.

Unit I: Aptitude

Concept of Aptitude, Aptitude Tests: DAT, GATB. Concept of Interest; Interest Tests: The strong Campbell Interest Inventories, Kuder preference Record. Application: Use of Psychological tests in career selection.

Unit II: Emotions

Theories of emotions: James-Lange's theory, Cannon-Bard's theory, Schachter-Singer's theory, cognitive appraisal theory. Application to everyday life: use of incentives to motivate the employees to work hard.

Unit III: Personality

Assessment of Personality- Behavioural assessment (Observation, Rating scales), Personality inventories (16 PF, MMPI, NEO-PI). Projective techniques: TAT, Rorschach Ink Blot Test, Sentence Completion Test. Applying psychology to everyday life: Parents as a role model for children and film stars as role models for adolescents.

Unit IV: Intelligence

Theories of Intelligence: Spearman, Gardner, and Sternberg. Individual Differences in Intelligence: mental retardation, and giftedness. Application: Early childhood intervention: towards boosting intelligence.

GE/OE (Digital and Cyber Forensics)

GE 2(BGO1T02): Programming with C

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand programming structures like Sequence, Selection, Iteration and Modular.
2. Understand development tools such as algorithm, flowchart and pseudo code for any problem to solve them programmatically.
3. Understand basic concepts of programming in C such as character set, Operators, Functions, arrays, strings, functions, structures, unions and pointers.
4. Understand the file handling, sequential access and random access programmatically.
5. Apply their knowledge to solve programming problems using C language.

Unit I: Programming Fundamentals

Programming Structure: Sequence, Selection, Iteration and Modular, Problem-Solving Techniques and Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics), Developing Algorithm and Drawing flowcharts

Unit II: Introduction to C Programming

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, jump statements: break, continue, goto (Special emphasis on problem solving)

Unit III: Arrays, Strings, and Functions in C Programming

Arrays: Need, Types: Single and Two-Dimensional Array. Strings: Strings Manipulation, Arrays of Strings, Evaluation order. Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

Unit IV: Structures, Unions, Pointers, and File Handling in C Programming

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures. Union: Unions, Differences between Structure and Union. Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers. File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Paper II: Grain Size and Geostatistics in Geology (BGO1T02)

Unit I

Concept of grain size of minerals-grains; very coarse-grained, medium-grained, fine-grained, glassy material; grain-size distribution of acidic, intermediate, basic and ultrabasic igneous rocks with textures of rocks; glassy acidic and basic igneous rock types.

Unit II

Surface processes leading to rock breakdown- physical, chemical and biological; weathering; resistance of rocks to weathering; factors influencing weathering; Processes of sediment transport; grain size variation from river, marine, deltaic and glacial sediments.

Unit III

Wentoworth's scale of grain sizes of sediments; grain sizes of sediments and sedimentary rock types; grain angularity and roundness, conversion of millimeter to phi scale of grain size.

Unit IV

Arithmatic mean, mode, median, range, variance, frequency, skewness, kurtosis, standard deviation of grain sizes; identification of depositional environment based on grain size distribution; CM plot, depositional environment based on grain size distribution from probability ordinate paper.

Books Recommended:

1. Blatt, H., Middleton, G.V. and Murray, R.C. (1980) Origin of Sedimentary Rocks, Prentice-Hall Inc.
2. Hota, R.N. (2011) Practical Approach to Petrology, CBS Publisher and Distributors Pvt Ltd., New Delhi
3. Reineck, H.E. and Singh, I.B. (1973) Depositional Sedimentary Environments, Springer-Verlag.
4. Isaaks, E.A. and Srivastava, R.M. (1990) An Introduction to Geostatistics, Oxford University Press.
5. Morrison, D.F. (1967) Multivariate statistical methods, McGraw-Hill.
6. Tucker, M.E. (1981) Sedimentary Petrology: An Introduction, Wiley and Sons, New York.

SEMESTER 1: BASIC STATISTICS

Course Outcomes:

1. To discuss the interpretations of Statistics in numerical data.
2. To give overview of Statistics in various sectors & disciplines
3. To apply & use of Statistics Methods in various diverse fields

UNITS	TOPICS	HOURS
Unit 1	Concept of Sample Space - Events - Definition of Probability - Addition and Multiplication laws of Probability - Conditional Probability - Baye's Theorem - Simple Problems.	**8**
Unit 2	Random Variables - Distribution Function - Expectation and Moments - Moment Generating Function - Probability Generating Function - Simple Problems.	**8**
Unit 3	Concept of Bivariate Distribution - Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression.	**7**
Unit 4	Standard distributions: Discrete distributions - Binomial, Poisson, Hyper Geometric and Negative Binomial Distributions - Continuous Distributions Normal, Uniform, Exponential.	**7**
	TOTAL	**30 HRS**

Recommended books:

1. S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan & sons
2. Hoel, P.G (1971): Introduction to Mathematical Statistics, Wiley.
3. Wilks S.S. Elementary Statistical Analysis, Oxford and IBH
4. Hogg, R.V. &Craig.A.T.(1998) : Introduction to Mathematical Statistics, Macmillan
5. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.

	Semester I (GE/OE)
	Name of the Paper - Statistics for Competitive examinations
	Paper code – (BGO1T02) 2 Credits (2 hrs Theory per week)
	Course Objectives
	To train the students to solve the problems of statistics that appear in most of the competitive exams conducted by Banking, State and Central Governments and other agencies.
	Course Outcomes (CO)
	After the successful completion of the course, the students will be able to develop the data analysis skills required for Competitive Examinations.
	CONTENTS
	Unit 1 (15 Hrs)
(A)	**Collection Classification and Presentation of Statistical Data** Primary and Secondary data, Methods of data collection; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of frequency distributions.
(B)	**Measures of Central Tendency** Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency, Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures. Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only
	Unit 2 (15 Hrs)
(A)	**Measures of Dispersion** Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.
(B)	**Introduction to Probability** Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.
	References
1	Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
2	Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay.
3	Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur

GE/OE for B.Sc. I Reproductive Biology (BGO1T02)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the male reproductive system.
- Understand, describe and explain the female reproductive system.
- Understand, describe and explain menstrual cycle.
- Understand, describe and explain spermatogenesis, oogenesis and fertilization.

Unit- I

1. Female reproductive organs.
2. Function of Sertoli cells and Leydig cells.
3. Structure of Sperm.
4. Sperm transportation in male tract.

Unit -II

1. Female reproductive organs.
2. The anatomy, histology and function of uterus, cervix, vagina, fallopian tubes and mammary gland.
3. Structure of Ovary.
4. Sperm transport in female tract.

Unit- III

1. Menstrual cycle- different phases of menstrual cycle, menarche and menopause.
2. Hormonal control of menstrual cycle.
3. Male reproductive hormone and their function.
4. Female reproductive hormone and their function.

Unit- IV

1. Spermatogenesis, spermiogenesis and spermiation
2. Oogenesis, Folliculogenesis, Ovogenesis, Ovulation
3. Oocyte maturation – Primary follicle to Graffian follicle
4. Fertilization- Sperm egg recognition, Acrosome reaction and species barriers

Suggested Reading:

Tortora GJ and Derrickson BH (2009). Principles of Anatomy and Physiology, XII Edition, john Wiley and Sons, Inc., pp. 1281.

Widmaier EP, Raff H and Strang KT (2008). Vander's Human physiology. 11th Edition. McGraw Hill, pp. 770.

Khurana I (2018). Medical Physiology for undergraduate students.2nd edition, Elsevier, pp. 938.

GE/OE for B.Sc. I Attractive Insects BGO1T02

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the general characters of insects.
- Understand, describe and explain suborders of Odonata .
- Identify, recognized, describe and explain certain damselflies.
- Understand, describe and explain ecological significance of dragonflies.
- Identify, recognized, describe and explain certain dragonflies.
- Identify, recognized, describe and explain certain butterflies.
- Identify, recognized, describe and explain certain beetles.

Unit -I

1.1 Introduction to class Insecta: Systematic position of class Insecta, General Characters of class Insecta .

1.2 Introduction to order Odonata: General characters of odonata, suborders and families of order Odonata.

1.3 General characters of suborder Zygoptera, morphological difference between dragonflies and damselflies.

1.4 General characters, distribution of Coromandel marsh dart, *Ceriagrion coromandelianum* (Fabricius, 1798) and golden dartlet, *Ischnura aurora* (Brauer, 1865)

Unit- II

2.1 General characters of suborder Anisoptera, Ecological importance of dragonflies.

2.2 General Characters of Family Libellulidae; general characters, morphological features and distribution of green marsh hawk, *Orthetrum sabina* (Drury,1770)*;* ground skimmer, *Diplocodes trivalis* (Rambur, 1842).

2.3 General characters, morphological features and distribution of the granite ghost, *Bradinopyga geminata* (Rambur, 1842), ditch jewel, *Brachythemis contaminata* (Fabricius, 1793).

2.4 General characters, morphological features and distribution of the scarlet skimmer, *Crocothemis servilia* (Drury, 1770); pied paddy skimmer, *Neurothemis tullia* (Drury, 1773).

Unit- III

3.1 General characters of family Aeshnidae; Morphological features, distribution of pale spotted emperor, *Anax guttatus* (Burmeister, 1839).

3.2 General characters of family Gomphidae; Morphological features, distribution of common clubtail, *Ictinogomphus rapax* (Rambur, 1842).

3.3 Introduction to Coleoptera: General characters, distribution and habitat of beetles.

3.4 Morphological features, distribution and habitat of Indian glow worm, *Lamprophorus tenebrosus* (Walker, 1858); seven spotted ladybird beetle, *Coccinella septumpunctata* (Linnaeus, 1758); *six-spotted zigzag ladybird***,** *Cheilomenes sexmaculata* ((Fabricius, 1781).

Unit- IV

4.1 General characters, distribution and habitat of butterflies; morphological features of Nymphalidae, Papillionidae and Pieridae.

4.2. Morphological features, distribution and habitat of the common core, *Euploea core* (Cramer, 1780); the blue pansy, *Junonia orithya* (Linnaeus, 1758); *Danaus chrysippus* (Linnaeus, 1758)

4.3 Morphological features, distribution and habitat of lemon butterfly, *Papilio demoleus* (Linnaeus, 1758); the crimson rose, *Pachliopta hector* (Linnaeus, 1758); the tailed jay, *Graphium agamemnon* (Linnaeus, 1758).

4.4 Morphological features, distribution and habitat of common jezebel, *Delias eucharis* (Drury, 1773); common grass yellow, *Eurema hecabe* (Linnaeus, 1758); common emigrant, *Catopsilia pomona* (Fabricius, 1775).

Suggested Reading

Marshal SA (2018). Beetles: The natural history and diversity of Coleoptera. Boston Mils Press, pp. 800.

Smetacek P (2016). A naturalists guide to the butterflies of India. Prakash Books India Private Limited, pp. 176.

Andrew R.J., Subramanian K.A., Tiple A.D. (2008). Common odonates of Central India. e- book for " the 18th International Symposium of Odonatology, Hislop College, Nagpur", pp. 56.

Subramanian K.A. (2005). Dragonflies and damselflies of peninsular India: A field guide. Project report of Centre for Ecological Science, Indian Institute of Science, Banglore and Indian Academy of Science, Banglore, pp. 35.

GE/OE Basket Semester II
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
II	**GE/OE**	1	Sustainable agriculture	Botany	**BGO2T03**
		2	Bioethics	Biochemistry	
		3	Applications of Biotechnology in Agriculture	Biotechnology	
		4	Programming in C	Computer Science	
		5	PC Assembly & Maintenance	Electronics	
		6	Introduction to Climate Crises	Environmental Science	
		7	A. Introduction to Forensic Auditing & Fraud Assessment / B. Chemistry of Natural & Synthetic Molecules / C. Instrumentation Aids/ D. Basics of Microbial Forensics/ E. Basics of Clinical Psychology (Psychology)/ F. Office Automation/ G. Criminal Law-I (Law)	Forensic Science	
		8	Introduction to Landforms	Geology	
		9	Basic Physics and Basic Computer -II	Home Science	
		10	Business statistics I	Mathematics	
		11	Introduction to Microscopy and staining	Microbiology	
		12	Energy sources	Physics	
		13	Statistical methods and psychological testing	Statistics	
		14	Industrial entomology	Zoology	
		15	Physical Chemistry	Cosmetic Technology	
		16	Computer Application in Design	Fashion Design	
		17	Computer Application in Designing	Textile Science	

B. Sc. Semester-II
GE / OE-3 Botany (BGO2T03)
Sustainable Agriculture

GE/OE-III Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I

Introduction — 7.5 Hrs.

1. Concept and importance of sustainable agriculture
2. General principles and goals of sustainable agriculture
3. History and policy for sustainable agriculture in India
4. Barriers or problems in adoption of sustainable agriculture
5. Farming system: Scope and types

Unit-II

Sustainable agriculture system: Objectives, Characteristics and advantages of following practices — 7.5 Hrs.

1. Organic farming.
2. Natural farming.
3. Biodynamic of agriculture.
4. Conservation agriculture.
5. Integrated farming system.
6. Precision farming.
7. Crop rotation and inter cropping
8. Vertical farming

Unit-III

Sustainable agriculture system: Objectives, Characteristics and advantages of following practices — 7.5 Hrs.

1. Permaculture.
2. Agroforestry.
3. Integrated pest management
4. Rain water harvesting- artificial ground water recharge.
5. Floating farming.
6. Mulching.
7. Vermi-composting.
8. Soil solarization.

Unit-IV

Factors affecting: sustainability of agricultural resources and control measures — 7.5 Hrs.

1. Land or soil related problems.
2. Irrigation related problems.
3. Indiscriminate use of agrochemicals.
4. Environmental pollution.
5. Erosion of genetic biodiversity.

Note: Field visits are compulsory.

Suggested readings

1. Gopal Chandra De. 1980., Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd., Bangalore. 3) Hand book of Agriculture, ICAR Publication.
2. Panda, S.C., 2006. Agronomy Agribios Publication, New Delhi.
3. Reddy, S.R. Principles of Agronomy Kalyani Publishers, Ludhiana, India.
4. Sankaran, S and Subbiah Mudliyar, V.T., 1991. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
5. Lampkin, N (1990) Organic Farming. Farming Press, Ipswich (ISBN 0 85236 191 2)
6. Kristensen, P., Taji, A. and Reganold, J. (2006). Organic Agriculture: A Global Perspective. CSIRO Press, Victoria, Australia.
7. Palsnnipsn S. P., Cropping systems in tropics- Principles and practices
8. Altieri, M. A. 1995, Agroecology: The Science and Sustainable Agriculture. 2nd EdnWestvies Press, Colorado.
9. A. Zaman. 2002 Watershed Management for Sustainable Agriculture in Indian Perspectives. 12th ISCO Conference
10. Chadha G. K. Sen S. and Sharma H. R. 2004. State of Indian Farmer: A Millenium Study, Vol.2: Land resources, Ministry of Agriculture, Govt of India.
11. Niti Gupta, Shanal Pradhan, Abhishek Jain and Nahya Patel (2021); Sustainable Agriculturein India: What we know and how to scale up. New Delhi. CEEW Report April 2021
12. Deb, D. L. 1994. Natural Resources Management for Sustainable Agriculture and Environment. Angkor Publishers Ltd., New Delhi.
13. Saroja Raman. 2006. Agricultural Sustainability- Principles, Processes and Prospects. Food products Press, New York.
14. Subramaniyan, S. 2004. Globalization of Sustainable Agriculture. Kalyani Publishers, Ludhiyana.

General Elective Paper (Biochemistry-Major)

Semester 2 : BIOETHICS (BGO2T03)

COURSE OUTCOMES:

This course is designed to provide:

1. To Understand the terms ‘ethics’ and ‘bioethics’;

2. To Demonstrate understanding of the biosciences and ethical considerations associated with a current advance in biotechnology, modern biomedicine, agriculture and in the utilization of natural resources.

3.Integrate the use of scientific facts and ethical principles and argumentation in discussing cases involving moral dilemmas;

4. Use and critically evaluate information gathered from a variety of sources; a Recognize the diversity of informed ethical opinions regarding the development of current advancements in biology and biomedicine;

5. Develop scientific attitudes, reflective processes and decision making skills; a Develop a sense of moral obligation and responsibility both in their relationship with nature and in their future professional activity.

UNIT I: Theoretical background to bioethics

The nature of bioethics (defining bioethics, history and philosophy, modern science, a new history of biology, the scientific method, bioscience and biotechnology, importance of bioethics for the biosciences); theories of ethics (introduction to ethics, ethics and morality, moral reasoning and major ethical theories)

UNIT: II. Environmental ethics

Interactions of humans with the natural world (the place of humans in nature, environmental values, origin and emergence of environmental ethics, ideas of stewardship and Gaia); current themes in environmental ethics (anthropogenic impact on the biosphere and precautionary principles, environmental sustainability); current issues in environmental ethics (terrestrial and aquatic pollution, global climate change, environmental degradation and loss of biodiversity, ecotourism and ethics); humans and non-humans animals (animal welfare and animal rights, human use of nonhuman animals, ethics of animal research, legislation for, and alternatives to animal experimentation).

UNIT: III Ethics of biotechnology

Genetic modification (general ethical issues related to genetic modification, application of genetic modification – pharmaceuticals, GM food and crops, genetic modification of animals, research use of genetic modification, GM and less-developed countries; GM microorganisms as bacteriological warfare; conception of risk, assessment, management, communication and

standards of risk; interpreting the precautionary principles);Introduction to the Human Genome Project.

UNIT: IV Biomedical ethics

Cloning and stem cells (ethics of human cloning, reproductive cloning and therapeutic cloning, embryonic stem cells and the status of the early human embryo, experiments on embryonic stem cells, legislation and therapeutic cloning); ethical aspects of the assisted reproductive technologies (artificial insemination and donor insemination, in vitro fertilization, surrogate mothering, designer babies etc. in brief)

Refrences:

1. Bryant J., Baggott la Velle L., Searle S. (2006) Introduction to Bioethics, John Wiley & Sons, Chichester.
2. Downie R., Clarkeburn H. (2005) Bioscience Education,
3. Encyclopedia of Bioethics (2004) 3rd Edition (Stephen G. Post, Ed.), Thomson Gale, p. xi.
4. Greenwell P. and McCulley M. (2007) Molecular therapeutics: 21st Century Medicine. John Wiley & Sons,Chichester.
5. Hristova S. (2009). Ethics in the world of biotechnology, Faber, Sofia. (in Bulgarian);.
6. Jonsen A. (1998) The Birth of Bioethics, Oxford University Press, Oxford.

SEMESTER – II

APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE

Course Code: BGO2T03 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:

CO 1. Understand the biotechnological applications in agriculture
CO 2. Comprehend the pros and cons of GM crops and their plant products
CO 3. Appreciate the biotechnological applications for effective pest control and crop improvements
CO 4. Understand the importance of molecular markers in agriculture

Unit I **8 hours**

Agricultural Biotechnology: Concept and scope of biotechnology in Agriculture; Plant tissue culture, micro propagation; entrepreneurship in commercial plant tissue culture; Banana tissue culture – primary and secondary commercial setups, Small scale bio enterprises: Mushroom cultivation

Unit II **7 hours**

Transgenic plants: The GM crop debate – safety, ethics, perception and acceptance of GM crops; GM crops case study: Bt cotton, Bt brinjal; Plants as biofactories for molecular pharming; edible vaccines, plantibodies, nutraceuticals.

Unit III **8 hours**

Pest control and crop improvement: Baculovirus pesticides, Mycopesticides; Post-harvest Protection: Antisense RNA technology for extending shelf life of fruits and shelf life of flowers; Genetic engineering for quality improvement: Golden rice, Seed storage proteins, Flavours– capsaicin, vanillin

Unit IV **7 hours**

Molecular marker aided breeding: RFLP maps, linkage analysis, RAPD markers, STS, microsatellite, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), QTL, map based cloning, molecular marker assisted selection

References:

• Chrispeels M.J. and Sadava D.E. (1994) Plants, Genes and Crop Biotechnology, 2nd Ed., Jones and Bartlett Publishers, Boston.

• Gamborg O.L. and Philips G.C. (1998) Plant cell, tissue and organ culture, 2nd Ed., Narosa Publishing House. New Delhi.

• Gistou, P. and Klu, H. (2004). Handbook of Plant Biotechnology (Vol. I & II). John Publication.

• Hammond J., McGarvy P. and Yusibov.V. (2000). Plant Biotechnology, Springer Publ.

• Heldt. H.-W. (1997). Plant Biochemistry and Molecular Biology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.

• Kyte, L., Kleyn, J., Scoggins, H., and Bridgen M. (2003) Plants from test tubes. An introduction to micropropagation, 4th Ed., Timber Press, Portland.

• Murray D.R. (1996) Advanced methods in plant breeding and biotechnology. Panima Publishing Corporation.

• Nickoloff, J.A. (1995). Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana Press Incorp, USA.

• Sawahel, W.A. (1997). Plant genetic transformation technology. Daya Publishing House, Delhi.

B.Sc. Sem-II (Computer Science)
BGO2T03

PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.

Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

Semester – 2; OE1: PC ASSEMBLY & MAINTENANCE (BG02T03)

Course outcome:

At the end of this course students will have ability to

1. Identify basic terms, concepts, functions, and operations of personal computer (PC) system components.

2. Complete installations of memory modules, system boards, processors, power supplies, adapter boards, storage devices, and multimedia devices. 3 Analyse common symptoms and problems associated with PC components and provide solutions to troubleshoot and isolate the problems. Identify the purpose of various types of preventive maintenance products and procedures.

Syllabus :

1. Introduction to PC Hardware: Study of basic I/O systems, Types of Memories- Static RAM and Dynamic RAM, ROM, PROM, EPROM, EEPROM, CPU (Central Processing Unit)- ALU and control unit.
2. Motherboard and Processor: Study of different types of Motherboards, Motherboard Configuration, Identifying Internal and External connectors, Types of data cables, Types of Processors- Intel Celeron, P4 family, Xeon dual core, quad core, core2 duo, i3, i5, i7 and AMD.
3. BIOS Configuration: Study of BIOS Set-up- Advance set-up, Boot configuration, Boot Menu. Installation of OS (Operating Software) Windows installation. Hard Disk: Formatting of Hard disk, Partitioning of Hard disk in different logical drives, Disk defragmentation, Disk clean up, Scan disk etc.
4. Troubleshooting: Motherboard drivers, LAN, Audio, and Video. Configuration of External devices: Printers, Scanner set-up, Webcam, Bluetooth device, Memory card reader etc. Diagnostic and troubleshooting of PC: POST (Power on Self-Test), identifying problems by Beep codes errors, checking power supply using Multi-meter, Replacement of components etc. Antivirus and Application Software

Books:

1. Troubleshooting, Maintaining and Repairing PCs by Stephen J. Bigelow
2. The Complete PC Upgrade and Maintenance Guide by Mark Minasi.

OE/GE-3 : Introduction to Climate Crises

Unit-I:

Climate Change: Definition, scope and facts of climate change, Composition and thermal structure of atmosphere, weather and climate. Meteorological parameters – temperature, pressure, precipitation, humidity, wind speed and direction.

Monsoons: Definition, Indian monsoons – seasons: cold weather season (winter), the hot weather season (summer), season of advancing monsoon (rainy season) and season of retreating monsoon (the transition season), cyclones of the Indian region; El-Nino and La-Nina and their impacts.

Unit-II:

Air Pollution: types of air pollution. Air pollutants, Co-relation between air pollution and climate crisis. Impact of air pollution, Mitigation methods. Case studies of air pollution disasters. **Acid rain**: chemistry of acid rain, impacts of acid rain, mitigation measures of acid rain.

Greenhouse effect and global warming: Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases, global dimming and global warming potential, black carbon and carbon footprint.

Unit-III:

Impact of climate change: Influence on agriculture, climate change and food security, water stress and water insecurity, rise in sea levels, loss of biodiversity and extinction of species, vectorborne/zoonotic diseases, increase in floods and drought incidences.

Mitigation strategies of climate change: Carbon sequestration, carbon sink, carbon credit, carbon offsetting, carbon tax, geo-engineering.

Unit-IV:

Climate change and policy frameworks: United Nation Framework Convention on Climate Change (UNFCCC), The United Nation Conference on Environment and Development, Inter-governmental Panel on Climate Change (IPCC), The Kyoto Protocol, Paris Agreement.

India and Climate Change: Ministry of Environment, Forest and Climate Change (MoEF and CC), India's National Plan on Climate Change, The National Mission on Strategic Knowledge for Climate Change (NMSKCC), National Mission for Sustainable Agriculture (NMSA), National Bio-Energy Mission.

References :

1. Abhishek Tiwary and Jerem Colls.(2020). Air Pollution: Measurement, Modelling andMitigation.III Edition, Routledge Publication.
2. Agarwal.K.M, Sikdar P.K and Deb S.C. (2002). A Text book of Environment MacMillerIndia Ltd., Culcutta.
3. Climate Change: Science and Politics. (2021). Centre Science and Environment, NewDelhi.
4. Donald Ahrens. C. (2008). Essential of Meteorology: An Invitation to the Atmosphere.Cengage Learning Publication.
5. Howard J. Critchfield.(1983). General Climatology (4th Edition), Phi Learning Pvt Ltd.
6. IPCC. (2006). Guidelines for National Green house gas Inventories. Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on Behalf of the IPC.
7. John E. Oliver, John J Hidore. (2002). Climatology: An Atmosphere Science, SecondEdition. Printice Hall Publication.
8. John T. Hardy. (2003). Climate Change: Causes, Effects and Solution. John Wiley andSons Publication.
9. Mann, M.E. (2021 The New Climate War: The Fight to take back our planet, HachetteUK.
10. Nicholas Stern.(2008). The Economics of Climate Change: The Stern Review. Cambridge University Press, Great Britain.
11. Rajit Sengupta and Kiran Pandey, (2021). State of India's Enironment 2021: In Figures.Centre Science and Environment, New Delhi.
12. Roger G. Barry and Richard J. Chorley. (2007). Atmosphere, Weather and Climate, 8th Edition, Routledge Publication.
13. Shankar IAS Academy (2016). Environment 4th Edition. Chennai (India).

Semester II

GE/OE (Forensic Science)

GE 1 (BGO2T03): Introduction to Forensic Auditing, Forensic Accounting and Fraud Assessment

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Apply the principles of forensic auditing and understand the fundamental concepts of forensic auditing and its role in investigating financial irregularities.
2. Understand the different types of fraud, including financial statement fraud, employee embezzlement, and corruption schemes.
3. Utilize forensic accounting techniques, including data analysis, financial statement reconstruction, asset tracing, and forensic interviews.
4. Develop strong written and verbal communication skills to present their forensic audit findings and fraud assessment reports.
5. Collaborate effectively with other professionals, to gather evidence, analyze complex financial transactions, and build strong legal cases.

Unit-I: Basics of Forensic Auditing

Introduction to Forensic Auditing, the difference between a general audit and Forensic Audit, Legal and Regulatory Framework, Understanding the legal and ethical considerations in forensic auditing, Fraud Examination Techniques, Introduction to data analytics in forensic auditing, Investigative Procedures and Evidence Gathering, Fraudulent Financial Reporting, Case Studies and Real-World Applications, Ethical Considerations in Forensic Auditing

Unit-II: Basic of Forensic Accounting

Forensic Accounting, basics of Forensic Accounting, the difference between general and Forensic accounting, principles of Forensic Accounting and fraud examination, Roles of a forensic accountant, forensic accounting services, forensic accounting skills; critical thinking, reasoning and communication.

Unit-III: Fraud Assessment I

Introduction to fraud; definition of fraud, Role of fraud assessment in forensic auditing, Importance of proactive fraud risk management different types of frauds such as insurance frauds, management fraud, financial statement fraud (revenue and inventory related frauds), disclosure frauds (consumer fraud, identity theft, scams, money laundering), tax fraud, fraud in e-commerce.

Unit-IV: Fraud Assessment II

Nature of fraud, fraud cycle, fraud schemes and red flags. Fraud prevention and fraud detection, recognizing symptoms of fraud, fraud investigation, fraud risk assessment. Emerging Trends and Technologies in Fraud Assessment, Introduction to technological advancements in fraud assessment, Use of artificial intelligence, machine learning, and data mining in fraud detection Future challenges and opportunities in fraud assessment

GE/OE (Forensic Chemistry)

GE 1 (BGO2T03): Chemistry of Natural and Synthetic Molecules

Course Outcomes: By the end of this Course, the learners will be able to:

1. Examine the classification, structure, properties and biological importance of synthetic sugar and natural sugars and its significance in forensic science.
2. Recall and understand the fundamentals of dyes and paints along with their nature, classification, composition use and significance in forensic science.
3. Understand the nature, structure and physical properties of fats and oils.
4. Understand the structure, types, properties, preparation, and application of polymers and its significance in forensic science.

Unit I: Sugars

Introduction, Classification, Properties and Biological importance. Natural and synthetic sugars, structures of glucose, reducing and non-reducing sugars, significance in forensic science

Unit II: Dyes and Paints

Dyes & Paints: Introduction, Nature, classification, composition, uses. Paints. Components of paint: binders, pigments, solvents, additives; Role and properties of each component in paint formulation; Common types of paints and their distinguishing features. Forensic significance of Dyes and Paints.

Unit III: Oils and fats

Introduction, Structures of Fats and Oils, Physical Properties of Fats and Oils, Physical Properties of Fats and Oils, Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants: Acid value, Saponification value, Iodine value, significance and principle involved in their determination.

Unit IV: Polymers

Introduction, General idea of structures, types of polymerization processes, properties of polymers, Structure, preparation and applications of Polyethylene, Teflon, PVC, Polystyrene, etc. Significance in Forensic Science

GE/OE (Forensic Physics)

GE 1 (BGO2T03): Instrumentation Aids

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the basic principles of electromagnetic radiation and its properties.
2. Apply the appropriate electromagnetic radiation sources such as UV, visible and IR rays etc. for specific forensic analysis.
3. Understand the basic structure and basic concept of optical fiber and remembering different types of optical fibers used in forensic physics.
4. Understanding the working mechanisms of various transducers and their applications.
5. Understand the principles of detection and signal processing and the working mechanisms of different detectors and their applications.

Unit I: Electromagnetic Radiation Sources

Conventional Sources for UV, Visible and Infrared Rays, Sources of Radiations for X-Rays, Laser (Ruby, He-Ne, CO_2, Dye Laser, Semi-Conductor Laser).

Unit II: Optical Fibres

Importance of Optical Fiber, Propagation of Light Waves in Optical Fiber, Basic Structure, Stepped Index Monomode Fiber, Graded Index Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Fiber Losses and their Units (Basic Concept), Electrical and Optical Band Width, Bandwidth Length Product, Dispersion in Optical Fiber.

Unit III: Transducers

Strain Gauge, Resistance Thermometer, Thermocouple, Thermistors and its Applications, Microphone & Loudspeaker, Photo-Electric Transducers, LVDT

Unit IV: Detectors

Photographic Detectors, Thermal Detectors, Photoelectric Detectors, PMT and Semiconductor Detectors. Construction and Working Principle of Ionization Chamber, Proportional Counter, Geiger Muller Counter, Scintillation Counter, Solid State Detectors.

GE/OE (Forensic Biology)

GE 1 (BGO2T03): Basics in Microbial Forensics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the concept of microbiology, bioterrorism, bio-surveillance, biodefence, biotoxin and their aspect in forensic science.
2. Recall and understand the structure of bacteria and viruses along with their different culturing techniques.
3. Gain a comprehensive understanding of the functioning of Recombinant DNA technology and its significance in forensic science, Polymerase Chain Reaction, its history and development, different types of vectors and restriction enzymes.
4. Examine the growth curve of bacteria and analyze concepts such as reproduction of bacteria, control of bacteria and different staining technique.

Unit-I: Introduction to Microbiology

Introduction of Microbiology, History, and Development of Microbiology; Whittaker Classification system; General structure of Bacteria and Viruses; Types of culture media (basal, selective, differential, enriched, enrichment); Culturing techniques of microorganisms (Streak plate and pour plate method).

Unit-II: Bacterial Reproduction, Control, and Culture Techniques

Reproduction of bacteria; Control of microorganisms (Chemical and Physical); Growth curve of bacteria; continuous culture and synchronous culture of bacteria; Staining of bacterial cells (Simple and differential).

Unit-III: Recombinant DNA Technology and Forensic Applications

Introduction to Recombinant DNA technology (RDT): History and development; Types of vectors (Plasmid, Cosmid, YAC, BAC); Restriction enzymes; Joining of DNA molecules; Introduction to PCR; Forensic significance of RDT.

Unit-IV: Microbial Forensics, Bioterrorism, and Biological Toxins

Introduction to microbial forensics, the critical elements, the sample collection methods and guidelines, the various detection methods and the result interpretation. Bioterrorism; Types of biological agents (Category-A, B, C); Bio surveillance; Biodefence; Forensic aspects of biological toxins (Ricin, Botulin).

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Psychology)

GE 1 (BGO2T03): Basics of Clinical Psychology

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the fundamentals and characteristics of clinical psychology
2. Explore the activities of clinical psychologists, such as assessment, treatment, research, teaching, consultation, and administration.
3. Evaluate the scope and advancements in clinical psychology, including evidence-based practice, training, and different models of treatment delivery in the healthcare environment.
4. Analyze the ethical standards in clinical psychology, including principles of honesty, lack of bias, responsible caring, professional competence, and integrity in professional relationships.

Unit-I Basics of Clinical Psychology

Introduction and definition of clinical psychology, Historical overview of clinical psychology, characteristics of clinical psychology, Role of clinical psychologist, Legal, Educational, and Ethical Requirements to Be a Clinical Psychologist, Clinical Psychology and the Related Mental Health Professions. Qualification for clinical psychologist.

Unit-II: Clinical Psychologists at Work

Activities of Clinical Psychologists (Assessment, Treatment, Research, Teaching, Consultation, Administration, Employment Settings of Clinical Psychologists. Working with children and Family, working with adult, Working with people having disability and serious health issues and working with person of dementia.

Unit-III: Clinical Psychology in the 21st Century

Scope of clinical psychology, Evidence based practice, Clinical Psychology Training, Eclecticism and Integration, The Health Care Environment, Managed Care, Managed Care, Models of Treatment Delivery.

Unit-IV: Ethics in Clinical psychology

Ethical standards in clinical psychology, General principle, Value statement, honesty, lack of Bias, Responsible caring, professional competence and responsibility/ honesty and integrity in professional relationships.

GE/OE (Digital & Cyber Forensics)

GE 1 (BGO2T03): Office Automation

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the basic functions of word processing software, such as creating, editing, and formatting documents.
2. Understand the basic features of MS Word, MS office, MS excel, MS power point and Open Office Writer, calc., base, and impress respectively. for collaboration and version control.
3. Apply the MS PowerPoint and OpenOffice Impress to create visually engaging presentations of forensic findings.
4. Evaluate the effectiveness of different document formats for preserving metadata and maintaining data integrity in forensic analysis.
5. Create the design and templates for forensic reports, data analysis, or presentation purposes using MS Word, MS Excel, MS PowerPoint, or OpenOffice applications.

Unit I: Introduction to MS Office - MS Word and Open Office – Writer

MS Word - Working with Documents -Opening & Saving files, Editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Sending files to others, Using Tool bars, Ruler, Using Icons, using help, **Formatting Documents** - Setting Font styles, Font selection- style, size, colour etc, Type face - Bold, Italic, Underline, Case settings, Highlighting, Special symbols, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets & Numbering. **Setting Page style -** Formatting Page, Page tab, Margins, Layout settings, Paper tray, Border & Shading, Columns, Header & footer, Setting Footnotes & end notes – Shortcut Keys; Inserting manual page break, Column break and line break, Creating sections & frames, Anchoring & Wrapping, Setting Document styles, Table of Contents, Index, Page Numbering, date & Time, Author etc., Creating Master Documents, Web page. **Creating Tables**- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, and Formula, **Drawing -** Inserting Clip Arts, Pictures/Files etc., **Tools –** Word Completion, Spell Checks, Mail merge, Templates, Creating contents for books, Creating Letter/Faxes, Creating Web pages, Using Wizards, Tracking Changes, Security, Digital Signature. **Printing Documents–** Shortcut keys.

Free Open Source Software: OPEN OFFICE - WRITER: Introduction to Open Office Suite - Selecting the application package, working with Documents- Formatting Documents - Setting Page style- Creating Tables - Drawing- Tools - Printing Documents - Operating with MS Word documents.

Unit II: Introduction to MS Office – MS Excel and Open Office – Calc

MS Excel: Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Using help, Shortcuts, Spreadsheet types. Working with Spreadsheets- opening, Saving files, setting Margins, Converting files to different formats (importing, exporting, sending files to others), Spread sheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. **Entering &**

Deleting Data- Entering data, Cut, Copy, Paste, Undo, Redo, Filling Continuous rows, columns, Highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Data from external files, Frames, Clipart, Pictures, Files etc, Inserting Functions, Manual breaks, **Setting Formula -** finding total in a column or row, Mathematical operations (Addition, Subtraction, Multiplication, Division, Exponentiation), Using other Formulae. **Formatting Spreadsheets-** Labelling columns & rows, Formatting- Cell, row, column & Sheet, Category - Alignment, Font, Border & Shading, Hiding/ Locking Cells, Anchoring objects, Formatting layout for Graphics, Clipart etc., Worksheet Row & Column Headers, Sheet Name, Row height & Column width, Visibility - Row, Column, Sheet, Security, Sheet Formatting & style, Sheet background, Colour etc, Borders & Shading – Shortcut keys. **Working with sheets** – Sorting, Filtering, Validation, Consolidation, and Subtotal**. Creating Charts -** Drawing. **Printing. Using Tools –** Error checking, Spell Checks, Formula Auditing, Creating & Using Templates, Pivot Tables, Tracking Changes, Security, Customization.
OpenOffice-Calc - Introduction – Introduction to Spreadsheets, Overview of a Worksheet, Creating Worksheet & Workbooks, Organizing files, Managing files & workbooks, Functions & Formulas, Working with Multiple sheets, Creating Charts & Printing Charts – Operating with MS Excel documents, which are already created and saved in MS Excel.

Unit III: Introduction to MS Office-MS Access and Open Office-Base

MS Access: Introduction, Planning a Database, Starting Access, Access Screen, Creating a New Database, Creating Tables, Working with Forms, Creating queries, Finding Information in Databases, Creating Reports, Types of Reports, Printing & Print Preview – Importing data from other databases viz**.** MS Excel etc.
OpenOffice-Base – Introduction- Database Concepts – Creating a New Database, Creating Tables, Working with Forms, creating queries, Finding Information in Databases, Creating Reports, Types of Reports, Printing and Printing preview – Operating with other databases i.e. MS Access etc.

Unit IV: Introduction to MS Office-MS Power Point and Open Office-Impress

MS Power point: Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. **Creating a presentation** – Setting Presentation style, Adding text to the Presentation. **Formatting a Presentation** - Adding style, Colour, gradient fills, arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation- Inserting pictures, movies, tables etc into presentation, Drawing Pictures using Draw. **Adding Effects to the Presentation-** Setting Animation & transition effect**. Printing Handouts,** Generating Standalone Presentation viewer.
OpenOffice-Impress - Introduction – Creating Presentation, Saving Presentation Files, Master Templates & Re-usability, Slide Transition, Making Presentation CDs, Printing Handouts – Operating with MS Power Point files / slides.

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Law)

GE 1 (BGO2T03): Criminal Law I

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Understand the criminal law by interpreting and explaining the provisions of IPC 1860 related to offenses affecting the human body, offenses against property, and offenses relating to coins and government stamps.
2. Apply their knowledge of criminal law to practical scenarios.
3. Analyze legal provisions and case laws related to offenses affecting the human body, offenses against property, and offenses relating to coins and government stamps.
4. Synthesize their knowledge and skills to propose legal strategies and solutions in criminal law cases.
5. Evaluate the ethical considerations, legal principles, and forensic evidence in the investigation, prosecution, and adjudication of these offenses.

Unit I: Introduction to Indian Penal Code, 1860

Historical background**,** Jurisdiction under the Code**,** Definitions**,** Punishments**,** General Exceptions.

Unit II: Offences affecting the Human Body

Culpable homicide and Punishment for culpable homicide not amounting to murder. Murder and Punishment for murder. When culpable homicide is not murder. Punishment for murder by life-convict. Causing death by negligence. Dowry death. Abetment of suicide. Attempt to murder. Hurt and Grievous hurt. Sexual offences, Unnatural Sexual offences.

Unit III: Offences against Property

Theft, Extortion, Robbery and Dacoity. Criminal Misappropriation of Property. Criminal Breach of Trust. Receiving of Stolen Property. Cheating. Fraudulent Deeds and Dispositions of Property.

Unit IV: Offences relating to Coins, Government Stamps, etc.

Counterfeiting of coin, Government Stamps. Offences relating to Weights And Measures. Offences relating to Documents. Offences relating to Property Marks and other marks. Offences relating to Currency-Notes and Bank-Notes.

SEMESTER - II

Paper I: Introduction to Landforms (BGO2T03)

Unit I

From of Earth; atmosphere; hydrosphere; biosphere; weathering and erosion; differential weathering; products of weathering

Unit II

Concept of diastrophism; types of diastrophism – epeirogenic movements (continental building movements), orogenic movements (mountain building movements); sudden movements, slow and secular movments; evidences for upliftment of land; evidences for subsidence of land

Unit III

Development of (drainage) rivers system; identification and naming of streams; concept of drainage area, altitude, volume, slope, profiles of the land and drainage basin characteristics; stream order, stream length, mean stream length, stream length ratio.

Unit IV

River profiles; sea profiles; types of coast lines; coral reafs; ice sheets; glaciers; desertic lands.

Recommended Books

1. Arthur Holmes (1978) Principles of Physical Geology
2. Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3. Hamblin, Kenneth: The Earths' Dynamic System.
4. Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
5. Mallory and Cargo: Physical Geology.
6. Judson Kauffman and Leet: Physical Geology.
7. Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
8. Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
9. Manroe and Wicander: Physical Geology: Exploring the Earth

SEMESTER II

2. BUSINESS STATISTICS –I

Course Outcomes: This course will enable the students to

1. Translate the real word problems through appropriate statistical modellling.
2. Explain the concepts and use equations, formulae and statistical expression and relationship in a variety of context.
3. Analyze and demonstrate the statistical skill require in intensive areas in economics and business.

UNITS	TOPICS	HOURS
Unit 1	Permutations and combinations, Set theory, Logarithm, Binomial theorem, Compound interest, Annuities	**8**
Unit 2	Charts & Diagrams, Collection, Classification & Presentation of business statistical data	**8**
Unit 3	Frequency Distribution, Frequency Curve and Analysis of data	**7**
Unit 4	Measure of central tendency and Measure of dispersion	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. Fundamental of Mathematical Statistics, B L Agarwal, S. Chand
2. Business mathematics of Statistics., N.G. Das, J. K. Das, Mc Graw Hill
3. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
4. Fundamental of Mathematical Statistics, S.C. Gupta, V. K. Kapoor, Sultan Chand & Sons

INTRODUCTION TO MICROSCOPY & STAINING Course Code: BGO2T03			
GE/OE	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Microscopy I	1. Discovery of Microscope 2. Properties of Light 3. Simple Microscope 4. Compound microscope—Bright field Microscopy, 5. Principle, applications and ray diagram Dark field Microscopy,		**7.5 Hrs**
Unit-II			
Microscopy II	**Principle, applications and ray diagram:** 1. Transmission Electron microscopy 2. Scanning Electron microscopy 3. Phase-contrast microscopy, 4. Fluorescent microscopy		**7.5 Hrs**
Unit III			
Staining Techniques I	1. Stains & dyes, chromophore, auxochrome & chromogenes 2. Types of stains 2. Theories of staining 3. Staining techniques : Simple, negative staining, 4. Differential staining- Gram staining		**7.5 Hrs**
Unit IV			
Staining Techniques II	Special staining Technique 1. Acid-fast staining 2. Flagella staining 3. Endospores staining 4. capsule staining 5. Inclusion bodies staining		**7.5 Hrs**

Reference books -

1. Introduction to Microbial Techniques by Gunasekaran
2. Microbiology: Fundamentals and Applications by Ronald M. Atlas, New York: Macmillan Publication
3. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
5. Debnath M., Prasad G. B. and Bisen P. S. (2012). Microbes: Concepts and Applications. Germany: Wiley.
6. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An Application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.
7. Pierce B. E. and Leboffe M. J. (2019). Microbiology: Laboratory Theory and Application: Essentials. United States: Morton Publishing

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand the needs and basics of techniques used in observing microbes.
2.	Students will be aware of applications of basic techniques.
3.	Handling and use of microscopes for the study of microorganisms which are among the basic knowledge expected from a practicing microbiologist.

FYUGP Semester-II
Generic Elective / Open Elective Course (GE/OE-2) (BGO2T02)
(Energy Sources)

GE/OE-2 THEORY	**Hours: 04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 02**
Unit-I			
Conventional and Non-conventional energy Sources, Solar Energy	Conventional and Non-conventional energy Sources: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, Solar Energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. Solar energy utilization by Solar roof panels.		**7.5 Hrs**
Unit-II			
Ocean Energy, Tidal energy, Geothermal Energy	Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tidal energy, Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power. Geothermal Energy: Geothermal Resources, Geothermal Technologies. (02 L)		**7.5 Hrs**
Unit -III			
Hydro Energy, Biomass energy, Wind Energy	Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Biomass, biochemical conversion, biogas generation, Ocean biomass Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies		**7.5 Hrs**
Unit -IV			
Piezoelectric Energy, Electromagnetic Energy	Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power Linear generators, physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption Environmental issues and sustainability of renewable energy sources.		**7.5 Hrs**

Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhatme Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Solar Energy: Dr. P Jayakumar, Resource Assesment Handbook, 2009
6. Photovoltaics, J.Balfour, M.Shaw and S. Jarosek, Lawrence J Goodrich (USA).

Course outcomes

After the completion of this course students will be able

Sr. No	Course outcome
1.	To impart knowledge of basic concepts of Conventional and Non-conventional Energy Sources.
2.	To get the knowledge and methodology necessary for Solar, Ocean, geothermal, Hydro and Biomass energy resources.
3.	To learn the efficiency of the technology available for using source of energy and the environmental impact of using that source.
4.	To apply the knowledge of Energy Sources to real life problems.
5.	To create scientific temperament related to Energy Sources.

	Semester II (GE/OE)
	Name of the Paper - Statistical Methods And Psychological Testing
	Paper code – (BGO2T03) 2 Credits (2 hrs Theory per week)
	Course Objectives
	To introduce basic statistical methods, psychological testing and qualitative methods and their uses.
	Course Outcomes (CO)
	Statistical methods play a critical role in the field of psychology by helping researchers to draw meaningful conclusions from their data. It is important for psychologists to have a solid understanding of statistical methods so that they can design effective studies and accurately interpret their findings. After the successful completion of the course, the students will have knowledge of different psychological testing and qualitative methods and their uses.
	CONTENTS
	Unit 1 (15 Hrs)
(A)	**Data:** Ungrouped and grouped, frequency distribution. Graphical representation of data: Histogram and Frequency Polygon. Primary and Secondary data,; Tabulation of data; Graphs and charts; Frequency distributions;
(B)	**Application:** Diagrammatic presentation of data ,Graphical representation
(C)	**Data analysis** **Measures of central tendency**: Mean, Median, Mode (Properties and Computation of grouped & ungrouped data) **Application**: Computation of statistical problems.
(D)	**Measures of Dispersion** Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data. Computation of standard deviation
(E)	**Correlation**: Meaning & types: Spearman's Rank Correlation
	Pearson's Product Moment correlation , Normal Probability Curve (NPC): Properties
	Unit II (15 Hrs)
(A)	**Test of Significance**: All applications of Chi Square test , All applications of 't' test.
(B)	**Psychological Testing**: Introduction to psychological testing, characteristics of Psychological test, Reliability, Validity, Norms and standardization. Types of tests.
(C)	**Qualitative methods:** Methods of data collection - Interview, observation, case study.
(D)	**Application:** Use of psychological test in day to day life
	References
1	Chadha, N. K. (1991): Statistics for Behavioral and Social Sciences. Reliance Pub. House: New Delhi.
2	Garrett, H. E. & Woodworth, R. S. (1987): Statistics in Psychology and Education. Mumbai, Vakils, Feffer & Simons Pvt. Ltd.
3	Gregory, R. J. (2006): Psychological Testing: History, Principles, and Applications (4th Ed.) New Delhi: Pearson Education
4	King, B. M. & Minium, E. W, (2007): Statistical Reasoning in the behavioral Sciences USA: John Wiley & Sons

GE/OE for B.Sc. II Industrial Entomology BGO2T03

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the Mulberry sericulture
- Understand, describe and explain Tasar sericulture.
- Understand, describe and explain Eri sericulture
- Understand, describe and explain lac culture.
- Understand, describe and explain agricultural and medical pests.
- Understand, describe and explain apiculture.

Unit 1- Mulberry sericulture

1.1 Mulberry sericulture:- life history and rearing.

1.2 Silk gland of mulberry silkworm:- structure and silk synthesis.

1.3 Cocoon formation, cocoon harvesting and reeling.

1.4 Mulberry plantation and silkworm rearing house.

Unit 2- Tasar sericulture

2.1 Tasar silkworm biology and life cycle.

2.2 Mature tasar larvae, silk gland and silk proteins.

2.3 Hammock and cocoon formation, cocoon harvesting.

2.4 Natural host plants and predators of tasar silkworm.

Unit 3- Eri, lac culture , agricultural and medical pests

3.1 Eri silkworm biology and life cycle.

3.2 Lac insect- biology, lac cultivation and economic importance.

3.3 Agricultural pest: pest of paddy, pest of vegetables, pest of stored grain

3.4 Insect vectors spreading diseases in human (Malaria, Filarial, Kala- Azar).

Unit 4- Apiculture

4.1 Types of honey bees, *Apis dorsata, A. indica and A. melifera*.

4.2 Colony formation and Apiary products.

4.3 Beekeeping techniques: moveable frame hive and bee rearing management.

4.4 Economic importance honey, wax and other apiary products.

Suggested reading:

K.K. Nayar, T. N. Ananthkrishan and B.V. Davis. General and Applied Entomology, Tata McGraw -Hill Co.Ltd., pp. 589.

D. B. Tembhare. Modern Entomology(Second edition):, Himalaya Publication House.

C. L. Metcalf, W. P. Flint and R. I. Metcalf . Destruction and Useful Insect, Their Hanits and Control, , Mc Grow I Ill Co. New York.

H. S. Dennis. Agriculture Entomology, , Timber Press Inc.

Alford V. David. Text Book of Agriculture Entomology, Blackwell Science.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
GE/OE - Computer Application in Design (BGO2T03)

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours

Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: **(3 Hours)**

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : **(4 Hours)**

Out Put Device

2.1 Printers
2.2 Classification of Printers
2.3 Plotters

Unit III: **(4 Hours)**

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: **(4 Hours)**

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: **(30 Hours)**

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation, Consolidation, Subtotal
2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video. Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

GE/OE Basket Semester II
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
II	**GE/OE**	1	Hydroponics and Plant Growth Regulators	Botany	**BGO2T04**
		2	Antimicrobial Resistance	Biochemistry	
		3	Bioethics and Biosafety in Biotechnology	Biotechnology	
		4	Web Technologies	Computer Science	
		5	Home Automation	Electronics	
		6	Environmental Disaster and Management	Environmental Science	
		7	A. Forensic Gemology / B. Chemistry of Drugs / C. Introduction to Forensic Ballistics / D. Basics of Biostatistics and Bioinformatics/ E. Basics of Psychology (Psychology)/ F. Internet & Web Development/	Forensic Science	
		8	Tools and Techniques in Geology	Geology	
		9	Basic Chemistry- II	Home Science	
		10	Business statistics II	Mathematics	
		11	Statistics for Economics	Statistics	
		12	Fish farming	Zoology	
		13	Organic Chemistry	Cosmetic Technology	
		14	Chemical Processing-II	Fashion Design	
		15	Chemical Processing-II	Textile Science	

B. Sc. Semester-II
GE / OE-4 Botany (BGO2T04)
Hydroponics & Plant Growth regulators.

GE/OE-IV Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. **Hydroponics:** Introduction, Scope and Importance of Hydroponics, Differenttypes of hydroponic systems, NFT and DWC 2. Methods of hydroponic farming in tomato, spinach and cucumber. 3. Commercial Aspects of Hydroponics- Concept and importance of post-harvest management including cooling, cleaning, sorting, grading and packaging 4. Advantages and disadvantages of Hydroponics.	7.5 Hrs.
Unit-II	
1. Mineral nutrition –sources and types (Macro and Micronutrients) 2. Role and deficiency symptoms of Macronutrients – Nitrogen, Phosphorus, Potassium and Calcium. 3. Role and deficiency symptoms of Micro nutrients – Iron, Manganese, Boron and Zinc. 4. Government Schemes for hydroponics	7.5 Hrs.
Unit-III	
1. Plant growth regulators (Phyto-hormones) – i. Definition, Natural and synthetic, Auxins- Discovery, occurrence, Distribution,Structure. ii. Synthetic auxins – IPA, IBA, NAA, 2,4-D, 2,4,5-T iii. Effect of auxins on plant growth and development. (cell elongation and cell division, apical dominance, phototropism, geotropism and sex expression) iv. Uses of auxin in rooting, seedless production, promotion of flowering and tissue culture. 2. Gibberellins – History, types, structure, GAs, regulation by environment and its role in seed development and other physiological functions.	7.5 Hrs.
Unit-IV	
1. **Cytokinins-** History, structure, function, mode of action and uses. 2. **Ethylene -** History, structure, properties, function, properties and production. 3. **Abscisic acid (ABA) –** Discovery, structure, function, location and timing ofbiosynthesis, effect.	7.5 Hrs.

Suggested Readings:

1. How to Hydroponics 4th Edition by Keith Roberto
2. Hydroponic Grower Books Varieties
3. Hydroponics for the Home Grower by Howard M. Resh
4. Hydroponic Tomatoes by Howard M. Resh
5. Commercial Hydroponics by John Mason
6. Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production byOyokiKozai
7. The Hydroponics Gardening Guide to Growing Your Own Vegetables, Fruits and HerbsRiley Brown
8. The Ultimate Beginner's Guide to Container Gardening in Urban Settings. Roger Grant
9. Plant Growth Regulators Signaling Under Stress Conditions (Hb 2021) by Aftab T , Springer
10. Plant Growth Regulators Bio-stimulants and Chemicals on Horticultural Crops by Rajangam, J, A Subbiah, C Rajamanickam, K S Vijai Selvaraj, P Balasubramanian, T Sivakumar & K Balakrishnan, Satish Serial Publishing House
11. Plant Growth Regulators in Fruit Science by J.S. BAL
12. Plant Physiology by Ross, Salisbury (1999) CBS
13. Biochemistry- Plummer (1989) Mc Graw hills Publication
14. Plant Biochemistry - Day and Harborne (2000)
15. Introductory Plant Physiology Glenn Ray Noggle, George John Fritz

GE / OE- 4 - (Biochemistry)

Semester 2

ANTIMICROBIAL RESISTANCE (AMR) – (BGO2T04)

COURSE OBJECTIVES

After completion of the course students will be able to:

1. Learn about the global health challenge called Antimicrobial resistance(AMR)
2. Describe the role and importance of antibiotics, their sources and learn to categorize them on the basis of mechanism of action.
3. Enumerate and describe how bacteria can become resistant and the mechanisms that may be involved in that process
4. Describe how antimicrobial resistance emerges and spreads around the world
5. Understand the need for alternative therapeutics and global scenario on AMR.

UNIT 1

Antimicrobials and their action: Definition, natural sources, Antibiotics and antibiotic resistance in the pre-antibiotic era, Modern antibiotic era, classes of antibiotics, Antibiotic resistance(AMR): origin and current status. AMR in Agriculture, AMR in animals

UNIT 2

Mechanism of action of antibiotics: Inhibition of cell wall synthesis, Inhibitors of protein synthesis, Inhibitors of membrane function, Inhibitors of nucleic acid synthesis, antimetabolites

UNIT 3

Mechanism of resistance development: Drug resistant mutations in bacteria, antibiotic target modification, modifying cell wall permeability, Acquired resistance from gene transfer, antimicrobial efflux pumps, Bacterial biofilms, metabolic modifications, ESKAPE pathogens, Concept of MDR.

UNIT 4

AMR Challenges and threat, Sources of Antibiotic Resistance: Zoonotic, Human and Environment, causes of the antibiotic resistance crisis (drug related, patient related, environment related etc.), Strategies to overcome AMR, New approaches for alternatives to antibiotics, Role of WHO in AMR awareness.

List of Books:

1. Antimicrobial Resistance-Underlying Mechanisms and Therapeutic Approaches by Vinay Kumar, Varsha Shriram, Atish Paul, Mansee Thakur, Springer Singapore, Published: 03 January 2022
2. Antibiotics: Targets, Mechanisms and Resistance, Editor(s):Claudio O. Gualerzi, Letizia Brandi, Attilio Fabbretti, Cynthia L. Pon, Wiley-VCH Verlag GmbH & Co. KGaA, First published:4 October 2013
3. The End of an Antibiotic Era,Bacteria's Triumph Over a Universal Remedy By Rinke van den Brink · 2021 3 April 2019,
4. Antimicrobials, Antibiotic Resistance, Antibiofilm Strategies and Activity Methods; Publisher: IntechOpen, Editor:Sahra Kırmusaoğlu
5. Antimicrobial Stewardship: Principles and Practice 1st Edition,by K. LaPlante (Editor), Cheston Cunha (Editor), H. Morrill (Editor), Louis Rice (Editor), Eleftherios Mylonakis (Editor)

Open Elective Courses

SEMESTER – II

BIOETHICS AND BIOSAFETY IN BIOTECHNOLOGY

Course Code: BGO2T04 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Give an insight about the morals and principles while working in the field of biology.
CO 2. Make the students aware of the issues arising per while handling and developing genetically engineered organisms and laboratory animals.
CO 3. Understand the risks involved and the regulations to be followed when experimenting with biological samples.
CO 4. Develop a perception about the practices to be followed in a biotechnology laboratory and the management of the laboratory waste.

UNIT I 7 hours

An introduction to Bioethics; Medical ethics and environmental ethics; Concepts of Bioethics: Autonomy, Justice, Beneficence, Non-Maleficence; Control, resolution, and enforcement of regulations; Ethical committees and constitution

UNIT II 8 hours

Bioethics in health care: patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation; Bioethics in research: cloning and stem cell research, Human and animal experimentation, animal rights/welfare; Genetically engineered food, environmental risk, labelling and public opinion

UNIT III 7 hours

Introduction to biosafety and biosecurity; Biological hazards: types; primary containment for biohazards; introduction to biological safety cabinets; Risk assessment: HACCP and management (Assessment, Mitigation and Performance), International Guidelines regarding Biosafety and Biosecurity: OIE, WHO, NIH, CDC

UNIT IV 8 hours

Biosafety Levels: High risk micro-organisms and their management; Good Laboratory Practices (GLPs) and Good Manufacturing Practices (GMPs); Bio-waste Management; Plant biosafety, Principles of safety assessment of transgenic plants – sequential steps in risk assessment

References:

- Kuhse, H. (2010). *Bioethics: an Anthology*. Malden, MA: Blackwell

- Karen F. Greif, Jon F. Merz - Current Controversies in the Biological Sciences_ Case Studies of Policy Challenges from New Technologies (Basic Bioethics)-The MIT Press (2007)

- V. Sreekrishna - Bioethics and Biosafety in Biotechnology-to New Age International Pvt Ltd Publishers (2007)

- Padma Nambisan (Auth.) - An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology- Academic Press (2017)

- Kshitij Kumar Singh (auth.) - Biotechnology and Intellectual Property Rights_ Legal and Social Implications-Springer India (2015)

- David Castle - The Role of Intellectual Property Rights in Biotechnology Innovation (2011)

- Goel, D., & Parashar, S. (2013). *IPR, Biosafety and Bioethics*. Pearson Education India.15. Guidelines for Safety Assessment of Foods Derived from Genetically Engineered Plants. 2008.

- Alonso, G. M. (2013). *Safety Assessment of Food and Feed Derived from GM Crops: Using Problem Formulation to Ensure "Fit for Purpose" Risk assessments*

B.Sc. Sem-II (Computer Science)
BGO2T04

WEB TECHNOLOGIES

Credits : 2 **Duration : 30 Hours**

Course Objectives:
1. To comprehend and analyse the basic concepts of web programming and internet protocols.
2. To describe how the client-server model of Internet programming works.
3. To demonstrates the uses of HTML and DHTML.

Course Outcome:
After completing this course satisfactorily, a student will be able to:
1. Differentiate web protocols and web architecture.
2. Apply HTML and DHTML effectively to create websites.

UNIT I :

Introduction to Internet, History of Internet, Internet users, Internet working, Information on Internet, Requirements for connecting to Internet, Basic Internet Terms, Introduction to world wide web, Evaluation of world wide web, basic features, web browsers, popular web browsers, web servers, HTTP, URL, Search Engines, Search Engines categories, how to use Search Engines, Searching criterion.

UNIT II :

HTML: Introduction, Objective, HTML Browsers, Windows Switching, HTML Command Tags, URLs, links, new web page creation, main body of the text, putting headers, adding paragraph , formatting text in HTML and font mechanism, Color settings, superscripts and subscripts and other manipulations on text and paragraphs, using directory and menu lists, creation of links, inserting graphics, using images, all manipulations on tables and its display, Detailed working with forms, allowing visitors to upload files, active images ,working with frames & framesets, Frames handling, scroll bars, alternatives to frames,

UNIT III :

Introduction to browsers, Working with e-mail, Parts of e-mail text, working with messages.
DHTML: using DHTML in internet explorer, heading and horizontal line, hidden message, the message at the center of the page, moving boxes ,changeable box.

UNIT IV :

Cascading style sheets
Introduction to css, creating style sheets, common tasks with CSS, Colors, the font -family, font metrics ,length units ,absolute units ,relative units ,the pixel unit ,percentages as values ,keywords as values, various properties such as the font -size property, font -size property etc, Assigning classes ,tags and attributes for applying classes, applying classes to an HTML tag, applying classes to other document parts ,the layer tag, CSS Tags

Books

1. Internet and web design by R Bangia, Second edition , firewall media
2. Multimedia and Wed technology by R Bangia
3. Internet and web designing by ITELS (Macmillan)
4. Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl by Ivan Bayross
5. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson Education, PHI.
6. Internmet Programming with VBScript and Java Script. Kathhleen Kalata, (Thomsaon Publication)
7. Programming the World Wide Web By. Robert W. Sebesta. (Pearson)
8. Web Technology Theory and Practice By: M Srinivasan (Pearson Publication)

Semester – 2; OE2: Home Automation

Course outcome:

At the end of this course students will have ability to

1. Understand concept of Home automation
2. Able to deploy modules of Home Automation
3. Explain the connectivity issue associated with home automation4 Describe the tools and products used in home automation

Syllabus:

1. Concept & Need of Home automation, Historical Review of development, Current concepts in home automation, Basics of IoT, Sectors & types of control, Surveillance
2. Home automation & connectivity, WiFi, Cloud/ Bluetooth/ Cellular, Alexa ecosystem, Lights/appliances/climate control,
3. Video, cameras, Security/locks, entry system, fluid & Gas control , Sensors 4 Development Boards, Modules, Cyber/security, Designing of typical systems.

Books :

The Smarthome Book: Simple ideas to assist with your smarthome renovation by Andrew Howe

Smart Smart Home Handbook: Connect, control and secure your home the easy way: Control Your Home With Your Voice by Adam Juniper

The Smart Home Manual: How To Automate Your Home To Keep Your Family Entertained, Comfortable, And Safe by Marlon Buchanan

Alexa User Manual: The Illustrated Alexa User Guide - Hacks, Tips & Skills for All Amazon Alexa Devices, Including Other Smart Home Integrations by Gregory McGuire

GE/OE -4: Environmental Disaster and Management

Unit: I:

Natural Disasters: Meaning and nature of natural disaster, their types, causes and effects, Hydrological disasters (Flood, Flash flood, Drought and Cloud burst), Geological disasters (Earthquake, Volcanic eruption, Landslides, Avalanches, Tsunami and Mud flow).

Man-made Disaster: Man-made Disaster: Meaning and nature of man-made disaster, their types, causes and effects, Chemical, Biological, Radiological and Nuclear disaster, Fire (Building fire, coal fire, forest fire and oil fire), Accidents (Road, rail, air and sea accidents).

Unit: II:

Risk Assessment: Risk concept, Elements of risk, Role of Science and Technology in Disaster Risk Reduction, Strategies of risk reduction, Decision making for risk reduction, Problems in risk assessment.

Vulnerability: Observation and perception, vulnerability identification, vulnerability types and dimensions, Vulnerability (social & economic factor). Physical and social infrastructure for vulnerability reduction, Hazard resistant design and construction, systematic management and strategic planning for vulnerability reduction.

Unit: III

Disaster preparedness: Concept and significance, Disaster preparedness measures, Institutional mechanism for disaster preparedness, Policy and programme of disaster preparedness. Role of Government, NGOs and Information technology in Disaster preparedness.

Disaster Response: Essential components of disaster response, Disaster Response Plan (Communication, Participation and Activation of Emergency preparedness Plan), Search, Rescue, Evacuation and Logistic management, Relief and Recovery, Rehabilitation and Reconstruction.

Unit: IV

Mitigation and Management Techniques: Mitigation and Management techniques of Disaster, Training, awareness program and project on disaster management Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, National and State Bodies for Disaster Management.

Global Initiatives for Disaster management : GDPRR- Global platform for Disaster Risk Reduction, , AMCDRR – Asian Ministerial Conference on Disaster Risk Reduction, SENDAI Framework, SDG 11.5 – Reduce the adverse Effects of Natural Disasters, CDRI – Coalition for Disaster Resilient Infrastructure.

Reference Books:

1. Textbook of Environmental studies by Benny Joseph , *McGrew-Hill Publishing Company Limited.*
2. Disaster Management by Mukesh Dhunna, *Vayu Education of India, New Delhi, 2009First edition.*
3. Introduction to Environmental Science *by G. Tyler Miller, Jr. Scott Spoolman, Cengage learning Publication.*
4. Environmental Science by S.C. Santra, *New Central Book agency Pvt. Ltd. Kolkata ,India.*
5. Environmental Management *by H.P. Behera and M.S. Khan, Himalaya Publication.*
6. Disaster Management Programmes And Policies *by Siddhartha Gautam K LeelakrishaRao, Publication - Vista International.*
7. Introduction To Disaster Management *,by B.C.Bose 46 ,Rajat Publishers.*
8. Global Disaster Management ,*by Arun Kumar, SBS Publishers.*
9. Handbook Of Disaster Management (2 Vol.set) , *Author : Reepunjaya Singh ,ABD Publishers.*
10. Handbook of Disaster Management *William L. Waugh 2005.*
11. Disaster Management : Text and Case Studies *D.B.N. Murthy Jain Book Agency 2000.*
12. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
13. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
14. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
15. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.

    Modh S. (2010) Managing Natural Disasters, Mac Millan Publications

GE/OE (Forensic Science)

GE 2/A (BGO2T04): Forensic Gemology

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and recognize the fundamental concepts and terminology of gemology, including gemstone types, properties, and classification.
2. Demonstrate comprehension of the various techniques and instruments used in gemstone analysis, such as microscopic examination, spectroscopy, and X-ray techniques.
3. Apply analytical skills to identify and differentiate gemstones, including natural gems, synthetic gems, and treated gemstones, using appropriate laboratory techniques and instruments.
4. Analyze and evaluate gemstone origin through the interpretation of geological processes, gemstone deposits, and advanced techniques like elemental analysis, stable isotope analysis, and inclusion analysis.
5. Evaluate the forensic applications of gemology in real-world scenarios, including the identification of stolen jewellery, gemstone fraud, smuggling cases, and the role of gemstone analysis in trace evidence analysis and expert testimony.

Unit 1: Introduction to Forensic Gemology

Introduction to forensic science and its application in gemstone investigations. Basics of gemology: gemstone types, properties, and classification. Legal and ethical considerations in forensic gemology. Introduction to gemstone identification methods and instruments.

Unit 2: Gemstone Analysis Techniques

Microscopic examination: magnification, gemstone inclusions, and identifying synthetic gems Spectroscopy techniques: absorption, emission, and Raman spectroscopy. X-ray techniques: XRD (X-ray diffraction) and XRF (X-ray fluorescence). Advanced analytical techniques: FTIR (Fourier Transform Infrared Spectroscopy), UV-Vis (Ultraviolet-Visible Spectroscopy), and LIBS (Laser-Induced Breakdown Spectroscopy)

Unit 3: Gemstone Origin Determination

Geological processes and gemstone formation. Gemstone deposits and their characteristics. Geographic origin determination techniques: elemental analysis, stable isotope analysis, and inclusion analysis. Synthetic gemstone identification and differentiation.

Unit 4: Forensic Applications of Gemmology

Gemstone identification in forensic investigations: stolen jewellery, gemstone fraud, and smuggling cases. Trace evidence analysis using gemstones. Expert testimony and legal considerations. Case studies and real-world examples of forensic gemology.

GE/OE (Forensic Chemistry)

GE 2/B (BGO2T04): Chemistry of Drugs

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to pharmaceutical drugs, including drug classification, drug dependence, and examples of common drugs.
2. Understand the principles, practices, and challenges of pharmaceutical drugs in contemporary society, including the differences between narcotic drugs, psychotropic substances, and plant drugs.
3. Apply the knowledge and skills required to properly classify and identify different types of pharmaceutical drugs, including understanding the chemical composition, characteristics, and therapeutic applications of specific plant drugs.
4. Analyze the mode of action of antibiotics, including the chemistry and classification of penicillin, chloramphenicol, streptomycin, and tetracyclines, and their importance.
5. Evaluate the risks and benefits of using pharmaceutical drugs, including the potential for drug dependence and the ethical considerations surrounding the use of certain types of drugs.

Unit I: Pharmaceutical Drugs

Introduction, Classification, Origin of Drugs, Natural Drugs, Synthetic Drugs, Drug Dependence - Physical Dependence, Psychological Dependence, Analgesic, Antipyretic, Antibiotics and anti-histamines (examples of common drugs).

Unit II: Narcotic drugs and Psychotropic Substances

Introduction, Classification, Sign and Symptoms, Tolerance, Drug Dependence - Physical Dependence, Psychological Dependence, depressants, stimulants, hallucinogens and sedatives.

Unit III: Plant drugs

Introduction to Plant Drugs: Definition and significance, Historical background and cultural uses, Importance in traditional medicine systems. Overview of medicinal plants and their classification, Characteristics and therapeutic applications of the following plant drugs – Tulsi, Turmeric, ginger, Giloy, Garlic, Aloe vera, etc.

Unit IV: Antibiotics

Definition, Introduction and significance of antibiotics, Historical background and discovery of antibiotics, Importance in medicine and healthcare, Classification of antibiotics based on chemical structure and mechanism of action. Chemistry and mode of action of penicillin, chloramphenicol, streptomycin and tetracyclines etc.

GE/OE (Forensic Physics)

GE 2/C (BGO2T04): Introduction Forensic Ballistics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the various types of firearms commonly used in forensic investigations.
2. Understand the principles of ballistics and firearm identification, including the concepts of rifling, bullet trajectories, and gunshot residue analysis.
3. Analyze ammunition-related evidence, such as cartridge cases, bullet fragments, and firearm markings, to determine the type of firearm used, the sequence of shots, propellants and potential links between firearms and crime scenes.
4. Recall the fundamental concepts and principles of internal ballistics, including the ignition of propellant, pressure development, and projectile acceleration inside a firearm barrel.
5. Understand the factors influencing terminal ballistics, such as bullet design, velocity, target composition, and angle of impact, and how they affect the behaviour of projectiles during a shooting incident.

Unit I: Firearms

Early Fire Arms, Hand Cannons, Matchlock, Wheel Lock, Snaphaunce, Flintlock, Percussion System, Cartridge System, Centre Fire System, Dreyse Needle, Smooth Bore Firearms, Rifling, Revolver, Pistols, Actions of Firearms, Shotgun, Sub Machine Gun, Machine Gun, Improvised Firearms.

Unit II: Ammunition

Propellants- Black Powder, Smokeless Powders, Primers- Berdan Primer, Boxer Primer, Primer Cap Types- Rim Fire, Centre Fire, Pin Fire. Caseless, Blank Ammunition, Tear Gas, Grenade Launcher, Dummy, Cartridge Cases - Rimless, Semi Rimmed, Rimmed, Belted. Bulletsand Its Types, Components of Shotgun Ammunition.

Unit III: Internal Ballistics

Energy Considerations, Initiation, Combustion of Propellants, Density of Loading, Atmospheric Temperature, Shape of the Cartridge Case. Heat Problems, Barrel Pressure and Its Determination, Recoil, Measurement of Recoil, Vibration and Jump, Barrel Fouling.

Unit IV: Terminal Ballistics

Introduction, Stopping Power of Bullet, Shockwave and Cavitation Effect, Wounding Mechanism, Elements of Wound Ballistics; Nature of Target, Velocity of Projectile, Constructional Features of Projectile. Range.

GE/OE (Forensic Biology)

GE 2/D (BGO2T04): Basics of Biostatistics and Bioinformatics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Gain a solid understanding of different types of sampling, data collection techniques and statistical techniques in reference with biostatistics.
2. Develop the understanding of concepts such as mean, median, mode, range, standard deviation, variance, probability, corelation and regression and distribution curves along with their significance.
3. Learn techniques to retrieve database and methods of deposition of database using different tools by understanding the formats and contents of data entries.
4. Gain a comprehensive understanding of Entrez, PubMed, DDBJ, DMBL.
5. Examine the properties of protein and nucleic acid sequence and understand the concept of comparative genomics along with their application.

Unit-I: Introduction to Biostatistics

Sampling techniques; Data collection; tabular and graphical representation of Data; Analysis of Mean, mode, median, range, variance, standard deviation and standard error (with examples).

Unit-II: Test of significance

Z-test, T-test and Chi-square test; Probability Distribution: Binomial Poisson and Normal distribution; Correlation and linear regression; Analysis of variance; ANOVA; One-way and two-way classification.

Unit-III: Databases

Introduction to databases with respect to organization of data; contents and formats of database entries; retrieval of data using text-based search tools; sources of data; method for deposition of data to databases; Introduction to Entrez, PubMed, DDBJ, EMBL.

Unit-IV: Proteomics and Genomics

Protein and nucleic acid sequences properties: Proteomics tools at the ExPASy server and GCG utilities and EMBOSS; Comparative genomics: Basic concepts and applications.

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Psychology)

GE 2/E (BGO2T04): Basics of Psychology

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Define the fundamental concept of psychology, goals, types of psychological profession including its historical and modern perspective.
2. Analyse the structure and functioning of neurons, neurotransmitters, brain, central nervous system, peripheral nervous system etc.
3. Understanding the concept of learning, its definitions, and apply its knowledge to operant and classical conditioning along with their application and explanation with experiments.
4. Develop and implement the concept of memory and forgetting, types of memory, levels of processing theory and their physical aspects.

Unit I: The Science of Psychology

What is Psychology? definitions, goals, types of psychological professions, Historical perspectives in psychology: Structuralism, Functionalism, Gestalt, and Psychoanalysis. Modern perspectives in psychology: Behaviouristic, Humanistic, Bio-psychological, and Cognitive.

.

Unit II: Biological Foundation of Behaviour

Neuron: Structure, function, synapse, and neurotransmitters, Central Nervous System - Brain: Structure and function of brain; (ii) Cerebral hemispheres, Spinal cord- (i) Structure and function of brain, Peripheral Nervous System: Structure and function, Autonomic Nervous System, Somatic Nervous system, Glandular system.

Unit III: Learning

Learning: Definition, Classical Conditioning: Pavlov's experiment, extinction, spontaneous recovery, generalization, discrimination, higher-order conditioning. Operant Conditioning: Thorndike's Laws of learning, Skinner's experiment, positive reinforcer, negative-reinforcer, schedules of reinforcement, shaping. Cognitive Learning Theories Tolman's Latent Learning, Kohler's Insight Learning, Bandura's Observation Learning Theory., Application of classical and operant and classical conditioning to everyday life.

Unit IV: Memory

Memory: definition and Process, The information-processing model: Three stages of memory Sensory, Short-term, Long term. Types of long-term memory- Procedural, Declarative (episodic, semantic), Explicit and implicit. Levels of processing theory. Forgetting: Course of forgetting (Ebbinghaus' forgetting curve) Causes of forgetting (encoding failure, decay of memory traces, interference, motivated forgetting). Physical aspects of memory.

GE/OE (Digital & Cyber Forensics)

GE 2/F (BGO2T04): Internet and Web Development

Course Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of the fundamental concepts, principles, and protocols of the internet, World Wide Web, HTML, and JavaScript.
2. Demonstrate a deeper understanding of the internet, World Wide Web, HTML, and JavaScript by interpreting and explaining concepts, protocols, and standards.
3. Apply their knowledge and skills in practical scenarios.
4. Develop the ability to analyze internet-based artifacts and web applications.

Unit I: **Internet**

History of internet, the early years, The global Internet, A global information infrastructure, Review of packet switching and its relevance to the internet, topologies, Routers, Dial-up access, IP address. Transmission Control Protocol (TCP), Domain names, Names and IP address, TCP/IP, Flexibility, Reliability and efficiency.

Unit II: **World Wide Web (WWW)**

Browsing the World Wide Web (WWW), HTML, Web page design with HTML, Features and importance of HTML, Advanced WEB technologies.

Unit III: **HTML**

General Introduction to Internet and WWW, Text tags, Graphics, Video and Sound Tags, Link and Anchor Tags, Table Tags, Frame Tags, Miscellaneous tags (layers, image maps etc), CSS, DHTML, HTML Forms and Fields.

Unit IV: **JavaScript**

Basic data types; control structures; standard functions; arrays and objects, event driven programming in Javascript; Example Applications.

Paper II: Tools and Techniques in Geology (BGO2T04)

Unit I

Thin section and polished section making; Sample etching, staining and model count techniques; heavy mineral analysis and paleocurrent interpretation; principle and geological application of X ray defractometry.

Unit II

Use of MS WORD in writing geological texts for fields; use of MS Excel in computing mineral variations, mean, average, standard deviation, covariance; use of MS Power Point in preparing geological texts for presentation.

Unit III

Use of computers in inserting geological pictures in geological reports; use of computers in inserting clip arts in geological reports; use of computers for illustrations by shapes – lines, basic shapes, block arrows, basic charts, callouts and stars and banners; use of computers in inserting symbols, equations.

Unit IV

Use of computers in insertion of columns, line charts, pie charts, bar charts, area charts, scatter diagrams in geological reports; addition of page numbers in WORD file; word counts; setting of margins, page orientation, page-size selection; addition of line numbers.

Books Recommended:

No Textbook - only handouts and web pages

SEMESTER II

5. BUSINESS STATISTICS –II

Course Outcomes: This course will enable the students to

1. Integrate concept in international & national business concept with functioning of global trade.
2. Evaluate the legal, social and economic environment of business.
3. Apply decision-support tools to business decision making.
4. Will be able to apply knowledge of business concepts and functions in an integrated manner.

UNITS	TOPICS	HOURS
Unit 1	Moments- Central & Non-Central Moments, Beta & Gamma Coefficients, Skewness, Kurtosis.	**8**
Unit 2	Correlation and Regression, Bivariate Data, Covariance, Correlation Data, Rank Correlation.	**8**
Unit 3	Probability and Probability Distribution, Attributes	**7**
Unit 4	Interpolation, Finite Differences, Newton's Forward & Backward Interpolation Formulae, Index Numbers, Time series Analysis.	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. Business mathematical Statistics., N.G. Das, J. K. Das
2. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill, New Delhi.
3. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
4. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.
5. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
6. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd., Calcutta.
7. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press, Calcutta.
8. Fundamentals of Applied Statistics, S. C . Gupta and V. K. Kapoor, Sultan Chand and Sons, New Delhi.

	Semester II (GE/OE)
	Name of the Paper - Statistics for Economics
	Paper code – (BGO2T04) 2 Credits (2 hrs Theory per week)
	Course Objectives
	The objectives of this paper are to acquaint the students of economics with basic methods of data analysis in Economics using statistical tools/models. The paper aids the students of economics in understanding the importance of decision in determining the choice
	Course Outcomes (CO)
	After the successful completion of the course, the students will have knowledge of basic statistical tools required in Economics.
	CONTENTS
	Unit 1 (15 Hrs)
	Introduction to Statistics **Statistics-** Meaning, Scope, Importance and Limitations; Sources of Data-Primary and Secondary;
	Classification of Data Qualitative and Quantitative; Geographical ,cross sectional and time series data; discrete and continuous data; frequency and non-frequency data
	Scales of measurement - Nominal, Ordinal, Interval and Ratio;
	Frequency and Tabulation of Data. Ungrouped and grouped, frequency distribution. Graphical representation of data: Histogram and Frequency Polygon. Primary and Secondary data,; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of data
	Measures of Central Tendency: Mean-Arithmetic, Harmonic and Geometric, Median and Mode;
	Unit 2 (15 Hrs)
	Measures of Dispersion: Range, Inter-quartile Range, Mean Deviation, Standard Deviation and Co-efficient of Variation
	Correlation- Meaning and Types-Simple, Partial and Multiple Correlation; . Measures of Correlation-Karl Pearson and Spearman‟s Rank Correlation; **Regression**- Meaning and Types Simple Regression and Multiple Regression Analysis and its Applications
	References
1)	Gupta, S. P. (2012): Statistical Methods, S. Chand and Sons, Educational Publishers, New Delhi.
2)	2) Gupta, S.C. and Kapoor, V. K. (2016): Fundamentals of Applied Statistics, 3 rd Edition, Sultan Chand & Sons, New Delhi.
3)	3) Monga, G. S. (2015): Mathematics and Statistics for Economics, Second Revised Edition,Vikas Publishing House, Pvt. Ltd. New Delhi.
4)	4) Salvatore, D. (2015): Mathematics and Statistics, Schaum‟s Series, Tata McGraw Hill

GE/OE for B.Sc. II Fish Farming BGO2T04

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain suitable aquaculture fish on specific criteria.
- Understand, describe and explain construction and management of fish pond.
- Understand, describe and explain breeding techniques.
- Comprehend the status of freshwater resources.
- Evaluate economically important freshwater biological resources for their commercial utilization.
- Adjudge different types of rearing process and steps along with procedure involve in preparation and management of nursery and rearing pond of fish culture.
- Understand, describe and explain the marketing of fish.
- Understand, describe and explain various diseases in fishes.

UNIT- I

1.1 Cultivable species of fish (Indian carps, exotic carps and other economic important fishes), Growth and fecundity.

1.2 Construction of fish farm: Selection of site, topography, layout of fish farm, Types of fish ponds (Nursery, rearing and stocking ponds), Construction of various ponds.

1.3 Management of fish pond: Pre-stocking management, fertilization of ponds, lining, liming, eradication of predatory and weed fishes, and control of aquatic insects.

1.4 Methods of fish cultivation: pond culture , cage culture, pen culture, Raceway culture, culture in recirculatory water system, monoculture and polyculture.

UNIT – II

2.1 Post stocking management of fish pond- Feeding, Thining, Harvesting.

2.2 Methods of collections of fish seed, resources (natural water bodies and hatcheries), Transport of fish seed

2.3. Induced breeding: Induced breeding of carps and other cultivable fishes.

2.4 Bundh breeding: dry and wet bundh breeding.

UNIT – III

3.1 Physical and chemical factors affecting fish culture.

3.2 Rearing of spawn, fry and fingerling.

3.3 Fishing crafts and gears- Spear, Harpon, Hooks and Lines, Types of fishing nets.

3.4 Preservation and processing of fish.

UNIT – IV

4.1 Fish marketing: Marketing practices, information, marketing channels and systems.

4.2 Fish diseases and its control: Biotic (Viral diseases, Bacterial diseases, Fungal, Protozoan, Helminthes, copepod) diseases and abiotic diseases (Air embolism, gas bubble diseases, acidosis, alkalosis)

4.3. Fishery Survey: Methods and techniques, Fish breeding centres of Maharashtra.

4.4. Fish products and by-products: i. Fish body oil, ii. Fish liver oil, iii. Fish meal, iv. Isinglass, v. Fish protein concentrate, vi. Fish glue, vii. Fish manure.

Suggested reading:

Pandey K and J.P. Shukla JP (2018). A Textbook of fish and fisheries Rastogi Publication, Meerut, pp. 588.

Khanna SS and Singh HR (2014). A text book of fish biology and fisheries. 3rd edition, Narendra Publishing House.

Gupta SK and Gupta PC (2006). General and applied Ichthyology (Fish and Fisheries). S. Chand and Company, pp. 1160.

GE/OE Basket Semester III
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
III	**GE/OE**	1	Nutraceuticals	Botany	**BGO3T05**
		2	Sports Biochemistry	Biochemistry	
		3	Biotechnology in Forensic Science	Biotechnology	
		4	Chemistry in everyday life	Chemistry	
		5	Data Base Management System	Computer Science	
		6	Data Base Management System	Computer Application	
		7	Data Base Management System	Data Science	
		8	Basic Electronics for Life Science	Electronics	
		9	Modern Technologies for Environmental Management	Environmental Science	
		10	A. Forensic Meteorology/ B. Forensic Chemistry/ C. Forensic Physics/ D. Forensic Biology/ E. (Psychology)/ F. Digital & Cyber Forensic/ G. Criminal Law-II (Law)	Forensic Science	
		11	Pedology and Soil Testing	Geology	
		12	Applied Physics and Computer Application-I	Home Science	
		13	Data Base Management System	Information Technology	
		14	Financial mathematics	Mathematics	
		15		Microbiology	
		16	Digital systems	Physics	
		17		Statistics	
		18	Animal husbandry	Zoology	
		19		Applied Electronics	
		20	Introductory Pharmacology & Toxicology	Cosmetic Technology	
		21		Interior Design	
		22	Hand Printing	Fashion Design	
		23	Textile Testing-I	Textile Science	

GE/OE Basket Semester IV
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
IV	**GE/OE**	1	Biofuels technology	Botany	**BGO4T06**
		2	Pharmacogenomics	Biochemistry	
		3	Biotechnology & Law	Biotechnology	
		4		Chemistry	
		5	Cyber security	Computer Science	
		6	Cyber security	Computer Application	
		7	Cyber security	Data Science	
		8	Mobile App development	Electronics	
		9	Biodiversity and Wildlife Conservation	Environmental Science	
		10	A. Forensic Photography/ B. Forensic Chemistry/ C. Forensic Physics/ D. Forensic Biology/ E. (Psychology)/ F. Digital & Cyber Forensic/ G. Criminal Law-III (Law)	Forensic Science	
		11	Engineering Properties of Rocks and Soil	Geology	
		12	Applied Chemistry - II	Home Science	
		13	Cyber security	Information Technology	
		14	Mathematics for Competitive Examinations	Mathematics	
		15	Basics of Biomolecules	Microbiology	
		16	Communication Systems	Physics	
		17		Statistics	
		18	Bio-statistics	Zoology	
			Communicable diseases	Zoology	
		19		Applied Electronics	
		20	Introductory Pharmacology & Toxicology	Cosmetic Technology	
		21		Interior Design	
		22	Home Linen Designing	Fashion Design	
		23	Textile Testing-II	Textile Science	

Annexure – V
Basket of Skill Enhancement Courses (SEC)

SEC Basket Semester I

Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
I	SEC	Communicative Skills and Personality Development 1	Languages	BVS1P02
		Soil analysis and hydrobiology	Botany	
		Beekeeping	Zoology	
		Desk Top Publishing	Computer Science	
		Aptitude and Reasoning	Mathematics	
		DNA Manipulation Techniques	Biotechnology	
		Quality control testing of fermented food	Microbiology	
		Food Adulteration Analysis	Chemistry	
		Food Adulteration Analysis	Biochemistry	
		Geo-statistics in Geology	Geology	
		Simulation and Modelling of Electronic Circuits 1	Electronics	
		Environmental Sampling and Monitoring	Environmental Science	
		PPT Presentation Course	Statistics	
		A. Chemical Laboratory Techniques B. General Practices in Forensic Biology C. Physics Workshop	Forensic Science	

Skills Enhancement Course (BoS Languages)

Title of the Course: Communication Skills and Personality Development: 1

Semester -I (2 Credits each)

Introduction: The course is designed to inculcate basic communication skills among the learners and to help them to become confident individuals. Communication Skills is one of the essential attributes in today's world. This course will help the learners to understand the different aspects of communication skills in a professional scenario. This course is based on Bloom's Taxonomy and guides the learners to remember, understand, analyze, and apply the acquired language skills. Each section in this course has exercises based on experiential learning.

Course Outcomes:

1. By the end of this course, the learners will imbibe the basic Listening and Speaking skills.
2. They will develop basic business vocabulary and will be able to use them proficiently.
3. The learners will be able to successfully construct correct sentences and use them appropriately in different situations.
4. This course will reinforce basic communication etiquettes and values.

Semester I (2 Credits-30 hours)

Communication Skills and Personality Development: 1

Unit I: Oral and Aural Communication Skills-1 (6 Hours)

1.1 Importance of Listening Skills
1.2 Active and Effective Listening Skills
1.3 Reading Skills

Unit II: Oral and Aural Communication Skills-2 (6 Hours)

2.1 Understanding the Use of Formal and Informal Language

2.2 Oral Communication Skills: Monologues and Dialogues

2.3 Situational Conversation (Introducing Yourself, Greeting People, Leave Taking)

Unit III: Let's Add Word Power- 1 (6 Hours)

3.1 Commonly confused words (Homonyms, Homophones, Homographs)

3.2 Word list with their etymology

3.3 Academic Word List 1 (formation of nouns, adjectives, and adverbs)

Unit IV: Let's Add Word Power- I (6 Hours)

4.1 Academic Word List 2 (Compound words, one word substitution)

4.2 Professional Vocabulary with Meanings

4.3 Some Common Errors (Error recognition exercises on vocabulary)

Unit V: Written Communication (6 Hours)

5.1 Pamphlets (Describing Places of attraction)

5.2 Advertisements (Classified Ads: Sale of Property, Vehicles and Advertisement for Vacancies)

5.3 E-mail Writing (Official Mails)

Reference Books:

1. English Language Skills for Academic Purposes: A Textbook for College Students, Charul Jain, Pradyumansinh Raj, Yunus Karbhari, Macmillan Education.
2. Communicative English II: An Active Course of Phonetics and Grammar, Macmillan Education.
3. Essential English for Indian Learners: Foundation, Dr. Jitendra Kumar Singh, Macmillan Education
4. Introduction to Life Skills: A Textbook for College Students, Arvind Nawale, Macmillan Education.
5. English in Action: A Textbook for College Students, Editors: T. Vijaykumar, K, Durga Bhawani, Y.L.Shrinivas, Macmillan Education.
6. English in Use: A Textbook for College Students, Macmillan Education.
7. Stream: English Coursebook for College Students, Suresh Gadhavi. Mahendra Mishra, Macmillan Education
8. Meera Banerjee, Business Communication Skills, Macmillan Education.

Evaluation Scheme for SEC
(Communication skills and Personality Development: 1)

DISTRIBUTION OF MARKS (Theory Examination)				
UNITS	MCQs	SAQs	VSAQs	Total Marks
Unit I	06	04	05	15
Unit II		04	05	09
Unit III		04	05	09
Unit IV			05	05
Unit V		04x3 (3 questions of 4 marks each)		12
				50

Internal Assessment will be based on a continuous evaluation. It should ideally follow the following marking scheme:

Assignments & Viva-voce (15+15), Attendance (10), Participation in Classroom Projects and Activities (10)

Framework for Internal Evaluation		
Assessment Criteria	**Units**	**Marks**
Assignment and Viva-voce	Based on the contents from all the units	15+15
Attendance and Participation in Activities	Based on the contents from all the units	10
Classroom Projects and Activities (Seminars, Mini Projects, Discussion Forums and Elocution, Role Plays, Cue cards, competitions, etc.)	Unit I,II, IV, V	10
		50

Pattern of the Question Paper (Theory Examination)

Q1. (A) Six MCQs carrying 1 marks each from Unit I [6 Marks]

(B) One out of two SAQs with internal choice to be answered in 75 words from Unit I [4 Marks]

(C) One out of two SAQs with internal choice to be answered in 75 words from Unit II [4 Marks]

Q2. (A) One out of two SAQs with internal choice to be answered in 75 words from Unit III [4 Marks]

(B) 5 out of 6 VSAQs from Unit I (Carrying 1 mark each) [5x1=5 Marks]

(C) 5 out of 6 VSAQs from Unit II (Carrying 1 mark each) [5x1=5 Marks]

Q3. (A) Preparing a Tourist Pamphlet. [4 Marks]

(B) Draft an advertisement on any one of the given topics. [4 Marks]

(C) E-mail Writing. [4 Marks]

Q4. (A) 5 out of 6 VSAQs from Unit III (Carrying 1 mark each) [5x1=5 Marks]

(B) 5 out of 6 VSAQs from Unit IV (Carrying 1 mark each) [5x1=5 Marks]

B. Sc. Semester-I
SEC Botany
(BVS1P02)
Soil Analysis and Hydrobiology

VSEC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I

Physical Properties of Soil — 15 Hrs.

1. To study the different types of soils.
2. To find out moisture percentage of the soil.
3. To study the texture of given soil samples.
4. To determine the soil pH.
5. To determine the water holding capacity of the soil.
6. To measure temperature of soil.
7. To study the colour of given soil samples.
8. To determine the porosity of soil samples.

Unit-II

Chemical Properties of Soil — 15 Hrs.

1. To study the soil flora.
2. To study and mapping of soils in the fields.
3. To determine electrical conductivity of given soil samples.
4. To determine the presence of carbonates in the given soil samples.
5. To determine the presence of nitrates in the given soil samples.
6. To determine the presence of Phosphate in the given soil samples.
7. To determine the presence of Potassium in the given soil samples.
8. To determine the base deficiency of given soil samples.

Unit-III

Properties of Water **15 Hours** — 15 Hrs.

1. To measure temperature and pH of given water samples.
2. To determine the Dissolved oxygen in given water samples.
3. To determine the BOD in given water samples.
4. To determine the COD in given water samples.
5. To determine the Turbidity in given water samples.
6. To determine the Nitrogen and Phosphates in given water samples.
7. To determine Total solids in given water samples.

Unit-IV	
1. To determine Boiling and Melting point of given water samples. 2. To determine conductivity of given water samples. 3. To determine Hardness of given water samples. 4. To determine Colour and odour of given water samples. 5. To determine Calcium and magnesium of given water samples. 6. Diversity of Hydrophytic plants of selected water bodies. 7. Count the density of phytoplanktons.	15 Hrs.

Note- (Minimum 5 Experiments should be conducted from each unit)

B.Sc. Semester-II BOTANY PRACTICAL
EXAMINATIONSEC-2 Botany (BVS1P02)
Subject: Soil Analysis and Hydrobiology

TIME: FIVE HOURS **MAX. MARKS: 50**

Q. 1:	To determine the Physical Properties of given soil samples	10 M
Q. 2:	To determine the Chemical Properties of given soil samples	10 M
Q. 3:	To determine the Physical and Chemical Properties of given Water samples	10 M
Q. 4:	To study Phytoplanktons and Hydrophytes of water bodies	10 M
Q. 5:	Practical Record, Viva Voce and Excursion report.	10 M

Suggested Readings:

1. Marc Pansu , Jacques Gautheyrou (2006), Handbook of Soil Analysis, Springer Berlin, Heidelberg.
2. Dr. D. K. Maharaj (2017), Laboratory Manual for Soil Testing, S.K. Kataria & Sons.
3. Bandyopadhyay, P. C. (2012), Soil analysis, Genetech.
4. P. D. Sharma (2013), Ecology and Environment, Rastogi Publ. New Delhi.
5. Dr. B. P. Pandey (2021), Modern Practical Botany, Vol-III, S. Chand Publishing, New Delhi.
6. Dr. R.S. Shukla and Dr. P.S. Chandel (2018), A text Book of Plant Ecology, S. Chand Publishing, New Delhi.
7. V.N. Sahai (2016), Fundamentals of Soil, 5th Edition, Kalyani Publishers.
8. S.K. Pal (2013), Soil Sampling and Methods of Analysis, New India Publishing Agency.
9. Dr. G.S. Wagh (1905), Experimental Methods for Water Analysis, Nirali Prakashan.
10. Priyanka Singh (2017), Practical Manual Of Water Analysis by SINGH,P, Agri Biovet Press.
11. Leo M.L. Nollet, Leen S. P. De Gelder (2013), Handbook of Water Analysis, 3rd edition, CRCPress.
12. Dr. Hem Raj (2021), Vinesh Aquatic Biology, S. Vinesh& Co.
13. Rajiv Tyagi (2011), Textbook of Hydrobiology, Discovery Publishing House Pvt Ltd.
14. Gelarld A. Cole (2015), Textbook of Limnology, CBS PUBLICATION.

SEC Basket Biochemistry (2 credit, 4-hour Practical) Semester 1

FOOD ADULTERATION ANALYSIS (BVS1P02)

Course Objective: The objective of this course is to impart practical skill enhancement in field of food adulteration testing. Completion of this course will enable the students to understand, learn and perform skills needed in Food Science/Quality Analysis laboratories.

1. General Laboratory Rules and Personal Safety Precautions
2. Detection of Added Starch / Cereal Flours/ Cellulose in Milk.
3. Detection test For Skimmed Milk Powder in Natural Milk.
4. Detection of Preservatives added to Milk.
5. Detection of Rancidity in edible oils and fats.
6. Detection of Argemone oil in edible oil and fats.
7. Detection of Cottonseed oil in edible oil.
8. Detection of Lead Salts in Turmeric Powder
9. Detection of Metanil Yellow in Turmeric Powder
10. Detection of Artificially Coloured Tea Dust Mixed with Genuine Tea or Used Tea Leaves
11. Detection of Artificial Invert Sugar Syrup in Honey (Fieh's Test)
12. Detection of Added Color in Chilli, Turmeric and Other Curry powders.

References:

1. FSSAI Manual of Methods of Analysis of Foods – Milk and Milk Products (2015) Food Safety and Standards Authority of India, Ministry of Health and Family Welfare
2. Government of India New Delhi FAO (2009). Milk Testing and Payment Systems Resource Book – A Practical Guide to Assist Milk Producer Groups. FAO, Rome. Pp. 38-43.
3. Roy, N.K. and Sen, D.C. (1994). Rapid Analysis of Milk. In Textbook of Practical Dairy Chemistry. Kalyani Publishers. New Delhi. Pp. 85-118. FSSAI Manual of Methods of Analysis of Foods – Oils and Fats (2015) Food Safety and

SEC (Biotechnology)

SEMESTER – I

DNA MANIPULATION TECHNIQUES (BVS1P02)

Course Code: BVS1P02 **Total Contact Hours: 60**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Perform isolation of DNA from different sources
CO 2. Appreciate changes in DNA migratory properties by agarose gel electrophoresis
CO 3. Describe applications of restriction enzymes in DNA manipulation methods
CO 4. Compare effect of changes in DNA sequence and solution conditions on spectrophotometric properties of DNA
CO 5. Plan and analyse experiments pertaining to DNA manipulations.

PRACTICALS

1. Genomic DNA isolation from Bacteria
2. Genomic DNA isolation from Plant Cells
3. Genomic DNA isolation from Animal Cells
4. Total DNA isolation from soil
5. Check the homogeneity of isolated DNA by Agarose gel electrophoresis
6. Restriction digestion of lambda phage DNA and agarose gel electrophoresis
7. Comparison of different restriction enzyme digests of lambda DNA by agarose gel electrophoresis
8. Melting curve analysis of Lambda DNA
9. Effect of salt concentration on Tm value of lambda DNA
10. Demonstration of southern hybridisation
11. DNA ligase activity analysis by ligation of lambda DNA RE digests
12. Monitoring changes in lambda DNA Tm values on UV irradiation
13. DNA methyltransferase activity assay
14. DNA methylation analysis by restriction fragment analysis
15. DNA methylation quantification by ELISA

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.
2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.
3. Davis, Leonard. *Basic methods in molecular biology*. Elsevier, 2012.
4. Chawla, H. (2011). *Introduction to plant biotechnology (3/e)*. CRC Press.
5. Doyle, Jeffrey. "DNA protocols for plants." *Molecular techniques in taxonomy* (1991): 283-293.

B.Sc. Semester – I
SEC (Chemistry)
BVS1P02: Food Adulteration Analysis
Practical 2 credits

Course Outcomes
By the end of this course, students will be able to:

1. *Get basic knowledge on various foods and about adulteration.*
2. *Understand the adulteration of common foods and their adverse impact on health*
3. *Comprehend certain skills of detecting adulteration of common foods.*
4. *Be able to extend their knowledge to other kinds of adulteration, detection and remedies.*
5. *Know the basic laws and procedures regarding food adulteration and consumer protection.*

List of Experiments

1. Collection of information on adulteration of some common foods from local market
2. Adulteration detection for Milk and Milk products
    - Detection of water in milk
    - Detection of detergent in milk
    - Detection of starch in milk and milk products (khoya, chenna, paneer)
    - Detection of mashed potatoes, sweet potatoes and other starches in ghee/butter
3. Adulteration detection for Oil and Fats
    - Detection of other oils in coconut oil
    - Detection of TOCP (Tri-Ortho-Cresyl-Phosphate) in oils and fats
    - Proper winterization of refined winterized salad oils
4. Adulteration detection for Sugar & Confectionery
    - Detection of sugar solution in honey
    - Detection of chalk powder in sugar/pithi sugar/jaggery
    - Detection of aluminium leaves in silver leaves
5. Adulteration detection for Food Grains & Its Products
    - Detection of extraneous matter (dust, pebble, stone, straw, weed seeds, damaged grain, weevilled grain, insects, rodent hair and excreta) in food grains
    - Detection of dhatura in food grains
    - Detection of excess bran in wheat flour
6. Adulteration detection for Salt, Spices & Condiments
    - Detection of foreign resin in asafoetida (hing)
    - Detection of papaya seeds in black pepper
    - Detection of light black berries in black pepper
7. Adulteration detection for Fruits & Vegetables
    - Detection of malachite green in green vegetables like bitter gourd, green chilli and others.
    - Detection of artificial colour on green peas.
    - Detection of rhodamine B in sweet potato.
8. Adulteration detection for Beverages
    - Detection of clay in coffee powder
    - Detection of chicory powder in coffee powder
    - Detection of exhausted tea in tea leaves
    - Detection of iron filings in tea leaves

9. Adulteration detection for chilli powder
    - Detection of Brick powder in chilli powder
    - Detection of salt powder in chilli powder
    - Detection of talc. powder in chilli powder
10. Invited lecture/training by local expert /Visit to a related nearby laboratory/ Assignments, Group discussion, Quiz etc.

Note: Minimum 10 experiments should be performed.

References

1. A firstcourseinFoodAnalysis–A.Y.Sathe,NewAgeInternational(P)Ltd.,1999
2. https://eatrightindia.gov.in/dart/
3. Choudhary A., Gupta N., Hameed F., Choton S. An overview of food adulteration: Concept, sources, impact, challenges and detection. Int. J. Chem. Stud. 2020;8:2564–2573. doi: 10.22271/chemi.2020.v8.i1am.8655.
4. Ayza A., Yilma Z. Patterns of milk and milk products adulteration in Boditti town and its surrounding, South Ethiopia. J. Agric. Sci. 2014;4:512–516.
5. El-Loly M.M., Mansour A., Ahmed R. Evaluation of raw milk for common commercial additives and heat treatments. Internet J. Food Saf. 2013;15:7–10.
6. Everstine K., Spink J., Kennedy S. Economically motivated adulteration (EMA) of food: Common characteristics of EMA incidents. J. Food Protection. 2013;76:723–735. doi: 10.4315/0362-028X.JFP-12-399.
7. FoodSafety,casestudies–Ramesh.V.Bhat,NIN,1992
8. https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/Beverages and confectionary.pdf
9. https://cbseportal.com/project/Download-CBSE-XII-Chemistry-Project-Food-Adulteration#gsc.tab=0 (Downloadable e material on food adulteration
10. https://www.fssai.gov.in/

SEC Basket

B.Sc. Sem-I (Computer Science)

BVS1P02

DESK TOP PUBLISHING

Credits: 2 **Duration : 60 Hours**

Course Objectives:

1. To understand the fundamentals & concepts of Page Maker
2. To give the students a hands-on experience on Page Maker
3. To understand the fundamentals & concepts of Adobe Photoshop
4. To give the students a hands-on experience on Adobe Photoshop.

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. understand the fundamentals & concepts of Page Maker
2. create book works, building booklets.
3. create animations
4. work with multiple layers

Unit I

Page Maker: Creating & opening publications, using the tool box, working with Palettes, text & Graphics, starting a publication from a template, saving & closing a publication

Drawing & Shaping Objects: Positioning ruler guides, typing text, formatting graphics, creating columns, creating styles, changing type style & alignment, rotating & moving of text block & graphics , placing text file ,setting tab, indents, leaders, copying graphic between publications ,positioning & resizing the logo.

Unit II

Page Maker: Setting up pages, changing document setup, using master pages, choosing a measurement system & setting up rulers, adjusting layout, numbering pages, rearranging pages, creating running header & footers, importing text, threading text blocks, balancing columns, edit story, customizing the dictionary, hyphenation, layers, frames, locking object, wrapping text around graphics, cropping a graphic

Unit III

Photoshop: Introduction to Adobe Photoshop, History of Photoshop, Hardware requirements of Adobe Photoshop, installation of Adobe Photoshop, Features of Photoshop, Interface Layout of Photoshop, Fundamentals: Digital Image, pixels, resolution, DPI, raster images/bitmaps, vector images/graphics, various file formats: PSD, JPEG, GIF, TIF, PNG etc., colour modes Exploring the workspace: Application bar, Menu Bar, Options Bar, Workspace ,Document Window, Document ,Title Bar, Status Bar, Toolbox.

Unit IV

Photoshop: Getting Familiar with Palettes: layers, channels, colors, history, Opening an existing file, Creating a new document, Saving files, Reverting Files, Closing Files, Getting Familiar with different Workspaces, Selecting a Workspace, Saving & Deleting Workspace & quitting the Application, Tools: brushes, Move Tool, Eyedropper Tool, Zoom Tool, Hand Tool, Type Tool, Quick Selection Tool Editing Images, Making Colour adjustments, working with Selection tools: Marquee Tool, Lasso Tool, Magic Wand Tool, making a selection based on colour Range, Modifying a Selection.

Books

1.Desk Top Publishing from A to Z by Bill Grout and Osborne, McGraw Hill
2. Desk Top Publishing for PC user by Houghton, Galgotia public.
3.Adobe Pagemaker 6.5 by Shashank Jain and Satish Jain, BPB public.
4. Desk Top Publishing on PC by M. C. Sharma, BPB public.
5.Adobe Photoshop CS2 Classroom, Adobe Press.

Semester – 1; SEC -2 : Simulation and Modelling of Electronic Circuits 1

(BVS1P01)

Course outcome:

At the end of this course students will have ability to1 Understand

importance of simulation

2 Acquittance with simulation modules , software and limitations3 Drawing and

testing simple circuit

4 Learning concepts through simulation

Syllabus

1 Introduction to circuit simulation software, Basics Accessing tools and features, file management , Drawing Schematic, Analog Simulation

2 Different Analysis parameters3

Digital logic simulation

4 Mix mode simulation

Books:

User Manual : CircuitMaker, Proteus, Tinkercad, Easyada

SEC-1 (Environmental Science)

Environmental Sampling and Monitoring (BVS1P0)

Unit-I: Weather and Air Monitoring

Introduction to weather system and parameters: Light, Rainfall, Wind direction, Wind velocity, (Movement of pollutants), Temperature, Pressure, Humidity, Weather Monitoring tools / instruments and their working principle.

Air sampling: types, techniques, site and parameter selection, National standards for ambient air quality, Monitoring of particulate matter, SOx and NOx, Ambient and stack air monitoring techniques, air monitoring tools/instruments used for air and their working principle.

Unit-II: Water and Soil Monitoring / Sampling and its Analysis

Water Monitoring and its Analysis: Objectives of water monitoring, Collection of samples, sample preservation, Physical, chemical, biological parameters of water & its monitoring, General effluent standards, stream standards Drinking water standard (IS10500 and WHO Standards).

Soil Monitoring and its Analysis: Objectives of soil monitoring / testing, Types of soil sampling and sample units, Site selection, important soil quality indicators Instruments / equipment's used in soil monitoring.

Unit-III: Noise and Radiation Monitoring

Noise and Radiation Monitoring Introduction of noise & vibration, National standard for noise Sound Exposure Level (SEL), Equivalent Sound Level [Leq(h)] Noise Index, Radiation types and measurement, G. M counter, scintillation counter, personal dosimetry, Units of measurements, Half-life period, and radiation dose measurement

Instruments used in Environmental Monitoring: pH meter, Conductivity meter, Colorimeter, UV Spectrophotometer, Atomic Absorption Spectrophotometer (AAS), Flame photometer, Hot air oven, autoclave, Laminar flow, RDS, RSPM 2.5, Handy sampler, Gas chromatography, Mass spectroscopy, Scanning electron microscopy.

Unit-IV: Unit-IV: Field work/Assignment/ Training/Seminar related to:

Ambient Air Quality Monitoring, Stack Monitoring, Water Sampling & Monitoring Noise/ Quality Monitoring, Analysis of Water and Wastewater, Soil Monitoring

Books for References:

1. Handbook of Methods in Environmental Studies: Vol.1 By Maiti, Subodh. (2003)
2. Handbook of Methods in Environmental Studies: Vol 2 (Air, noise, soil and overburdenanalysis). By Maiti, Subodh. (2003).
3. Waste Water Engineering, Metcalf and Eddy, INC, Tata McGraw Hills
4. Indian Standard for Drinking Water, BSI, New Delhi. Environmental Pollution Control, S.Rao, Wiley Eastern Ltd.,1993
5. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993, 10.
6. Fundamentals of Air Pollution, Samuel, J. W., 1971, Addison Wesley Publishing
7. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and CompanyLtd., 1994.
8. Noise Pollution, Vandana Pandey, Meerut Publishers, 1995. Environmental PollutionControl, C. S. Rao, Wiley Eastern Ltd., 1993.
9. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993.
10. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and CompanyLtd.,1994.
11. Environmental Chemistry, A. K. De., New Age Intl. Pub Co, New Delhi, 1990.
12. Environmental Pollution Analysis - S. M. Khopka.

SEC (Forensic Chemistry)

A. Chemical Laboratory Techniques (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Gain hands-on experience in various laboratory techniques and analytical methods.
2. Perform purification, separation, measurement, and analysis of substances using appropriate instruments and procedures.
3. Develop practical skills in purification, separation, measurement, and analysis.
4. Apply these techniques and methods to conduct experiments, analyze data, and draw conclusions.

List of Practical

1. Purification by Crystallization Distillation, Centrifuge, and Washing.
2. Evaporation, Sublimation.
3. Measuring MP & BP.
4. Measurements of Flash point and Fire point.
5. Detecting solubility.
6. Measurement of Viscosity.
7. Determination of rate of a reaction (kinetics).
8. Volumetric analysis.
9. Titration experiments -Determining strength of acid, Saponification & Iodine value of fat/oil.
10. Solvent extraction.
11. Paper Chromatography.
12. Thin layer chromatography.

SEC (Forensic Biology)

B. General Practices in Forensic Biology (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Demonstrate proficiency in measuring pH of solutions using appropriate techniques and instruments, and interpret the results to assess the acidity or alkalinity of the solution.
2. Prepare commonly used buffers and understand their composition and purpose, and evaluate their effectiveness in maintaining stable pH conditions.
3. Perform the preparation of agarose gel and polyacrylamide gel, understanding the principles and procedures involved, and demonstrate proficiency in gel preparation techniques.
4. Conduct electrophoresis of proteins and DNA on agarose or polyacrylamide gels, analyze the resulting gel patterns, and interpret the migration behavior of biomolecules based on their size or charge.
5. Apply spectrophotometric techniques to measure the concentration of proteins and DNA,

List of Practical:

1. Measurement of pH of the solution.
2. Preparation of commonly used buffers (Phosphate Buffer Saline, Glycine buffer)
3. Preparation of agarose gel.
4. Preparation of Polyacrylamide gel.
5. Electrophoresis of protein.
6. Electrophoresis of DNA.
7. Spectrophotometric measurement of protein.
8. Spectrophotometric measurement of DNA.
9. Paper Chromatographic separation of amino acids.
10. Thin layer Chromatographic separation of lipids.
11. Determination of Isoelectric point of protein.
12. Preparation of silica gel column.

SEC (Forensic Physics)

C. Physics Workshop (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Develop practical skills in the use of laboratory instruments and tools, data analysis, electrical circuitry, electronic component soldering, and the application of various measurement devices.
2. Gain a comprehensive understanding of the functioning and principles of the travelling microscope, spectrophotometer, and various electrical components used in laboratory experiments.
3. Design and construct electronic switches using transistors and relays, and study the operation of timer circuits
4. Gain a solid foundation in experimental techniques and electrical principles.

List of Practical

1. Familiarization with Meter Scale, Vernier Calliper, Screw Gauge and their Utility
2. Study of Travelling Microscope
3. Study of Spectrophotometer
4. Study of Pulleys and Levers
5. Study of Cutting and Drilling Tools
6. Determination of Thickness of Thin Wires and Metal Sheets
7. Study of Electrical Components
8. Study of Transformer Characteristics
9. Study of Ammeters, Voltmeters and Ohm-meters
10. Study of Digital Multimeter for Measuring Voltage
11. Study of CRO as a Versatile Measuring Device
12. Soldering of electrical circuits having discrete components and ICs on PCB
13. Making regulated power supply
14. Study of Electronic Switch using Transistor and Relay Study of Timer Circuit using IC 555

SEC (Geology)

Geostatistic in Geology (BVS1P02)

Practical:

Practicals on arithmatic mean, mode, median, range, variance, frequency, skewness, kurtosis, standard deviation of grain sizes; identification of depositional environment based on grain size distribution; CM plot, depositional environment based on grain size distribution from probability ordinate paper.

Books Recommended:

1) Blatt, H., Middleton, G.V. and Murray, R.C. (1980) Origin of Sedimentary Rocks, Prentice-Hall Inc.
2) Reineck, H.E. and Singh, I.B. (1973) Depositional Sedimentary Environments, Springer-Verlag.
3) Isaaks, E.A. and Srivastava, R.M. (1990) An Introduction to Geostatistics, Oxford University Press.
4) Morrison, D.F. (1967) Multivariate statistical methods, McGraw-Hill.
5) Tucker, M.E. (1981) Sedimentary Petrology: An Introduction, Wiley and Sons, New York.

B.Sc. Mathematics (Major): SEMESTER 1

SEC-Aptitude and Reasoning (BVS1P02)

Course Outcome

On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical
5. Reasoning Ability

TOPICS:

1. Logarithm
2. Permutation and Combinations
3. Profit and Loss
4. Time, Speed and Distance
5. Time & Work
6. Ratio and Proportion
7. Data Interpretation
8. Tables
9. Column Graphs
10. Bar Graphs
11. Line Charts
12. Pie Chart
13. Venn Diagrams
14. Analogy
15. Blood Relation
16. Directional Sense
17. Number and Letter Series
18. Coding – Decoding
19. Calendars
20. Clocks

Reference books:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical reasoning for CAT and other management entrance test By
1. Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition
6. https://prepinsta.com/
7. https://www.indiabix.com/
8. https://www.javatpoint.com/

Quality Control Testing of Fermented Food
Course Code: (BVS1P02)

SEC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

A) 1. **Chemical quality**

1) Determination of titrable acidity
2) Determination of Protein by Macro Kjeldahl method
3) Determination of fats
4) Determination of ash
5) Determination of moisture, fibre & carbohydrate
6) Quantitative estimation of reducible sugar by DNSA colorimetric method
7) Estimation of sodium by flame photometry.
8) Estimation of potassium by flame photometry.
9) Estimation of iron by colorimetry.
10) Estimation of ascorbic acid by titrimetric method.
11) Estimation of phosphates/phosphorus by colorimetric method.
12) Assay of Niacin

B) Microbiological quality

1) Assessing sanitary of contact surface by swabbing method.
2) Assessing air of processing facility of air for microbial load.
3) Bacteriological analysis of water intended for fermented food preparation.
4) Determination viable bacterial count by SPC in finished food product.
5) Determination of yeast & mold count in finished product.
6) Detection of *E.coli* in finished product.
7) Detection of *Salmonella* in finished products
8) *Detection of Bacillus cereus* in finished product.
9) Detection of *Staphylococcus aureus* in finished product.
10) Detection of Aflatoxin in finished product by TLC
11) Detection of anaerobic spore formers in finished product.

Perform at least five experiments from section **A & B each.**

Scheme of Practical Examination:

1. Two long expt.----------. 15 Marks each
2. Viva-voce----------. 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1) Manual of Methods of Analysis of Microbiological Examination of Food and Water-FSSAI Manual-2016

2) Manual of methods of analysis of foods milk and milk products -fssai-2016

3) Manual of methods of analysis of foods food safety and standards authority of india ministry of health and family welfare government of india new delhi 2015 beverages (coffee, tea, cocoa, chicory) sugar and sugar products & confectionery products -lab manual-2015

4) Manual of Methods of Analysis of Foods- Alcoholic Beverages- FSSAI-2021

5) Manual of Methods of Analysis of Foods- Spices,Herbs & Condiments-FSSAI-2021

6) Manual of Methods of Analysis of Foods- Cereal & Cereal products- FSSAI-2016

7) Manual of Methods of Analysis of Foods-Mycotoxins,FSSAI-2021

8) Manual of Methods of Analysis of Foods- Meat & Fish products- FSSAI-2016

9) General guidelines for Sampling for Microbiological Analysis of Food-FSSAI-2022

10) Manual of Methods of Analysis of Foods- FOOD ADDITIVES- FSSAI-2016

11) Manual of Methods of Analysis of Foods-Water-FSSAI-2016

12) A Manual of Laboratory Techniques-National Institute of Nutrition-ICMR-Hyderabad

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of different types of quality control testing of fermented foods.
2.	The knowledge is very useful for opting job in industries.

	Semester I (SEC) BOS (Statistics)
	Paper code – BVSIP02 2 Credits (4 hrs practical per week)
	NAME OF THE PAPER - PPT PRESENTATION COURSE
	List of Practicals
1	**Introduction to PowerPoint**: This section will cover the basics of PowerPoint, including the interface, tools, and functions. Student will learn how to create new slides, add content, and use themes**.**
2	**Design principles** : In this section, student will learn about design principles and how to apply them to PowerPoint presentations. Student will learn about layout, color, typography, and more
3	**Content creation**: This section will cover how to create compelling content for PowerPoint presentations. You'll learn how to structure the presentation, use images and videos, and incorporate data effectively.
4	**Animation and transitions**: In this section, student 'll learn how to use animations and transitions to make the PowerPoint presentations more engaging. Student will learn about the different types of animation and transition effects and how to use them effectively
5	**Delivery and presentation skills**: This section will cover how to deliver PowerPoint presentation effectively. Student will learn about public speaking skills, body language, and how to engage audience.
6	**Advanced features**: This section will cover some of the more advanced features of PowerPoint, such as using macros, customizing templates, and creating interactive presentations.
7	**Tips and tricks**: In this section, student will learn some tips and tricks for making PowerPoint presentations more effective and professional.
8	**Conclusion:** The course will end with a conclusion that summarizes what is learned and provides tips for continuing to improve PowerPoint presentations

B.Sc. Sem. I (Zoology) - SEC

Course: Bee Keeping (BVS1P02)

Credit: 2

Course outcomes: After completion of course, students will

- Able to identify queen, drones and workers of honey bee.
- Able to handle artificial bee hive.
- Understand the economic importance of honey bee.
- Identify and recognized enemies of honey bee.
- Able to do internship in commercial bee keeping unit.

Practical:

1. Introduction to Apiculture.
2. To demonstrate construction of bee hive and different species of bees.
3. To study the morphology and anatomy of bee.
4. To study the life cycle and division of labour.
5. To analyse the social behaviour of bees.
6. To study the handling of artificial bee hive and its maintenance.
7. To collect and preserve the bee pasture.
8. To study the seasonal management of colony (Season: Vasant, Grishma, Sharad and Shishir).
9. Manipulation for honey production.
10. Economics of bee keeping.
11. To study the queen rearing.
12. To find out and study bee enemies and their control.

Suggested reading:

1. **Goud R (2022).** Practical Manual on Apiculture, Sericulture and Lac culture. Jaya Publication House
2. **Jayashree KV, Tharadevi CS, Arumugam N. (2014).** Apiculture. Saras Publication, pp. 360.
3. **Brett J (2012).** Apiculture and Bee keeping simplified. Alfa one Publishing Company, pp. 106.
4. **Elumalai D, Mohan C, Poovizhiraja B, Ramamurthy R (2012).** Principles and practices of apiculture. Jaya Publishing House.
5. **Petterson J (2016).** Beekeeping: Everything You Need to Know to Start Your First Beehive. Weldon Owen Publisher, pp. 192.
6. **Sathe TV (2018).** Fundamentals of bee keeping. Daya Publishing House.

SEC Basket Semester II (BVS2P04)
Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
II	**SEC**	Communicative Skills and Personality Development 2	Languages	**BVS2P04**
		Plant Pathology and Disease Management	Botany	
		Tally	Computer Science	
		Financial Mathematics	Mathematics	
		Wine Technology	Biotechnology	
		Tools and Techniques in Geology	Geology	
		Water and wastewater analysis	Chemistry	
		Lac culture	Zoology	
		Testing of food adulteration	Microbiology	
		Teaching Material for Young Children Extension Teaching Material	Home Science	
		Blood Processing Techniques	Biochemistry	
		File Handling in C	Electronics	
		Entrepreneurship Development and Services by Environmental Consultancy	Environmental Science	
		Financial literacy	Statistics	
		A. Security Features of Security Documents B. General Techniques and Recombinant DNA Technology in Microbial Forensics C. Mobile App Development	Forensic Science	

Title of the Course: Communication Skills and Personality Development: 2

Semester -II (2 Credits-30 Hours)

Unit I: Communication Skills: Concepts and Context (6 Hours)

1.1 Communication Skills: Definition and Importance

1.2 Communication Process

1.3 Situational Conversation

(Making announcements, Giving Statements, Giving Commands and making requests, Asking questions and Expressing surprises.)

Unit II: Building Confidence and Self-esteem (6 Hours)

2.1 Developing Self-awareness (Activity Based)

2.2 Social Awareness and Civic Skills (Elocution and Extempore Activity)

2.3 Developing Critical Thinking (Group Discussions and Case Studies)

Unit III: Communication Focus: Writing with a purpose. (6 Hours)

3.1 Reading and Comprehension

3.2 Creative Writing (Writing a review of a Movie or a book review)

3.3 Paragraph Writing (Describing People and Places)

Unit IV: Professional Etiquettes and Manners (6 Hours)

4.1 Asking and Giving permission.

4.2. Use of Courtesy Words (“please”, “excuse me”, “sorry” “Thank you” etc.)

4.3 Greetings and Salutations (Verbal and Non-verbal Communication)

Unit V: Brush up on your Interview Skills (6 Hours) (Activities on Mock-interviews and Telephonic Interviews)

5.1 Preparing a Professional CV

5.2 Grooming for the interview (Non-verbal and Verbal Skills)

5.3 Spotting the errors (Subject Verb Agreement, Use of Appropriate Words, Use Prepositions)

Reference Books:

1. English Language Skills for Academic Purposes: A Textbook for College Students, Charul Jain, Pradyumansinh Raj, Yunus Karbhari, Macmillan Education.
2. Communicative English II: An Active Course of Phonetics and Grammar, Macmillan Education.
3. Essential English for Indian Learners: Foundation, Dr. Jitendra Kumar Singh, Macmillan Education
4. Introduction to Life Skills: A Textbook for College Students, Arvind Nawale, Macmillan Education.
5. English in Action: A Textbook for College Students, Editors: T. Vijaykumar, K, Durga Bhawani, Y.L.Shrinivas, Macmillan Education.
6. English in Use: A Textbook for College Students, Macmillan Education.
7. Stream: English Coursebook for College Students, Suresh Gadhavi. Mahendra Mishra, Macmillan Education

Evaluation Scheme for SEC (Communication skills and Personality Development: 2)

DISTRIBUTION OF MARKS (Theory Examination)				
UNITS	MCQs	SAQs	VSAQs	Total Marks
Unit I	06	04	05	15
Unit II		04	05	09
Unit III		4x3 (3 questions of 4 marks each)		12
Unit IV			05	05
Unit V		04	05	09
				50

Internal Assessment will be based on a continuous evaluation. It should ideally follow the following marking scheme:

Assignments & Viva-voce (15+15), Attendance (10), Participation in Classroom Projects and Activities (10)

Framework for Internal Evaluation		
Assessment Criteria	**Units**	**Marks**
Assignment and Viva-voce	Based on the contents from all the units	15+15
Attendance and Participation in Activities	Based on the contents from all the units	10
Classroom Projects and Activities (Seminars, Mini Projects, Discussion Forums and Elocution, Role Plays, Cue cards, competitions, etc.)	Unit I,II, IV, V	10
		50

Pattern of the Question Paper (Theory Examination)

Q1. (A) Six MCQs carrying 1 marks each from Unit **[6 Marks]**

(B) One out of two SAQs with internal choice to be answered in 75 words from Unit I **[4 Marks]**

(C) One out of two SAQs with internal choice to be answered in 75 words from Unit II **[4 Marks]**

Q2. (A) 5 out of 6 VSAQs from Unit I (Carrying 1 mark each) **[5x1=5 Marks]**

(B) 5 out of 6 VSAQs from Unit II (Carrying 1 mark each) **[5x1=5 Marks]**

Q3. (A) Comprehension. **[4 Marks]**

(B) Write a review of a book/ a movie **[4 Marks]**

(C) Paragraph Writing **[4Marks]**

Q4. (A) CV writing. **[4 Marks]**

(B) 5 out of 6 VSAQs from Unit IV (Carrying 1 mark each) **[5x1=5 Marks]**

(C) 5 out of 6 VSAQs from Unit V (Carrying 1 mark each) **[5x1=5 Marks]**

B. Sc. Semester-II SEC
Botany (BVS2P04)
Plant Pathology and Disease Management

VSEC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I

1. Acquaintance with various laboratory equipment: (Laboratory equipment and their use:pH meter, autoclave, hot air oven, laminar flow, spectrophotometer, electrophoresis, light and electron microscopy, incubator, Centrifuge / ultracentrifuge, ELISA Reader, Freeze dryer, GC-MS, HPLC, Thermocycler, {Practical to be conducted from available instruments}. 2. Methods of sterilization, Methods of inoculation. 3. Nutritional media and their preparations. Preservation of microorganisms in pureculture. 4. Enumeration of microbial population in soil- bacteria, fungi. 5. Methods of isolation and purification of microbial cultures	15 Hrs.

Unit-II

6. General study of different Vegetative and reproductive structures of fungi. 7. Study of symptoms of various plant diseases. (Fungal diseases of cereals, millets, oilseeds, pulses, fruits, vegetables, plantations, fibers, spices, medicinal and ornamental crop with special reference to etiology, disease cycle, perpetuation, epidemiology and management). 8. Measurement of plant disease *9.* Study of representative fungal genera *Colletotrichum, Alternaria, Cercospora, Aspergillus, Helminthosporium, Curvularia, Penicillium, Rhizopus, Mucor, Trichoderma*etc.	15 Hrs.

Unit-III

10. Staining and identification of plant pathogenic bacteria 11. Study of phanerogamic plant parasites 12. Transmission of plant viruses 13. Study of morphological features and identification of plant parasitic nematodes. 14. Extraction of nematodes from soil	15 Hrs.

Unit-IV

15. Koch's postulates 16. Study of fungicides and their formulations 17. Methods of pesticide application and their safe use. **18.** Calculation of fungicide sprays concentrations**.** 19. Collection and preservation of disease specimen. 20. Detection and Diagnosis of pathogens in seeds and other planting materials: Nucleic acid probes, Southern, Northern and Western hybridization, ELISA, ISEM and PCR. Nucleic acid probes, Southern, Northern and Western hybridization, ELISA, ISEM and PCR (Methodology only)	15 Hrs.

B.Sc. Semester-II

PRACTICAL EXAMINATION

SEC Botany (BVS2P04)

Subject: Plant Pathology and Disease Management

TIME: FIVE HOURS	**MAX. MARKS: 50**
Q.1. Identify giving reasons two of the given plant pathology material and "A".	10 Marks
Q.2. Make suitable stained preparation of the given Fungal culture "B"	10 Marks
Q.3. Perform Gram staining of the given Bacterial culture/ Curd "C"	5 Marks
Q.4. Techniques of inoculation "D"	5 Marks
Q.5. Spotting:	10 Marks
E. One of the instruments of Micro biology laboratory.	
F. Whole specimen or a permanent slide of Fungal pathology specimen.	
G. Whole specimen or a permanent slide of bacterial.	
H. Whole specimen or a permanent slide of Plant disease studied Viral, phytoplasma.	
I. Instrumentation.	
Q.6. Viva-voce	5 Marks
Q.7. Practical Record and pathology field report,	5 Marks

Suggested Readings

1. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur 2) Agrios, GN. 2010. PlantPathology. Acad. Press.
2. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur 4) Singh RS. 2008. PlantDiseases.8th Ed. Oxford & IBH. Pub. Co.
3. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
4. Alexopoulos, Mims and Blackwel. Introductory Mycology
5. Mehrotra RS &Aggarwal A. 2007.Plant Pathology.7th Ed. Tata McGraw Hill Publ. Co. Ltd.
6. Gibbs A & Harrison B. 1976. Plant Virology – The Principles. Edward Arnold, London.
7. Hull R. 2002. Mathew. S Plant Virology. 4th Ed. Academic Press, New York.
8. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
9. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
10. Dhingra OD & Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
11. Nene YL &Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, NewDelhi.
12. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.
13. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
14. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management inAgriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.
15. Singh RS & Sitaramaiah K. 1994. Plant Pathogens – Nematodes. Oxford & IBH, New Delhi.
16. Thorne G. 1961. Principles of Nematology. McGraw Hill, New Delhi.

Walia RK & Bajaj HK. 2003. Text Book on Introductory Plant Nematology. ICAR, New Delhi

SEC Basket Biochemistry (2 credit, 4-hour Practical) Semester 2

Blood Processing Techniques (BVS2P04)

Course objective: After completion of this course student will have practical knowledge of various skills needed for blood processing and handling.

1. Instrumentation and facilities required for blood processing laboratories.

2.Separation of plasma from a given blood sample.

3. To prepare fresh frozen plasma and its processing for use in patients.

4. Separation of Serum from a given blood sample.

5. Types and principal of working of autoanalyzer.

6. Demonstration of blood analysis using autoanalyzer.

7. Separation of blood components using centrifugation technique.

8. To perform capillary blood collection.

9. To perform venous blood collection.

10. Differential leucocyte count of blood.

11. To Perform WBC count

12. To perform RBC count

13. To perform ESR of blood.

14. To perform platelet count.

References:

1. Dicken Weatherby. Blood Chemistry and CBC Analysis. Bear Mountain publisher.
2. Diana Garza. Phlebotomy Handbook: Blood Specimen Collection from Basic to Advanced. Pearson publication.
3. F.A. Davis Company. Blood Collection. 2nd Edition. FA Davis company publication.

Skill Enhancement Courses (Biotechnology)

SEMESTER – II

WINE TECHNOLOGY

Course Code: BVS2P04 **Total Contact Hours**: **60**

Course outcomes:

On completion of this course, students will be able to:

CO 1. Demonstrate an understanding of the basic concepts of wine chemistry and wine microbiology
CO 2. Students will be able to learn wine production
CO 3. Students will be able to check quality of grapes and wine
CO 4. Students will be able to evaluate wine quality using chemical and sensory techniques

PRACTICALS

1. Introduction to Wine technology Laboratory and common Wine technology laboratory instruments e.g., Lab fermenter, Refractometer, Hydrometer Colorimeter, pH Meter, Distillation Unit and Chemical Balance
2. Preparation of Malt Extract Glucose Yeast extract Peptone (MGYP) medium for growth & identification of yeast.
3. Isolation of bacteria and yeast from fruits
4. Determination of reducing sugar in molasses sample
5. Identification of grape and wine varieties
6. Preparation of wine from fruits (grapes/apple)
7. Determination of viable count of yeast from fermenting wine sample by Neubaur's chamber
8. Determination of viable count of yeast from fermenting wine sample by Spread plate method.
9. Determination of alcohol content of wine by titrimetric/hydrometer/ specific gravity methods
10. To study the effect of alcohol concentration on yeast growth
11. To learn the techniques of Stem cuttings and its propagation
12. To learn the technique of "Whip" grafting for propagation of grape plants
13. To collect infected fruit samples and study the morphology of major disease-causing organisms
14. Sensory evaluation of white wine and red wine.
15. Determination of BOD of given sample (winery/distillery/brewing waste)
16. Determination of COD of given sample (winery/distillery/brewing waste)

Reference Books

1) Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
2) Frobisher M. (1974) Fundamentals of Microbiology, 9th Edition
3) Patel A. H. Industrial Microbiology.
4) Prescott S. C. and Dunn C.G. (1983) Industrial Microbiology, Reed, g. (Ed.) AVI Tech books.
5) Stanbury P. F., Whitaker A. and Hall S. J., (1997) Principles of Fermentation, 2nd Edition
6) Boltan R. B. (1996) Principles and practice of winemaking, Chapman and Hall.
7) Glaudio Delfins & Formica J. V. (2001) Wine microbiology Science and Technology.
8)The microbial world – Stainer
9). General Microbiology – Volume I and II Power and Daginwala
10) Elements of Microbiology – Pelczar

B.Sc. Semester – II (Chemistry)
Skill Enhancement Course (SEC)
Water and wastewater analysis (BVS2P04)
Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *Identify sampling locations for different types of water samples.*
2. *Carry out sampling of water and wastewater from various sources.*
3. *Analyze spot parameters at sampling location.*
4. *Carry out complete physico-chemical analysis of different types of water samples.*
5. *Suggest remedial measures for water detoxification.*

List of Experiments

A. Physicochemical analysis:

1. Determination of temperature of water sample.
2. Determination of pH of water sample using pH paper as well as pH meter.
3. Determination of electrical conductivity of water sample.
4. Determination of turbidity of water sample.
5. Determination of total dissolved solids (TDS) in water sample.
6. Determination of alkalinity (hydroxide, bicarbonate and carbonate) of water sample.
7. Determination of chloride content of water sample.
8. Determination of sulphate content of water sample.
9. Determination of hardness (total, temporary and permanent) of water sample.
10. Determination of calcium and magnesium hardness of water sample.

B. Demand analysis:

1. Determination of Dissolved Oxygen (DO) in water sample.
2. Determination of Chemical Oxygen Demand (COD) of water sample.
3. Determination of Biochemical Oxygen Demand (BOD) of water sample.

C. Heavy metals:

1. Estimation of iron by spectrophotometry using 1,10-phenanthroline.
2. Estimation of copper by solvent extraction with DDC.
3. Estimation of Cr(VI) by spectrophotometry using DPC.

Note: Minimum 10 experiments should be performed.

References:

1. William C. Lipps, Ellen Burton Braun-Howland, Terry E. Baxter (2012), Standard Methods for the Examination of Water and Wastewater, Amer Public Health Assn.
2. Ramteke, Moghe (1987), Laboratory manual of Water Analysis, CSIR-NEERI, Nagpur.
3. Leo M.L. Nollet, Leen S. P. De Gelder, (2014) Handbook of water analysis, CRC Press, Taylor and Francis.

SEC Basket

B.Sc. Sem-II (Computer Science)

BVS2P04

TALLY

Credits: 2 **Duration : 60 Hours**

Course Objectives:

1. To understand the concepts of accounting.
2. To give the students a hands-on experience on Tally.
3. To understand the different features of Tally.

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. understand the fundamentals of accounting
2. work on Tally Software
3. prepare Ledger, Voucher and Orders in Tally.
4. prepare balance sheet, payroll report and VAT report in Tally

UNIT I

Accounting Basics - Defining the need for accounting, Defining accounting, Exploring the branches of accounting, Describing the functions of accounting, Listing the advantages of accounting, Listing the limitations of accounting, Explaining important terms in accounting, Exploring the concepts of accounting, Understanding the conversions of accounting, Describing an account and its types, Explaining the rules of debit and credit, Describing a journal, Describing a ledger, Describing trial balance, Describing a financial entries, Understanding adjustment entries.

Introduction to Tally ERP 9 – Features of Tally, Enhancement in Tally. ERP 9, Installation procedure of Tally. ERP 9, Opening Tally. ERP 9, Components of the Tally. ERP 9 window, Creating a Company.

UNIT II

Stock and Godown in Tally ERP 9 – Stock groups, Stock categories, Stock items, Units of measure, Godowns. **Group, Ledgers, Vouchers and Orders** – Introducing groups, Introducing ledgers, Introducing vouchers, Introducing purchase orders, Introducing a sales order, Introducing invoices.

UNIT III

Reports in Tally ERP 9 – Working with balance sheet, Working with profit & loss A/c report, Working with stock summary report, Understanding ratio analysis, Working with trial balance report, Working with day book report. **Payroll** – Exploring payroll in Tally. ERP 9, Required features to create a pay slip, Description of payroll info, Working with payroll vouchers, Defining payroll reports, working with statements of payroll report, Describing salary disbursement.

UNIT IV

Taxation – Indian Tax Structure, Tax deducted at source in tally.ERP 9, Create a Tax Ledger, TDS Vouchers, Printing a TDS Challan, Tax collected at source in Tally.ERP 9, TCS reports in Tally ERP 9, Calculating VAT in Tally.ERP 9, VAT Classification, VAT Vouchers, VAT Reports in Tally ERP 9, Service Tax.

Books :

1.Business Accounting with MS Excel and Tally.ERP 9 Course Kit, Vikas Gupta, Dreamtech Press.
2.Computerised Accounting using Tally.ERP 9 1 , Sahaj Enterprise, Tally Education Private Ltd (TEPL).
3.SIMPLIFIED TALLY.ERP 9, Vishnu Priya Singh, Computech Publications Limited (Asian Publishers)
4.Mastering Tally Erp 9: Basic Accounts, Invoice, Inventory, A.K. Nadhani, BPB Publication
5.Tally 6.3 Tutorial, A.K. Nadhani, K.K. Nadhani BPB Publication.
6.Accounting Principles, Robert N. Anthony, James S. Reece, Irwin Professional Publishing

Semester – 2; SEC Semester II

File Handling in C (BVS2P04)

Course Outcome:

At the end of this course students will demonstrate the ability to

1. Handle various kinds of files.
2. Implement file Operations in C programming for a given application.

File handling: Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files.

Entrepreneurship Development and Services by Environmental Consultancy

Unit-I:

Introduction: Most popular business types and requirements for formation, Need for Government/ Professionals/ Licenses and Collaboration, Understanding psychology ofsustainability and circular economy as a consultant, Current Projects and Thrust Area of CPCB/MPCB, Patents for Business Development, Copyrights and Logos for consultancies.

Development of Laboratory and Training Centre: Guidelines for Recognition of Environmental Laboratories under the Environmental (Protection) Act, 1986, Guidelines for Recognition as NABL Accredited Laboratory, Importance of Training Centre.

Unit-II:

Compliance Requirements by MPCB/CPCB: Detailed study of SPCB/CPCB/MoEFCC websites, Registration with MPCB and Application for consent Service (Maitri Portal), Consent under Water and Air Act, Authorization's required under rules of Environment Act, CEPI and categorization of the Industries.

Water and Wastewater Treatment/ Air Pollution Control: Design and Development of STP/ETP, Treatment and Maintenance Services, Phyto-remediation and Patents, Supply of Equipment's and Installation of Air Pollution Control Devices.

Unit-III:

Important Services Provided by Consultants: Remote Sensing and GIS Mapping Services, Energy Conservation Services, Restoration of Lands/Water bodies, Organic farming and Green Belt Development. Preparation of EMS reports, Green Building Certifications: LEED,WELL buildings, IGBC, TERI Griha , Life Cycle Assessment reports. Ecological and Carbon Footprints.

Establishment of an NGO: Cause and Mission of NGO, Board of Directors/members and name of your NGO, Memorandum Articles of incorporation/ Articles of Association, NGO registration, Fund's collection, Building a wide network. **Individual Start up in the field of Environment:** Sole Proprietorship/Freelance – Minimum requirements and Registration, One Person Company (OPC): The Companies Act, 2013, Section 2(62), Section 3(1) (c), Sole Proprietorship vs OPC**.**

Unit-IV: Field Work/ Project/ Training/Assignment related to Entrepreneurship Development and Services by Environmental Consultancy.

B.Sc. Sem-II (Forensic Science - Major)

SEC (Forensic Science)

A. Security Features of Security Documents (BVS2P04)

Course Outcome: By the end of this Course, the learners will be able to:

1. Identify and describe security features of different currency notes.
2. Examine and explain security features of various identification documents.
3. Study and describe security features of educational documents, stamp papers and credit cards/debit cards.

List of Practical:

1. To study the security features of Indian Currency note INR 100.
2. To study the security features of Indian Currency note INR 500.
3. To study the security features of Indian Currency note INR 2000.
4. To examine the security features of Passport.
5. To examine the security features of Cheque.
6. To examine the security features of Pan card.
7. To study the security features of Aadhar card.
8. To study the security features of educational documents.
9. To study the security features of Stamp paper.
10. To study the security features of Credit Card/ Debit Card.

B.Sc. Sem-II (Forensic Science - Major)

SEC (Forensic Biology)

B. General Techniques and Recombinant DNA Technology in Microbial Forensics

(BVS2P04)

Course Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate the ability to operate a high-speed cooling centrifuge machine effectively.
2. Perform the separation of serum and plasma from blood samples using centrifugation techniques.
3. Apply centrifugation methods to separate and collect bacterial cells from a broth.
4. Perform gradient centrifugation to separate components in a given sample effectively.
5. Conduct turbidimetric evaluation of bacterial suspensions to assess their optical density and growth characteristics.

List of Practical

1. To study the operation of high-speed cooling centrifuge machine.
2. Separation of serum from blood.
3. Separation of plasma from blood.
4. Separation and collection of bacterial cells from the broth using centrifugation.
5. To perform gradient centrifugation of the given sample.
6. To perform the turbidimetric evaluation of bacterial suspension.
7. To study the restriction enzyme activity.
8. To set the program of the PCR cycle.
9. To study negative staining of bacteria.
10. To perform the plasmid DNA isolation from bacteria.
11. To study Salient features of BAC
12. To study Salient features of YAC

B.Sc. Sem-II (Forensic Science - Major)

SEC (Digital & Cyber Forensics)

C. Mobile App Development (BVS2P04)

Course Outcome: By the end of this Course, the learners will be able to:

1. Gain a solid understanding of the Android Studio IDE, its features, and its role in Android application development.
2. Apply principles of user interface design to create visually appealing and user-friendly layouts using different layout types in Android applications.
3. Implement various features and functionalities in Android applications, such as displaying shapes, creating a calculator, handling notifications, and designing a BMI calculator.
4. Develop skills in implementing navigation within Android applications, allowing users to move between screens and interact with different activities.
5. Learn techniques for optimizing performance, such as implementing multithreading for smooth image display, ensuring responsive user experiences in Android applications.

List of Practical

1. Study of Android Studio IDE
2. Displaying “Welcome to Android Laboratory”
3. Designing Simple Toast
4. Designing User Interface based on Layouts
5. Displaying different Shapes
6. Designing Simple Calculator Application
7. Navigation in Android
8. Displaying the Notification
9. Creating an Alarm
10. Designing BMI Calculator Application
11. Displaying images using multi-threading

SEC (Geology)

Tools and Techniques in Geology (BVS2P04)

Practical:

Sample etching, staining and model count techniques; heavy mineral analysis and paleocurrent interpretation; use of computers in insertion of columns, line charts, pie charts, bar charts, scatter diagrams in geological reports.

Books Recommended:

No Textbook - only handouts and web pages

B.Sc. Mathematics (Major): SEMESTER II (SEC)

Financial Mathematics (BVS2P04)

Course Outcomes

1. Calculate variables using both simple and compound interest;
2. Calculate variables using annuities formulas, including bond market value calculations;
3. Describe the features of promissory notes, bonds, and annuities;
4. Judge if a project is viable based on a Net Present Value calculation;
5. Demonstrate the interaction between interest rates and market prices for bonds;
6. Communicate using financial terminology;
7. Solve common business problems employing mathematics of finance.

TOPICS:

1. Arbitrage and risk aversion
2. Interest (simple and compound, discrete and continuous),
3. Time value of money,
4. Inflation,
5. Net present value,
6. Internal rate of return,
7. Comparison of Net Present Value (NPV) and Internal Rate of Return (IRR)
8. Bonds, bond prices and yields. Floating-rate bonds
9. Immunization
10. Asset return
11. Short selling
12. Portfolio return, (brief introduction to expectation, variance, covariance and correlation) random returns
13. Portfolio mean return and variance
14. Diversification
15. Portfolio diagram
16. Feasible set

Reference BOOKS:

1. David G. Luenberger; Investment Science; Oxford University Press, Delhi, 1998.
2. John C. Hull; Options, Futures and Other Derivatives, 6th Ed.; Prentice-Hall India, Indian reprint, 2006.
3. Sheldon Ross; An Elementary Introduction to Mathematical Finance, 2nd Ed.; Cambridge University Press, USA, 2003.

SEC (Microbiology)

Testing of Food Adulteration

Course Code: (BVS2P04)

SEC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 12 practical)

1) Detection of starch in milk & milk products
2) Detection of developed acidity in milk
3) Detection of carbonates as neutralizers in milk
4) Detection of urea in milk.
5) Detection of Margarin or Vanaspati in ghee & butter
6) Detection of mineral oil in oils & fats.
7) Detction of Mentanil yellow in ice cream.
8) Detection of Mentanil yellow in beverages.
9) Detection of Mentanil yellow in pulses
10) Detction of Kesari dal in pulses.
11) Detection of Argimone seeds in mustard seeds.
12) Detection of aluminium in silver foil.
13) Detection of sugar solution in honey.
14) Detection of chicory in coffee.
15) Detection of artificial color (coal tar) dyes in tea
16) Detection of Talc powder in cardmum.
17) Detection of tamarind powder in coffee.
18) Detection of coloring matter in turmeric powder
19) Detection of RhodamineB in red chilly powder

Scheme of Practical Examination:

1. Three expt. ----------. 10 Marks each
2. Viva-voce---------- 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1) Manual of Methods of Analysis of Microbiological Examination of Food and Water- FSSAI Manual-2016

2) Manual of methods of analysis of foods milk and milk products -fssai-2016

3) Manual of methods of analysis of foods food safety and standards authority of India ministry of health and family welfare government of India new Delhi 2015 beverages (coffee, tea, cocoa, chicory) sugar and sugar products & confectionery products -lab manual-2015

4) Manual of Methods of Analysis of Foods- Alcoholic Beverages- FSSAI-2021

5) Manual of Methods of Analysis of Foods- Spices, Herbs & Condiments-FSSAI-2021

6) Manual of Methods of Analysis of Foods- Cereal & Cereal products- FSSAI-2016

7) Manual of Methods of Analysis of Foods-Mycotoxins,FSSAI-2021

8) Manual of Methods of Analysis of Foods- Meat & Fish products- FSSAI-2016

9) General guidelines for Sampling for Microbiological Analysis of Food-FSSAI-2022

10) Manual of Methods of Analysis of Foods- FOOD ADDITIVES- FSSAI-2016

11) Manual of Methods of Analysis of Foods-Water-FSSAI-2016

12) A Manual of Laboratory Techniques-National Institute of Nutrition-CMR- Hyderabad

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of food adulteration testing
2.	The knowledge is very useful for opting job in industries.

	Semester II (SEC) Statistics
	NAME OF THE PAPER – FINANCIAL LITERACY Understanding basic financial concepts can be incredibly helpful in both your personal and professional life. Consider taking courses on topics like budgeting, investing, and financial planning.
	Paper code – BVS2P04 2 Credits (4 hrs practical per week)
	List of Practicals
1	**Budgeting**: This topic covers the basics of creating and sticking to a budget, including tracking expenses, setting financial goals, and prioritizing spending.
2	**Saving and investing**: This topic covers the different types of savings accounts and investment vehicles available, as well as how to assess risk and build a diversified portfolio.
3	**Credit and debt management:** This topic covers the basics of credit scores and reports, as well as strategies for paying off debt and avoiding high interest rates.
4	**Retirement planning:** This topic covers the different types of retirement accounts available, as well as how to calculate retirement needs and develop a retirement savings plan.
5	**Insurance:** This topic covers the basics of different types of insurance (such as health, life, and auto insurance) and how to determine which types of insurance are necessary.
6	**Taxes:** This topic covers the basics of income taxes, including how to file a tax return, how to take advantage of deductions and credits, and how to plan for tax obligations.
7	**Financial goal-setting**: This topic covers strategies for setting and achieving short-term and long-term financial goals, as well as how to adjust goals as circumstances change.

B.Sc. Sem. II SEC

Course Name: Lac culture (BVS2P04)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Identify, recognized, describe and explain male and female Lac insect and different stages of its life cycle.
- Identify, recognized, describe and explain various host plants of Lac insect.
- Handle different tools and materials involved in Lac culture.
- Separate Lac from sticks; dry and wash the crude Lac.
- Process the crude lac to Shellac.
- To do internship and work in commercial Lac cultivation unit.

Practical:

1. Study of systematic position of Lac insects, *Laccifer lacca* .
2. Identification and classification of host plants of Lac insect.
3. Identification of male and female lac insect and different life stages of Lac insects.
4. Study appropriate pruning tools, cutting tools and harvesting tools.
5. Estimation of male: female ratio in the brood.
6. Demonstration of manual scraping of rejected brood Lac and sticks.
7. Study of brood Lac with expected larval emergence.
8. Study of dead and living encrustation on brood lac.
9. Study of features of active and inactive brood
10. Demonstration of easy separation of Lac from the sticks.
11. Demonstration of drying of Lac in open air for optimum moisture content.
12. Demonstration of washing of stick Lac with an alkaline solution to clean off impurities.
13. Demonstration of processing of crude Lac to shellac by different methods (handmade, traditional native process, heat process and solvent process).

Suggested reading:

Glover PM (1931). A practical manual of lac cultivation. Criterion Printing Works, pp. 81.

Goud R (2022). Practical Manual on Apiculture, Sericulture and Lac culture. Jaya Publication House

Jaiswal AK, Sharma KK, Ramani R (2011). LAC Culture Operations When, why and How? Indian Institute of Natural Resins and Gums, pp. 18.

Ghorai N (2021). Lac culture in India. International Books and Periodicals Supply Service, pp.167.

SEC Basket
Semester IV
Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
IV	**SEC**	English for Business Communication	Languages	**BVS4P06**
		Medicinal plants, cultivation, practices and marketing	Botany	
		Clinical Pathology	Zoology	
		Visual Basic Programming	Computer Science	
		Logic and sets	Mathematics	
		Plant Transformation Techniques	Biotechnology	
		Phytochemistry	Chemistry	
		Mushroom Cultivation	Microbiology	
		Enzyme Kinetics	Biochemistry	
		Data Interpretation and Drafting of Geological Reports	Geology	
		Troubleshooting of Electronic Gadgets	Electronics	
		Biomedical Waste Management	Environmental Science	
		A. Forensic Psychology B. Law	Forensic Science	

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

NOTIICATION

No. Acad/138. Date :4th June, 2014

To,

The Principal

of all the affiliated Science Colleges

of Rashtrasant Tukadoji Maharaj

Nagpur University, Nagpur

Subject:- Direction No. 2 of 2014.

Sir/Madam,

I am forwarding herewith a copy of the Direction No. 2 of 2014 issued by the Hon'ble Vice-Chancellor under Section 14(8) of Maharashtra Universities Act, 1994 **'Direction governing examination leading to the Bachelor of Science (Information Technology) (Three Years Degree Course – Semester Pattern)"** and Examination Scheme to be implemented from Academic Session 2014-2015.

You are requested to kindly bring it to the notice of all teachers and students of your college.

Thanking you,

Yours faithfully,

Encl: As above. Sd/-

(**Dr. A.V. Gomashe**)

Registrar,

Rashtrasant Tukadoji Maharaj

Nagpur University, Nagpur.

No. Acad/138 Nagpur dated the 4thJune, 2014

Copy for information and necessary action along with the Direction and Scheme as mentioned above to :-

1. The Dean, Faculty of Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
2. The Chairman, Board of Studies in Computer Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
3. The Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
4. The Director, B.C.U.D., Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
5. The Deputy Registrar (Examinations) Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
6. The Deputy Registrar (Coll. Sec.) Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
7. The Asstt. Registrar (Prof. Exam.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
8. The Asstt. Registrar (Conf.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
9. The Asstt. Registrar (Exams & Enqury.), Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
10. The Asstt. Registrar University's Sub-Centre at Gadchiroli, R.T.M. Nagpur University, Nagpur.
11. The Officer-in-Charge, Publication Section, R.T.M. Nagpur University, Nagpur.
12. The Asstt. Registrar, Ordinance Section, R.T.M. Nagpur University, Nagpur
13. The P. A. to the Hon'ble Vice-Chancellor, R.T.M. Nagpur University, Nagpur
14. The P. A. to the Hon'ble Pro-Vice-Chancellor, R.T.M. Nagpur University, Nagpur
15. The P. A. to the Registar, R.T.M. Nagpur University, Nagpur
16. Mrs. Veena Prakashe, Information Scientist, R.T.M. Nagpur University, Nagpur

Sd/-

(**Puran Meshram**)

Deputy Registrar(Acad.)

Rashtrasant Tukadoji Maharaj

Nagpur University, Nagpur.

RASHTRASANT TUKDOJI MAHARAJ

NAGPUR UNIVERSITY,

NAGPUR

FACULTY OF SCIENCE

BOARD OF STUDIES IN COMPUTER SCIENCE

SYLLABUS FOR

Bachelor of Science (Information Technology) [B.Sc. (IT)]

Three Years (SIX SEMESTERS) DEGREE COURSE

(FROM SESSION 2014-15)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FACULTY OF SCIENCE

DIRECTION NO. 2 OF 2014

DIRECTION GOVERNING THE EXAMINATION LEADING TO THE DEGREE OF BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

(Issued under Section 14(8) of the Maharashtra Universities Act, 1994)

Whereas, Maharashtra Universities Act No. XXXV has come into force with effect from 22nd July, 1994 and further amended by Maharashtra Universities (Amendment and Continuance)Act, 2003, hereinafter referred as 'Act' has come into force from 8th August 2003.

AND

Whereas, the University Grants Commission, New Delhi vide letter No.D.O.No.F 1-2/2008/(XI Plan), dated.31 Jan.2008 regarding new initiatives under the XIth Plan – Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reforms at the earliest.

AND

Whereas, the Board of Studies in all the Science subjects in their meeting held during 28/06/2013 prepared the syllabi and scheme of examination for the B.Sc. (I T) degree course and recommended for starting of the semester pattern in Faculty of Science from the academic session 2014-15,

AND

Whereas, the recommendations of various Board of Studies in the faculty of Science regarding Up-gradation and Revision of various syllabi and introduction and implementation of Semester Pattern Examination System at under graduate level was considered by the faculty of Science in its meeting held on 9/07/2013 and constituted a Committee to decide the policy decision regarding semester pattern examination system.

AND

Whereas, the Dean, Faculty of Science has consented to the syllabi and the scheme of examination for the award of B.Sc. (I T) degree in Faculty of Science,

AND

Whereas, the faculty of Science in its meeting held on 9/07/2013 vide item No. 35, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Semester pattern and the draft syllabi of B.Sc. (I T) Semester-I & VI along with draft direction and other details.

AND

Whereas, the new scheme of examination as per semester pattern is to be implemented from the Academic Session 2014-15 for B.Sc. (I T) First Year & onwards which is to be regulated by this direction and as such

there is no direction issued and in existence and framing of an Ordinance for the above examination is a time consuming process.

AND

Whereas, the admission of students in the semester pattern at B.Sc. (I T) First Year are to be made in the Academic Session 2014-15.

Now, therefore, I, Anoop Kumar, Vice Chancellor of Rashtrasant Tukadoji Maharaj Nagpur University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called, **"Examination leading to the Degree of BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY) (Three Year Degree Course-Semester Pattern).**

2. This direction shall come into force with effect from the date of its issuance.

3. (i) The following shall be the examination leading to the Degree of BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY) in the faculty of Science namely:

a. The B.Sc. (I T) Semester-I Examination;

b. The B.Sc. (I T) Semester-II Examination;

c. The B.Sc. (I T) Semester-III Examination;

d. The B.Sc. (I T) Semester-IV Examination;

e. The B.Sc. (I T) Semester-V Examination; and

f. The B.Sc. (I T) Semester-VI Examination.

(ii) The period of Academic Session shall be such, as may be notified by the University.

4. The theory examination of Semester-I, II, III, IV, V and VI shall be conducted by the University and shall be held separately at the end of each semester at such places and dates as may be decided by the University and shall be held as per the schedule given in Table 1.

Table 1

Sr. No	Name of the Examination	Main Examination	Supplementary Examination
1	Semester I, III and V	Winter	Summer
2	Semester II, IV, and VI	Summer	Winter

5. Subject to compliance with the provisions of this Direction and of other Ordinances in-force from time to time, the following persons shall be eligible for admission to the examinations:-

(a) A student who has prosecuted a regular course of study for not less than one academic year prior to that examination;

(b) A teacher in an Educational Institution eligible under the provisions of Ordinance No. 18, and

(c) A women candidate who has not pursued a regular course of study.

Provided that in the case of the persons eligible under clauses (b) and (c), an applicant to the examination shall have attended a full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. The candidate shall submit a Certificate to that effect signed by the Principal of the college.

6. Eligibility of every applicant for admission to B.Sc. (I T) Semester course shall:-

A)In case of the B.Sc. (I T) Semester I examination:-

The candidate should have passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with English and other Modern Indian Languages together with

mathematics or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

Provided that students passing the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education and offering Vocational Stream with mathematics shall be eligible for admission to the B.Sc. (I T) Semester I course.

B) In case of the B.Sc. (I T) Semester II, III, IV, V and VI Examinations:- The student should have attended a minimum of 90 days in the respective semester and passed the previous semester examination as per the rules of ATKT as mentioned in Para 7 of this direction.

7) The ATKT rules for admission for the B.Sc. (I T) Course **(Theory and Practical as separate passing head and on calculation fraction, if any, shall be ignored)** shall be as given in the following Table- 2.
Table 2

Admission to Semester	**The student should have attended the Session / term satisfactorily**	**Candidates should have passed at least one half of the passing heads of the following examinations (Theory and Practical as separate passing head and on calculation fraction, if any, shall be ignored)**
1	2	3
B.Sc. (I T) Semester I	Semester I and admitted As per para 6 of this Direction	---------
B.Sc. (I T) Semester II	Semester II	---------
B.Sc. (I T) Semester III	Semester III	One half of the total head prescribed for Sem I and Sem II examination
B.Sc. (I T) Semester IV	Semester IV	---------
B.Sc. (I T) Semester V	Semester V	a) Passed Sem I & II examination and b) One half of the total head prescribed for Sem III & IV examination
B.Sc. (I T) Semester VI	Semester VI	---------

8. a) Without prejudice to the other provisions of Ordinance No. 6 relating to the Examinations in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every candidate.

b)The students admitted to this Degree course shall be governed by the general Ordinances / Directions of the University which are applicable to all the regular or ex-students. These Ordinances includes complete as well as relevant provision of Ordinance No. 1, 2, 6, 7-A, 9, 10, 19, 109, Ordinance No. 30 of 2006, (amended Ordinance No. 4 of 2006), Direction 9 of 2008, Direction 5 of 2004 wherever applicable accordingly AND Direction / Ordinance of ATKT as well as reassessment / provisional admission as issued from time to time.

9. The fee for each Semester examination shall be as prescribed by the University from time to time.

10. Every examinee for the B.Sc. (I T) Semester I & II examination shall be examined in:

i)Compulsory English

ii)Any one of the following Languages

Marathi, Hindi, Urdu, Supplementary English, Gujarati, Bengali, Telugu, Sanskrit, French, German, Russian, Persian, Arabic, Pali and Prakrit or Latin

iii) six papers and three practicals at respective semester.

11. The Scope of the subjects of all semesters of B.Sc. (I T) examination shall be as indicated in the respective syllabi in force from time to time. The medium of instruction and examination shall be English, except for the courses in Languages.

12. The maximum marks allotted to each subject and the minimum marks which an examinee must obtain in order to pass the examination shall be as per the Appendix **A** appended to this Direction.

13. The practical examination of all semesters shall be conducted at the end of each semester as indicated in Table 3 given below.

Table 3

S. No	Name of the Examination	Main Examination	Supplementary Examination
1	Semester I, III and V	Winter	Summer
2	Semester II, IV, and VI	Summer	Winter

14. The scheme of awarding internal marks shall be as per Appendix- **B** appended with this Direction.

15. Successful examinees at the B.Sc. (I T) Sem-VI Examination who obtained not less than 60% marks (aggregate of Sem-I, II, III, IV, V & VI Examinations taken together, excluding Languages) shall be placed in First Division, those obtaining less than 60% but not less than 45% in Second Division, and all other successful examinees in the Third Division.

Explanation :

Division at the B.Sc. (I T) Examination shall be declared on the basis of the marks obtained only in the Subjects other than languages at the Sem-I, II, III, IV, V & VI Examinations taken together.

16. There shall be no classification of successful examinees at the Sem-I to Sem-V Examinations.

17. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Distinction in that subject.

Explanation :

(1) Distinction shall be awarded only in the Science Subjects.

(2) Distinction at the B.Sc. (I T) Examination shall be awarded on the basis of the marks obtained at the B.Sc. (I T) Semester - I, II, III, IV, V and Semester VI Examination taken together.

(3) Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.

18. Provisions of Ordinance No 7-A relating to the Condonation of Deficiency of Marks for passing an examination and compartment as amended up-to-date vide ordinance No. 45 of 1983 shall apply to the examinations under this Direction.

19. As soon as possible after the examinations, the Board of Examinations shall publish a list of successful examinees at the B.Sc. (I T) Sem-I & II; B.Sc. (I T) Sem-III & IV and B.Sc. (I T) Sem-V & VI Examinations. Such list at the B.Sc. (I T) Semester VI Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6. While preparing the Merit list for the B.Sc. (I T) Examination the marks secured by the candidate in the compulsory languages at their Semester I & II Examination will be taken into consideration in addition to the marks scored by them in their optional subjects.

20. No Person shall be admitted to B.Sc. (I T) Sem-I, II, III, IV, V and VI Examinations, if he/she has already passed the corresponding or an equivalent examination of any other Statutory University.

21. Successful examinees at the B.Sc. (I T) Sem I, II, III, IV, and V Examinations shall be entitled to receive a **Certificate** signed by the **Registrar** and successful examinees at the end of B.Sc. (I T) Sem VI examination shall, on payment of prescribed fees, receive a Degree in the prescribed format, signed by the Vice-Chancellor.

22. The provisions of direction no. 3 of 2007 for the award of grace marks for passing an examination, securing higher grade in subject(s) as updated from time to time shall apply to the examination under this direction.

23. **Absorption Scheme:**

a) While switching over to semester pattern, the failure students of annual pattern will be given three chances to clear the examination.
b) The candidates who have cleared first year annual pattern examination in the subject shall get admission to third semester directly by matchable scheme. However, candidates who are allowed to keep term will not be eligible for admission to third semester unless they clear all the papers and practicals of first year annual pattern examination.
c) The candidates who have cleared second year annual pattern examination in the subject shall get admission to fifth semester directly by matchable scheme.. However, candidates who are allowed to keep term will not be eligible for admission to fifth semester unless they clear all the papers and practicals of second year annual pattern examination.
d) The unsuccessful students of old course (Yearly pattern) shall be permitted to appear for higher class as per the new course (Semester Pattern) examination of the BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY) programme (Semester Pattern) provided that they submit a certificate from the Head of the Department/Principal of the College stating that they have satisfactorily undergone a course of study in all the subjects of the new course.
e) The absorption scheme of the BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY) programme (Semester Pattern) will be effective till the introduction of new syllabus with the new absorption scheme.
f) For other Statutory University candidates with similar yearly pattern program point No. 23 'a', 'b' and 'c' shall be applicable.
g) For other Statutory University candidates with Semester pattern BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY) program the Candidates shall be admitted to next higher semester provided that he/she shall have cleared previous semester and a R.T.M. Nagpur University Committee constituted form time to time for the purpose shall scrutinize and clear the case on the basis of subject and syllabus contents of his / her previous semester exam of the other Statutory University.

Sd/-

Nagpur (**Anoop Kumar)**

Date : 16.5.2014. **Vice-Chancellor**

Appendix - B:
Guidelines for Internal Assessment, Theory paper pattern and Practical

1. Each semester shall comprise of minimum 90 teaching days.
2. Each semester will comprise
    a. six theory papers – 50 Marks each
    b. internal assessment for each paper - 10 Marks each.
    c. three practicals –30 marks each
3. In addition to the above, Semester I and II will have
    a. One compulsory English paper of 60 marks with 15 marks internal assessment, Total 75 marks.
    b. One second language paper (Marathi, Hindi, Urdu, Supplementary English, Gujarati, Bengali,Telugu, Sanskrit, French, German, Russian, Persian, Arabic, Pali and Prakrit or Latin) of 60 Marks with 15 marks internal assessment, Total 75 marks.

Internal Assessment:

4. The internal assessment shall be done by the College at least 15 days prior to the final examination of each semester. The Marks shall be sent to the University immediately after the Assessment in the prescribed format.
5. Guidelines for Internal Assessment are appended herewith.

a) The internal assessment marks assigned to each theory paper as mentioned in Appendix - A shall be awarded on the basis of assignments like class test, attendance, project assignments, seminar, study tour, industrial visits, visit to educational institutions and research organizations, field work, group discussions or any other innovative practice / activity.
b) There shall be one / two assignments (as described above) per Theory paper.
c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shall conduct the Internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
d) The concerned teacher / department / college shall have to keep the record of all the above activities until six months after the declaration of the results of that semester.
e) At the beginning of each semester, every teacher shall inform his / her students unambiguously the method he / she proposes to adopt and the scheme of marking for internal assessment.
f) Teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD / principal.
g) Final submission of internal marks to the University shall be before the commencement of the University Theory examinations.

Theory Papers:

6. All Theory papers shall be divided into four units.
7. The theory question papers shall be of 3 hours duration and comprise of 5 questions with equal weightage to all units.
8. The pattern of question papers is appended herewith.

Each theory paper will be of 50 marks each. All questions are compulsory and will carry equal marks. Question paper for any theory paper will comprise of five questions of 10 marks each. Question No. 1 to 4 will be will be from four units each with an internal choice. The questions can be asked in the form of long answer type for 10 marks.
Question No. 5 shall be compulsory with three questions / notes of very short answer type from each of the four units having 1 mark each. The student shall have an option of answering any 10 questions out of the 12 questions.

Practical:

9. Practical exam shall be of 4 hours duration.

10. The Practical Record of every student shall carry a certificate as shown below, duly signed by the teacher-in-charge and the Head of the Department.
11. If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the Practical Examination and no Marks shall be allotted to the student.
12. The certificate template shall be as follows:

C E R T I F I C A T E

Name of the college / institution _
Name of the Department: _

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri / Kumari /
Shrimati _ of _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Semester _ _ _ _ _ _ _ _ _ _ during the academic year _ _ _ _ _ _ _ _. The candidate has satisfactorily completed the experiments prescribed by Rashtrasant Tukdoji Maharaj Nagpur University for the subject _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Dated _ _ _ / _ _ _ / _ _ _ _ _

Signature of the teacher who taught the examinee
1. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
2. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Head of the Department

Appendix-A

Teaching & Examination Scheme

Bachelor of Science (Information Technology) [B.Sc. (IT)]

Three Year (SIX SEMESTER) DEGREE COURSE

B.Sc. (IT) Part I (Semester I)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	-	English	4+1	-	4+1	3	60	15	75	30	-	-		75
2.	-	Marathi/Hindi/Urdu/Gujarati/ Sanskrit / Suppl. English	3	-	3	3	60	15	75	30	-	-		75
3.	Paper-I	Fundamentals of Information Technology	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-II	Programming Methodology in 'C'	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-III	System Analysis And Design	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-IV	Web Technologies	3	-	3	3	50	10	60	24	-	-	-	60
7.	Paper-V	Multimedia Application Development	3	-	3	3	50	10	60	24	-	-	-	60
8.	Paper-VI	Applied Mathematics-I	3	-	3	3	50	10	60	24	-	-	-	60
9.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
10.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
11.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester I: 450 + 150 = TOTAL = 600 Marks.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.
- Details of Course of Languages shall be as per B.Sc. I

Teaching & Examination Scheme
Bachelor of Science (Information Technology) [B.Sc. (IT)]
Three Year (SIX SEMESTER) DEGREE COURSE
B.Sc. (IT) Part I (Semester II)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	-	English	4+1	-	4+1	3	60	15	75	30	-	-		75
2.	-	Marathi/Hindi/Urdu, Gujarati, Sanskrit / Suppl. English	3	-	3	3	60	15	75	30	-	-		75
3.	Paper-I	Fundamentals of Digital Electronics	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-II	Object Oriented Programming using 'C++'	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-III	Operating Systems	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-IV	Web Programming	3	-	3	3	50	10	60	24	-	-	-	60
7.	Paper-V	Database Management System	3	-	3	3	50	10	60	24	-	-	-	60
8.	Paper-VI	Applied Mathematics-II	3	-	3	3	50	10	60	24	-	-	-	60
9.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
10.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
11.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:
1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester II : 450 + 150 = TOTAL = 600 Marks.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.
- Details of Course of Languages shall be as per B.Sc. I

Teaching & Examination Scheme
Bachelor of Science (Information Technology) [B.Sc. (IT)]
Three Year (SIX SEMESTER) DEGREE COURSE
B.Sc. (IT) Part II (Semester III)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Microprocessor & ALP	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Data Structures	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Data Communication & Network - I	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Linux Operating System	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	E-Commerce	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Statistical Methods	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:
1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester III: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Science (Information Technology) [B.Sc. (IT)]

Three Year (SIX SEMESTER) DEGREE COURSE

B.Sc. (IT) Part II (Semester IV)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Passing Min Marks	Duration Hours	Max Marks Practical	Passing Min Marks	Total (Th,Pr,Al)
1.	Paper-I	Software Engineering	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Java Programming	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Data Communication & Network - II	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Oracle	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	Compiler Construction	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Numerical Methods	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester IV: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Science (Information Technology) [B.Sc. (IT)]

Three Year (SIX SEMESTER) DEGREE COURSE

B.Sc. (IT) Final (Semester V)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Software Project Management	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Dot Net Framework and C#	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Network Security	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Data Warehousing	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	VB Programming	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Graph Theory	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester V: 450

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Teaching & Examination Scheme

Bachelor of Science (Information Technology) [B.Sc. (IT)]

Three Year (SIX SEMESTER) DEGREE COURSE

B.Sc. (IT) Final (Semester VI)

Sr.No.	Papers	Title of Paper	Teaching Scheme			Examination Scheme								
						Theory					Practical			
			Th+Tu (Periods)	Pr (Periods)	Total periods	Duration Hours	Max Marks Th. Papers	Max. Marks IA	Total	Min Passing Marks	Duration Hours	Max Marks Practical	Min Passing Marks	Total (Th,Pr,AI)
1.	Paper-I	Enterprise Resource Planning	3	-	3	3	50	10	60	24	-	-	-	60
2.	Paper-II	Advanced Java Programming	3	-	3	3	50	10	60	24	-	-	-	60
3.	Paper-III	Cloud Computing	3	-	3	3	50	10	60	24	-	-	-	60
4.	Paper-IV	Data Mining	3	-	3	3	50	10	60	24	-	-	-	60
5.	Paper-V	Animation Techniques	3	-	3	3	50	10	60	24	-	-	-	60
6.	Paper-VI	Operation Research	3	-	3	3	50	10	60	24	-	-	-	60
7.	Pactical-I	Practical I – based on paper I & paper II		6	6	-	-	-	-	-	4	30	12	30
8.	Pactical-II	Practical II – based on paper III & paper IV		6	6	-	-	-	-	-	4	30	12	30
9.	Pactical-III	Practical III – based on paper V & paper VI		6	6	-	-	-	-	-	4	30	12	30

Note:

1. Th = Theory; Pr = Practical; Tu = Tutorial; IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3. Candidate has to pass theory papers and practical separately.

Grand Total of Semester VI: 450.

- The strength of Batch of Practical and Tutorial for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

Valuation Pattern for practical examination:-

The valuation scheme of practical examination will be as under.

Record	- 06
Viva	- 06
Writing	- 09
Execution	- 09
TOTAL	**- 30**

B. Sc. (IT) Part I Semester-I
Paper I
Fundamentals of Information Technology

UNIT - I :

Basic Components of Digital Computers: Block Diagram**. CPU:** Functions of Each Unit: Primary Memory, ALU and CU, Instruction format. **Bus**: Data, Control and Address Bus **Number Systems:** Binary, Octal, Decimal, HexaDecimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**

Language Evolution : Generation of Languages : Machine, Assembly, High Level Languages. Characteristics of Good Language **Translators :** Compiler, Interpreter and Assembler. Source and Object Program.

UNIT - II :

Memory: Static & dynamic, RAM, ROM, PROM, EPROM, EEPROM, flash and Cache.
Storage Devices: Hard Disk, Zip Disk and Optical Disk. Pen Drive, Blue Ray

UNIT - III :

Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input , MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.
Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet.
Plotters: Drum, Flat-Bed and Inkjet.

UNIT - IV :

Network: Network terminology, Topologies : Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN. Repeaters, Bridge, Routers, Brouters and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network protocols. Architecture **:** Peer-to-Peer, Client/Server.

Reference Books:

1. Information technology concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai & Vikas Publishing House Pvt Ltd, New Delhi]

B. Sc. (IT) Part I Semester-I
Paper II
Programming Methodology in C

UNIT- I :

Programming Structure : Sequence, Selection, Iteration and Modular. **Problem Solving techniques**: Development Tools**:** Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) **Developing Algorithm and Drawing flowcharts**

UNIT- II :

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions. : Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do..while, Nested loops, Jump statement: break, continue, goto. (Special emphasis on problem solving)

UNIT- III :
Arrays: Need, Types: Single and Two Dimensional Array. **Strings**: Strings Manipulation, Arrays of Strings, Evaluation order **Function:** Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT- IV:

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures. **Union**: Unions, Differences between Structure and Union **Pointer:** Introduction, Address Operator (&), Pointer variables, Void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Reference Books:

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming - Kernighen Ritche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B. Sc. (IT) Part I Semester-I
Paper III
System Analysis and Design

UNIT - I :
Introduction : System, Subsystems, Components of Computerized Information System, Systems Analysts, SDLC, Prototyping. **Feasibility Study and Analysis:** Identifying Problems, Organizing Feasibility Analysis: Economic, Financial, Organizational and Technological. Feasibility Decision, Choice of a solution. **Data Collection:** Interviews, Brain Storming, Questionnaires, Document Search, Observation.

UNIT - II :
Structured tools and techniques of Data analysis : Structured English, Process Charts, SOP, Decision Tables and Decision Trees, Data Flow Diagram, Data Dictionary.
(Special emphasis on problem solving)
System Design : Input design: Input Validation, Human factor Consideration, Messages, System Tolerance. Output design: Categories of output, Design Principles, Control of Output. Forms: Principles of Form Design, Ways to ensure Quality Forms.
Codes: Types, Physical Representation of Codes, Principle of Code Design.

UNIT - III :
Implementation: Training, Operational Training and Related Activities, Planning to Implement Change, Change Strategies.
Testing: Preparation for Testing, Test Execution: Levels of Testing, Component, Function, Subsystem, System, Test Evaluation, Acceptance.
Conversion: Cold Turkey, Parallel, Pilot, Modular and Sequential Methods. Conversion Period Length. **System Evaluation.**

UNIT - IV :
Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, **Scheduling:** Work Breakdown Structure, Activity Networks and CPM, Gantt Charts, PERT Charts, Project Monitoring and Control. Risk Management, Software Configuration Management: Necessity, Configuring Management Activities
Software Reliability and Quality Management: Software Reliability, Software Quality, ISO 9000. Software Maintenance: Characteristics of Software Maintenance, Maintenance Process Models, Estimation of Maintenance Cost.
Software Reuse: What can be reused, Why no reuse so far, Basic Issues.

Reference Books:

1. Information Systems Analysis, Design and Implementation By K. M. Hussain Donna Hussain [Tata McGraw-Hill Publishing Company Ltd, New Delhi]
2. Fundamentals of Software Engineering by Rajib Mall [PHI Publication]
3. Workbook on Systems Analysis & Design by V. Garg [PHI Publication]
4. System Analysis and Design- Don Yeates, shiebls, Helmy (M).
5. System Analysis & Design - Edward –TMH
6. System Analysis and Design – Satzinger, Robert Jackson and Stephen Burd, Thomson Learning
7. Introduction to Systems Analysis Design, Igor Hawryszkiewycz, PHI

B. Sc. (IT) Part I Semester-I
Paper IV
Web Technologies

UNIT I

Introduction to Internet, Requirement for connecting to internet, Basic internet term, Introduction to World Wide Web (WWW), Evaluation of world wide web, basic features of www, web browsers, web server. **Internet Security:** Secure Transaction, Privacy issues, computer crimes and its type. **Security Issues:** Security threats like damage to data, loss of data and unauthorized use of data. **Security Procedure:** Firewall, Encryption, Password, Access Control List, Digital Certificate.

UNIT – II

Introduction to HTML, Features of HTML , Advantage and Disadvantage of HTML, Basic structure of HTML documents. **Creating web pages with HTML Tags :** <HTML>, <HEAD>, <TITLE>, <BODY>,Heading tags, Paragraph tags, Alignment, Font tag and its attributes, line break, Pre-formatted text tag, list element (Unordered lists, ordered list, Definition list, Marquee tags and its attribute. **Character formatting tags:** Logical verses physical style, logical and physical tags. Changing the colors of the fonts. **Linking :**Relative pathnames verses absolute pathnames, URLs, Linking within a web page, linking to a different web page, linking to external web page, linking to an image by image, linking to document located in different directory, types of URLs .

UNIT – III

Images: IMG element and its attributes, Images as a Hyperlink, Image map, Image Formats, Frames. **Tables:** TABLE element and its attributes, Creating simple tables, Row element, Data element, Spanning rows and columns. **Form designs**: Form Controls, Text controls, password fields, radio buttons, checkboxes, reset and submit buttons, select element, option , Image and textarea. **Embedding Multimedia:** Introduction, Embedding Multimedia, Inserting sound/audio formats, video file formats. DHTML: using DHTML in internet explorer, heading and horizontal line, hidden message, the message at the center of the page, moving boxes , changeable box.

UNIT – IV

Cascading Style Sheets (CSS): advantage of CSS, Disadvantage of CSS, Defining a Style, Inline style sheet, Embedded Style sheet, External style sheets. **Style sheet Properties:** Font, color, background, creating group, text, Box properties, span tag.

Scripting Language: JAVA SCRIPT – Introduction**,** Advantages, Disadvantages, Working of JavaScript, Structure of JavaScript program, Variable, Data types, Operators & Expression, Decision Making- if—else, switch, loops(for, for…in, while, do…while), break & continue, , Arrays

BOOKS:

1. Complete HTML by BPB
2. HTML – 4 Unleashed (SAMS)
1. Dynamic HTML by O'RELLY (SPD)
2. Java Script Programming for the absolute beginner by Harris (PHI)

B. Sc. (IT) Part I Semester-I
Paper V
Multimedia Application Development

Unit I
Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Unit II
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Unit III
Action Script I: ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class.
Action Script II: Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

Unit IV
Application Development: Application Frame work, Using Components with ActionScript MovieClip Subclasses.
Multimedia data compression: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Text Books:
1. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHI/Pearson Education.
2. Essentials Action Script 2.0, Colin Moock, SPD O,REILLY

B. Sc. (IT) Part I Semester-I
Paper VI
Applied Mathematics-I

UNIT- I:

Propositional Calculus:
Connectives, Negation, conjunction, Disjunction, statement formulas and truth tables, conditional and Bi-conditional, well formed formulas, Tautologies, Equivalence of formulas, duality law, Tautologies implications, Functionally complete set of, other connectives,

UNIT- II:

Disjunctive normal forms, connective normal forms, Principal disjunctive normal form, Principal conjunctive normal form.

UNIT- III:

Predicate Calculus:
The theory of Inference for statement Calculus, validity using truth tables, Rules of inference, consistency of premises and indirect method of Proof

UNIT- IV:

The statement function, variables and quantifier, Predicate formulas, Free and Bound variables, The universe of Discourse, Theory of inference for predicate calculus.

Reference Books:

1. Discrete Mathematical Structures with applications to computer Science By J,P.Tremblay & R. Manohar, (TMH)
2. Discrete Mathematical Structures by Kolman Busby and Ross (pearson)
3. Discrete Mathematics By Norman Biggs. (Oxford).
4. Logic and Discrete Mathematics : Grassmann, Tremblay (Pearson)
5. Introduction to Automata Theory, Languages, and computation :Hopcroft, Motwani and Ullman(Pearson)
6. An introduction to the theory of computer science , languages and machines : Sudkamp
7. Kenneth H Rosen Discrite Mathematics & it's Applications TMH

B. Sc. (IT) Part I Semester-II
Paper I
Fundamentals of Digital Electronics

Unit – I

Data and Information: Features of Digital Systems, Number Systems: Decimal, Binary, Octal, Hexadecimal & their inter conversions, Representation of Data: Signed Magnitude, one's complement & two's complement, Binary Arithmetic, Fixed point representation and Floating point representation of numbers.
Codes: BCD, XS-3, Gray code, hamming code, alphanumeric codes (ASCII, EBCDIC, UNICODE), Error detecting and error correcting codes.

Unit- II

Boolean Algebra: Basic gates (AND, OR, NOT gates), Universal gates (NAND and NOR gates), other gates (XOR, XNOR gates). Boolean identities, De Morgan Laws.
Karnaugh maps: SOP and POS forms, Quine McClusky method.

Unit –III

Combinational Circuits: Half adder, full adder, code converters, combinational circuit design, Multiplexers and demultiplexers, encoders, decoders, Combinational design using mux and demux.
Sequential Circuit Design:
Flip flops (RS, Clocked RS, D, JK, JK Master Slave, T, Counters, Shift registers and their types, Counters: Synchronous and Asynchronous counters.

Unit- IV

Computers: Basic Organization, Memory: ROM, RAM, PROM, EPROM, EEPROM, Secondary Memory: Hard Disk & optical Disk, Cache Memory, I/O devices

Books:

1. Modern Digital Electronics by R. P. Jain, 3rd Edition, McGraw Hill
2. Digital Design and Computer Organisation by Dr. N. S. Gill and J. B. Dixit, University Science Press

B. Sc. (IT) Part I Semester-II
Paper II
Object Oriented Programming Using 'C++'

UNIT - I :
Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers: Private, Protected and Public Members.

UNIT - II :
CONSTRUCTORS & DESTRUCTORS: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors. **OPERATOR OVERLOADING:** Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT - III :
DYNAMIC OBJECTS: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**. INHERITANCE:** Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT - IV :
VIRTUAL FUNCTIONS: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions. **EXCEPTION HANDLING:** Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Reference Books:

1. Mastering C++ by K R Venugopal Tata McGraw-Hill , New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B. Sc. (IT) Part I Semester-II
Paper III
Operating System

UNIT - I:
Structure of Operating System, Operating System functions, Characteristics of Modern OS. **Process Management**: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels **CPU Scheduling**: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT – II:
Performance comparison : Deterministic Modeling , Queuing analysis, Simulators. **Deadlock and Starvation:** Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT - III:
Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, Segmentation with paging. Protection.

UNIT - IV:
I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking. **Protection Mechanisms**: Cryptography, Digital Signature, User Authentication.

Reference Books:

1. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2. Operating System Concept : Silbershaz (Addision Education)
3. Operating Systems - H.M. Deitel - Addision Wesley.
4. Operating Systems- John J. Donoven.
5. Operating System : A.S.Godbole (TMH)
6. Modern Operating Systems : Tenenenbaum (Pearson Education)
7. Operating System : Peterson.

B. Sc. (IT) Part I Semester-II
Paper IV
Web Programming

Unit I

Internet, Internet users and working, Information on Internet, Requirements for connecting to Internet, Basic Internet Terms, Introduction to world wide web, Evaluation of world wide web, basic features, web browsers, popular web browsers, web servers, HTTP, URL, Search Engines, Search Engines categories, how to use Search Engines, Searching criterion, Introduction to browsers, Working with e-mail, Parts of e-mail text, working with messages.

Unit II

Java Script -Introduction , values and variables, operators, loops and various statements in java script, Date object, Math object, string object, window events, working with forms, document object, screen object, navigator object, images and animation, java script objects

Declaration, definition, and referencing. Identifiers scope rules. Recursion. Arrays; declaration, allocation & accessing, sorting of arrays, JavaScript objects : Math, String, Date, Number and Boolean.

Documents, forms, Statements, Functions, Objects in Java scripts, events and event handling, arrays, FORMS, Buttons, Checkboxes, Text fields and text areas.

Unit-III

Introduction to active server pages (ASP) : working of ASP, setup, ASP objects, file system object, session tracking & cookies. Accessing databases using ASP.

XML: Introduction, Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

Unit IV

XML displaying an XML Document, Data interchange with an XML Document, advantages of integrating ASP & XML. Introduction to Java Server Pages (JSP): scripting standard actions, Directives. Custom tag libraries. JSP & XML case study: advantages of integrating JSP & XML.

References:

1. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson Education
2. Techmedia : The Complete Java Script
3. Eddy et. al. : "Teach Yourself Active Server Pages" (IDG)
4. R Bangia, Second edition Internet and web design, firewall media
5. R Bangia Multimedia and Wed technology
6. Internet and web designing, Macmillan
7. Ivan Bayross Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl
8. Kathhleen Kalata, Internmet Programming with VBScript and Java Script. Thomson Publication
9. Robert W. Sebesta, Programming the World Wide Web Pearson
10. Pekowsky : "Java Server Pages" (Pearson Education)

B. Sc. (IT) Part I Semester-II
Paper V
Database Management System

UNIT- I :
DBMS : Definition: Databases, DBMS, Problems with traditional file processing system, Objectives of the database systems, Three level architectures of DBMS, Component of DBMS, Database Administrator, Database Users, Data model, Different types of data models, Concepts of Hierarchical, Network Models.

UNIT-II :
E-R Models : Basic Concepts, Entity, Attributes, Relation Ship, Mapping, Keys, Weak and Strong Entity Set, Problems on E-R Diagrams, Extended E-R Features: Specialization, Generalization, Aggregation, Problems on Reduction of an E-R Schema to Tables, Tabular representation of Strong, Weak entity Sets and Relationship Sets.

UNIT-III :
Relational Model: Structure, Relational Algebra, Fundamental Operations, Set –Intersection, Natural Join, Division and Assignment Operation. Extended Relational Algebra Operations, Aggregate Functions.

UNIT–IV :
Functional Dependency: Functional Dependency, Fully Functional Dependency, Partial Dependency, Transitive Dependency, Multi Valued Dependency. Normalization, Normal Forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF). Problems on Normal forms.

Reference Books:

1. Data Base System Concepts By A SilbersChatz By Henry Korth And S.Sudarshan [Mcgraw-Hill ltd. New Delhi] 3rd Edition.
2. Introduction to Data Base Management by NAVEEN PRAKASH [Tata McGrawHill ltd.]
3. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications.
4. Raghu Ramakrishnan & Johannes Gerhrke, "Data Base Management Systems", Mc Graw Hill International Edition, 2000
5. Muzumdar, Introduction to Database Management Systems. TMH

B. Sc. (IT) Part I Semester-II
Paper VI
Applied Mathematics-II

UNIT - I :
Set Theory: Set, Subsets operations on set, Venn diagram, algebra on sets, Cartesian product of sets, Binary relations, Properties of binary relation, Relation matrix and the graph of relation, Partial order relations, Equivalence relations, Equivalence Classes, Composition of relations.

UNIT - II :
Functions - definition, types of function, Invertible functions composition of functions.
Counting - Permutation, Combinations, The pigeonhole principle, recurrence relation, Mathematical Induction.

UNIT - III :
Algebraic Structures Semi groups & groups: Binary operations, Semi groups, isomorphism and Homomorphism, Product and Quotient of semi groups, Groups, subgroups, products and Quotient of groups.
Lattices: - Lattice concepts, isomorphic Lattices, Properties of lattices, Finite Boolean algebras.

UNIT - IV :
Graph Theory: Basic concepts, types of graphs, Representation of graph in memory, Euler path and circuits, Hamiltonian Path and circuits.
Trees:- Basic concepts, Libeled trees, Undirected trees.

Reference Books:

1. Discrete Mathematical Structures with applications to computer Science By J,P.Tremblay & R. Manohar, (TMH)
2. Discrete Mathematical Structures by Kolman Busby and Ross (pearson)
3. Discrete Mathematics By Norman Biggs. (Oxford).
4. Logic and Discrete Mathematics : Grassmann, Tremblay (Pearson)
5. Introduction to Automata Theory, Languages, and computation :Hopcroft, Motwani and Ullman(Pearson)
6. An introduction to the theory of computer science , languages and machines : Sudkamp
7. Kenneth H Rosen Discrite Mathematics & it's Applications TMH

B. Sc. (IT) Part II Semester -III
Paper I
Microprocessor and ALP

UNIT-I
An over view of 8085, Architecture of 8086 Microprocessor. Special functions of General purpose registers. 8086 flag register and function of 8086 Flags. Addressing modes of 8086. Instruction set of 8086. Assembler directives, simple programs, procedures, and macros.
Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT-II
Pin diagram of 8086-Minimum mode and maximum mode of operation. Timing diagram. Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA. DMA data transfer Method. Interfacing with 8237/8257.
8255 PPI – various modes of operation and interfacing to 8086. Interfacing Keyboard, Displays, 8279 Stepper Motor and actuators. D/A and A/D converter interfacing.

UNIT-III
Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. Introduction to DOS and BIOS interrupts. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance.
Serial data transfer schemes. Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing. TTL to RS 232C and RS232C to TTL conversion. Sample program of serial data transfer. Introduction to High-speed serial communications standards, USB.

UNIT-IV
Advanced Micro Processors - Introduction to 80286, Salient Features of 80386, Real and Protected Mode Segmentation & Paging, Salient Features of Pentium, Branch Prediction, Overview of RISC Processors.

TEXT BOOKS :
1. Advanced microprocessor and Peripherals - A.K.Ray and K.M.Bhurchandi, TMH, 2000.
2. Micro Controllers – Deshmukh, Tata McGraw Hill Edition.

B. Sc. (IT) Part II Semester -III
Paper II
Data Structures

UNIT - I :
LINKED LIST : Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.

UNIT - II :
STACKS : Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

UNIT - III :
QUEUE : Representation of Queues in Memory, Circular Queue. Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.
SORTING AND SEARCHING: Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations.
Hash Tables, Hashing Technique, Collision Resolution Technique.

UNIT - IV :

TREES : Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method
GRAPHS : Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs : BSF, DFS Method.

Reference Books:

1. Classical Data Structures : D. Samanta. PHI, New Delhi.
2. DATA STRUCTURE : LIPSCTUZ SCHUM OUTLINE SERIES
3. Data structure Using C++ : Y. Kanetkar
4. Data Structures Using C++: Tennenbaum
5. Data structures by Tremblay Sorenson
6. Data structures by Bhagat singh Naps

B. Sc. (IT) Part II Semester -III
Paper III
Data Communication & Network-I

Unit-I:-
Introduction to data communications and Networking:- Introduction, history, data communication and network architecture, protocols and standards, standards organization , layered network architecture, open systems interconnection , data communications circuits, serial and parallel data transmission, circuit arrangements and data communication networks , alternate protocol suite. Signal , Noise , Modulation and Demodulation:- Introduction, signal analysis, Electrical Noise and Signal to Noise ratio, analog modulation systems , Information capacity, bits, Bit rate, Baud and M-ary Encoding , digital modulation.

Unit –II:
Transmission Media:- Introduction , Metallic cable Metallic transmission lines, transverse electromagnetic waves, characteristics , transmission line classifications, M.T line types, M.T. line equivalent circuit , Wave propagation on metallic transmission lines , metallic transmission line losses. Optical fiber Transmission media:- Introduction, Advantages and Disadvantages of optical fiber cables , Electromagnetic spectrum , O.F. Communication system block diagram, Optical fiber Construction , the physics of light, velocity of propagation, propagation of light through an Optical fiber cable, Optical fiber modes and classifications , O.F. Comparison , losses in optical fiber cables, light sources, light detectors , lasers Digital transmission:- Introduction, Pulse modulation, pulse code modulation, dynamic range, Signal Voltage-to-quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM & Differential PCM.

Unit –III
Wireless Communication Systems:- Introduction, Electromagnetic Polarization, Rays & Wavefronts, Electromagnetic Radiation, Spherical wavefronts & the Inverse Square law, Wave Attenuation & Absorption, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, free-Space Pathloss, Microwave Communication Systems, Satellite Communication Systems. Data Communication Codes, Error Control & data Formats:- Introduction, Data Communication Character Codes, Barcodes, Error Control, Error Detection, Error Correction, Character Synchronization. Data Communication Hardware, Data Communications Circuit, Line Control Unit, serial Interfaces.

Unit – IV
Network Topologies & Connectivity Devices:- Introduction, Transmission Formats, Topologies, Collision & Broadcast Domains, Connectivity Devices, Standard Connectivity Device Logic Symbols Local Area Networks:- Introduction, IEEE Project 802, Access Control Methodologies, Medium access Control, LAN Data Link Layer, Logic Link Control Sublayer, MAC Sublayer, Ethernet.

References:

1. Godbole Data Communication and Networking .- (TMH)
2. P.C. Gupta – Data Communications and Computer Networks, PHI, New Delhi 2006
3. Comer Internetworking with TCP/IP Vol-1, PHI Publication.
4. Wayne Tomasi Introduction to Data Communications & Networking (Pearson Education)
5. Kenneth C. Mansfield, Jr; James L.Antonakos An Introduction to Computer Networking (Pearson Education)
6. W. Stallings - Data and Computer Communications, 7th Edn., Pearson Edn./ PHI, New Delhi,
7. Forouzan Data Communication and Networks, Tata McGraw Hill.
8. Tanenbum Computer Networks, 3ed edition,PHI Publication.

B. Sc. (IT) Part II Semester -III

Paper IV
Linux Operating System

UNIT - I :
Logging In and Logging Out, Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories, Spawning Processes. **Shell:** Creating User Account, Shell Program, bash shell, Changing shell prompt. **Commands:** Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp

UNIT - II :
Editor: Vi editor. **Hooking up Hardware Devices:** Formatting a Floppy Disk**,** Gathering important system information. Backing Up and restoring the File **System:** Simple Backup, gzip, gunzip, tar. **Printing files:** Print Spool directory, Sending files to Printer.

UNIT - III :
Sharing Files with other Users: Maintaining User Accounts, Changing Password, Creating Group Accounts, Granting Access to files, Changing File Ownership, Protecting Files, Making a File Read-Only. Working with Processes**:** Types of processes, ps Command, Creating process, killing process, free command and top utility.

UNIT - IV :
Managing Disk Space: df, du commands, Creating Additional Free Disk Space, Locating Unused Files, Setting System Clock. Communication Utilities: who, who am i, finger, mesg, write, wall, talk, Creating a message of the day. X Window System, Graphical User Interfaces: KDE and GNOME Desktop Environment.

Reference Books:

1. SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]
2. LINUX complete reference by Richard Peterson

B. Sc. (IT) Part II Semester -III
Paper V
E-Commerce

UNIT - I :
Introduction to e-Commerce, Scope of electronic commerce, definition, e-Commerce and Trade Cycle, e- Markets, Internet e-Commerce in perspective. Value chain, Supply chain, Porters value chain model, Inter organizational value chains.

UNIT - II :
Business strategy in electronic age: Competitive advantages, Strategy, Porters model, First Movers advantages, Advantages using e-Commerce. Introduction to business strategy, Strategic implications of IT, Technology, Business environment, Business capability, Existing business strategy, Strategy formulation and implementation planning, e-Commerce implementation, e-Commerce evaluation.

UNIT - III :
Business to Business e-Commerce: Inter organizational transactions, The credit transaction trade cycle, A variety of transaction, Pens and things, Electronics Market, Usage of e-Market, Advantages and disadvantages of e-Market, Future of e-Market, EDI, introduction, EDI and Business.

UNIT - IV :
Business to Consumer Electronic Commerce: Consumer trade transaction, Internet e-Commerce, e-Shop, Other e-Commerce technologies, Advantages and disadvantages of comsumer e-Commerce. Elements of e-Commerce: elements, e-Visibility, e-Shop, Online payments, Internet e-Commerce security.

Reference Books:

01. E-Commerce, Strategy, Technologies and Applications By: David Whiteley Tata McGraw-Hill Edition.

B. Sc. (IT) Part II Semester -III
Paper VI
Statistical Methods

UNIT- I:

Introduction - Definition of Statistics, Importance and scope of Statistics, Limitations of statistics, Distrust of Statistics. Statistical Data Collection - Primary and Secondary data, Methods of Collecting Primary data, Sources and Secondary Data, Census and Sample Investigation. Presentation of statistical Data - Classification, Tabulation, Frequency Distribution, Diagrams and Graphs. Frequency Distributions and

UNIT- II :

Measures of Central Tendency - Frequency Distribution, Continuous Frequency Distribution, Graphic Representation of a Frequency Distribution Average or Measures of Central Tendency or Measures of Locations, Requisites for an ideal Measure of Central Tendency Arithmetic: Mean Median, Mode, Geometric Mean and Harmonic Mean, Weighted Average, Relationship amongst different Averages.

UNIT- III:

Measures of Dispersion, Skewness and Kurtosis - Meaning and Significance of
Dispersion, Methods of Measuring Dispersion - Range, Quartile, Mean Deviation, Standard Deviation, Coefficient of Skewness, Kurtosis, Coefficient of Dispersion, Coefficient of Variation.

UNIT- IV:

Correlation and Regression - Definition of Correlation, . Scatter Diagram, Karl Pearson Coefficient of Correlation, Limits for Correlation Coefficient, Definition of Regression, Lines of Regression, Regression Curves, Regression coefficients, properties of Regression coefficients, Correlation Analysis vs. Regression Analysis.

Reference Books:

1.S Sastry Introduction to Numerical Analysis
2.Y. Rajaraman, Computer Oriented Numerical Methods - Prentice Hall Publication
3.Gupta and Kapoor Fundamental of Mathematical Statistics
4.Brian Flowers Introduction to Numerical Methods in C++ By. (Oxford)
5.E. Balaguruswamy, Numerical Methods - Tata McGraw Hill Publication
6.Srimanta Pal Numerical Methods (Oxford)
7.K Sankara Rao Numerical Methods for Scientists & Engineers [PIlI].
8.Manish Goyal Computer Based Numerical And Statistical Techniques (Laxmi)

B. Sc. (IT) Part II Semester -IV
Paper I
Software Engineering

Unit I

Introduction to Software Engineering : The evolving role of software, Changing Nature of Software, Software myths.

A Generic view of process : Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Unit II

Process models : The waterfall model, Incremental process models, Evolutionary process models, The Unified process. **Software Requirements :** Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

Unit III

Requirements engineering process : Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models : Context Models, Behavioral models, Data models, Object models, structured methods.

Unit IV

Design Engineering : Design process and Design quality, Design concepts, the design model.

BOOKS :

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition.McGrawHill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson education.
3. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers
4. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
5. Systems Analysis and Design- Shely Cashman Rosenblatt,Thomson Publications.
6. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

B. Sc. (IT) Part II Semester -IV
Paper II
Java Programming

UNIT - I :
Introduction to Java: -History of Java, features of Java, getting started with Java. **Java programs**:- Introduction of Application & Applets. **Variables**: -Variable naming, variable initialization, assign values, Rules of variables, Scope of variable. **Operators**: -Arithmetic, Assignment, Unary, Comparison, Shift, Bit-Wise, Logical, Conditional, New, Special, Relational. Data types:-Integers, Char, String, Float etc. Typecasting: **Tokens**: -Java tokens Order of precedence of operators Streams: - Input and output.

UNIT - II :
Creating a class & subclass: -Declaring a class, Naming class, Rules to assign Class & Subclass, Creating a new object, Class of an object. **Data members**: -Declaring data member, Naming variables, using class members. **Methods**: -Using data members, Invoke a method, passing arguments to a method, calling method. **Access Specifier & Modifiers**: -Public, Private, Protected, Static & Final. **Overloading**: -Method overloading, Constructor overloading. **Java class library**: - Different types of classes. **Decision making & loops**:-If-then-else, Switch,? : operator, While-loop, do-while loop, for. **Array**: -Creating an array, one-dimensional array, two-dimensional array. **String**: -String array, string methods. **Inheritance**: -Single & multiple inheritances **Interfaces**: -Defining interfaces, extending interfaces, implementing interfaces.

UNIT - III :
Packages: -Java API packages, creating packages, accessing packages, adding a class to packages. **Import statement**: - Introduction & implementation of import statement. **Applets**:-Introduction to Applets & Application, how applets application are different creating An applet. Applets life cycle, designing a web page, creating an executable applet, running the applet, applet tags, passing a parameter to applet, HTML tag, Converting applet to application. **Threads**:-Overview of threads, single & multiple threads, lift cycle of threads, stopping & blocking threads, working with threads, priority to thread, synchronization. **Exceptions & Errors**:-Introduction, types of error, exception, syntax of exception, handling techniques, exception for Debugging.

UNIT - IV :
Event: -Event driven programming**,** handling an (AWT) events**. Graphic class:-**Introduction, the graphic classes, drawing & filling of lines, rectangle, circle & ellipse, arcs, polygons, text & fonts, creating a font class, font objects, text, coloring object. **Streams:-**Introduction, Abstract stream classes, file input & output. **AWI Applications**: -Creating a GUI using AWT toolkit, using component class, frames. **Components & Control: -**Textfield, textarea class, label, button, choice, list, checkbox, class, and combo. **Menus: -**Creating a popup menus. **Image**: - Type of image, Properties of an image, Displaying an image. **Layouts**: -Using Window Listener interface, Different types of Layout, Layout manager, Flow manager, Grid manager. **Container**: -Different types of container (Frame, Dialog, Panel)

<u>Reference Books:</u>

1. Programming with Java a primer II edition:-E Balaguruswamy(Tata McGraw-Hill)
2. Java Programming (For absolute beginners) Russell PHI
3. Black Book on Java
4. Java-Complete References

B. Sc. (IT) Part II Semester -IV
Paper III
Data Communication & Network-II

Unit-I

Communication Architecture, Protocols & Architecture: Protocols, The Layers Approach, OSI Model, TCP/IP protocol suite, System Network Architecture.

Internetworking: Principles of Internetworking, Bridges, Routers, Repeaters, Gateways, Connection Oriented Internetworking, Connectionless Internetworking, Connectionless Internetwork Protocol, Router-level protocol.

Unit II

Transport Protocols- Transport services, Protocol Mechanism, Network services, ISO Transport Standards, TCP, UDP, TCP and UDP Packet format, Lightweight Transport Protocol.

Unit III

Session Services & Protocols- Session Characteristics, OSI Session Services, Definition, OSI Session Protocol definition. DNS, FTP, HTTP.

Unit IV

Digital Network, ISDN & Broadband ISDN : Overview of ISDN, Architecture and Interfaces of ISDN, Transmission structure, User Access, ISDN protocols, Broadband ISDN(B-ISDN).

Books

1. William Stalling, Data and Computer Communication, PHI Publication.
2. Forouzan, Data Communication and Networks, Tata McGraw Hill.
3. Godbole, Data Communication and Network, TMH
4. Tanenbum, Computer Networks , ,PHI Publication.
5. Comer Internetworking with TCP/IP Vol-1, PHI Publication
6. Data and Computer Communication by William Stalling, PHI Publication.
7. Data Communication and Network by Forouzan, Tata McGraw Hill.

B. Sc. (IT) Part II Semester -IV
Paper IV
Oracle

Unit I

Introduction to Oracle - Relational database management system (RDBMS), Codd's Rules for RDBMS, Oracle as multiuser system, Logging and Logging out of Oracle, Database Administrator (DBA) and its Role, Creation of user and Password.

Introduction to Structured Query language (SQL) – History and standardization of SQL, benefits of SQL, elements of SQL, Languages, Database objects, Reserve words, Keywords.

Data types – Char, Varchar, Date, Number, Long, Raw and Long raw.

Unit II

SQL Command – DDL command, DML command, DRL command, Aggregate function, Clauses, Set operator, Predicates, Join, Sub queries, Views. Simple reports commands.

PL/SQL - Introduction to PL/SQL, Advantages of PL/SQL, PL/SQL block structure, Character Set, Literals, PL/SQL data type, Variables, Control and loop statements, Loops and Labels.

Unit III

Cursor – PL/SQL Cursor, Explicit Cursors, Implicit Cursors. **Exception Management** - User defined, predefined exceptions, subprograms and packages - procedures, functions, package specification, body, calling sub programs, advantages of packages, cursers in packages.

Unit IV

Database Triggers & Built in Packages - Database triggers-syntax, parts, statement, body, restriction, types. **Built in packages** – DBMS standard. **DBMS OUTPUT -** Collection, member functions and procedures, PL/SQL table and records, declaration, referring, maintaining row count, insertions, deletions, nested tables, varying, arrays, initialization, declaration, varrays, member functions and procedures.

Books:-

1. ORACLE 9i PL/SQL PROGRAMMING, SCOTT URMAN, : ORACLE PRESS
2. ORACLE PL/SQL : PL/SQL IN 21 DAYS (TECHMEDIA) SAMS
3. ORACLE 9i THE COMPLETE REFERENCE
4. ORACLE : I.T. TODAY (ENCYCLOPEDIA)
5. Database System Using Oracle: A Simplified Guide to SQL & PL-SQL: Nilesh Shah, PHI Publication.
6. Database Management Systems (Complete practical approach) by Sharad Maheshwari & Ruchin Jain, Firewall media
7. Dr. P.S.Deshpande SQL & PL/SQL for Oracle 10g Black Book

B. Sc. (IT) Part II Semester -IV
Paper V
Compiler Construction

UNIT - I :
Compilers and translators, need, the structure of a compiler, Lexical Analysis, Syntax analysis, Intermediate code Generation, Optimization, Code Generation, Book keeping, Error Handling

UNIT - II :
High Level programming languages, Definitions of programming languages, The lexical and syntactic structure of a language, Data elements, structures, Operators, Assignment Statements, Data Environments, Parameter transmission, Storage management.

UNIT - III :
The role of the lexical analyzer, Approach to the design of lexical analyzer, Implementation of lexical analyzer, Context free grammars, Derivations and parse trees, Ambiguous grammar.

UNIT - IV :
Parsers, Shift-reduce parsing, Operator precedence parsing, Top-down parsing, predictive parsers, Symbol Table , Code Optimization: The principal source optimization, Loop optimization, The DAG representation of basic blocks, Code Generation : A machine model, a simple code generator, Register Allocation and assignment.

Reference Books:

1. Principles of Compiler Design - A.V. Aho, J. D.Ullman : Pearson Education.
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson.

B. Sc. (IT) Part II Semester -IV
Paper VI
Numerical Methods

UNIT - I :
Roots of Non-Linear Equations : Algebraic equation, Polynomial equation, Transcendental equation, Iterative method, Starting & Stopping Iterative method, Bisection Method, False Position method, Newton Raphson Method: Secant Method, Determining all possible roots, Multiple roots of polynomial, Complex Roots using Muller's Method.

UNIT - II :
Solution to Linear Equations Existence of solution, Gauss Elimination Method, Gauss elimination with pivoting, Gauss Jordan Method, Round off errors and refinement, m Conditioned system, Matrix inversion method.

UNIT - III :
Linear interpolation, Lagrange Interpolation, Spline Interpolation, Interpolation with equidistant points, Least Square regression Fitting, Transcendental equations, Multiple linear regression, m conditioning in Least square

UNIT - IV :
Integration & Differentiation : Trapezoidal Rule, Simpson 1/3 Rule, Simpson 3/8 rule, Gaussian Integration, Solution to differential equation (using Runge-Kutta second and fourth order methods, Multistep method for differential equations (Milne-Simpson method, Adams-bashforth-

Reference Books:
1.S Sastry Introduction to Numerical Analysis
2.Y. Rajaraman, Computer Oriented Numerical Methods - Prentice Hall Publication
3.Gupta and Kapoor Fundamental of Mathematical Statistics
4.Brian Flowers Introduction to Numerical Methods in C++ By. (Oxford)
5.E. Balaguruswamy, Numerical Methods - Tata McGraw Hill Publication
6.Srimanta Pal Numerical Methods (Oxford)
7.K Sankara Rao Numerical Methods for Scientists & Engineers [PIlI].
8.Manish Goyal Computer Based Numerical And Statistical Techniques (Laxmi)

B. Sc. (IT) Final Semester -V
Paper I
Software Project Management

Unit I
Managing Software Project: Process & Project Management, Project Management and the CMM, Project Management at Infosys, Introduction to CMMI, PCMM, The Project Planning Infrastructure: The process data base, process capability Baseline, Process Assets and the Body of Knowledge System.

Unit II
Process Planning: The Information System Development Process, Requirement Analysis, Requirement Change Management, Effort Estimation & Scheduling: Estimation and Scheduling Concepts, Effort – Estimation, Scheduling.

Unit III
Quality Planning: Quality Concepts, Quantitative quality Management Planning, Defect Prevention Planning. Risk Management: Concepts of Risks and Risk Management, Risk Assessment, Risk Control.

Unit IV
Measurement and Planning: Concepts in measurement, Measurements, Project tracking. Project Management Plan: Team Management, Customer Communication and Issue Resolution, Structure of the Project Management Plan.

Text Book:

1. Pankaj Jalote – Software Project Management in Practice, Pearson Education, New Delhi
2. B.Huges and M.Cotterell – Software Project Management, 3/e, TMH, New Delhi
3. Pankaj Jalote – CMM in Practice, Pearson Education, New Delhi
4. W. Humph Grey – Managing the Software Process, Addition – Wesley
5. R. T. Futrell, D. F. Shafer, L. I. Safer, “Quality Software Project Management”, Pearson Education

B. Sc. (IT) Final Semester -V
Paper II
Dot Net Framework and C#

Unit-1
The .Net framework: Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In –Time Compilation, Framework Base Classes.

Unit-II
C -Sharp Language (C#): Introduction, Data Types, Identifiers, Variables, Constants, Literals, Array and Strings, Object and Classes, Inheritance and Polymorphism, Operator Overloading, Interfaces, Delegates and Events. Type conversion.

Unit-III
C# Using Libraries: Namespace- System, Input-Output, Multi-Threading, Networking and sockets, Managing Console I/O Operations, Windows Forms, Error Handling.

Unit-IV
Advanced Features Using C#: Web Services, Window Services, Asp.net Web Form Controls, ADO.Net. Distributed Application in C#, Unsafe Mode, Graphical Device interface with C#. .Net Assemblies and Attribute: .Net Assemblies features and structure, private and share assemblies, Built-In attribute and custom attribute. Introduction about generic.

Books:-

1. Wiley," Beginning Visual C# 2008",Wrox
2. Fergal Grimes," Microsoft .Net for Programmers". (SPI)
3. Balagurusamy," Programming with C#", (TMH)
4. Mark Michaelis, "Essential C# 3.0: For .NET Framework 3.5, 2/e, Pearson Education
5. Shibi Parikkar, " C# with .Net Frame Work" , Firewall Media.

B. Sc. (IT) Final Semester -V
Paper III
Network Security

Unit I
Introduction, Security Concepts, Threats and Risks, Attacks – Passive and Active, Security Services, Confidentiality, Authentication, Non-Repudiation, Integrity, Access Control, Availability, Model for Internetwork Security, Internet Standards and RFCs Access Control Mechanisms ,Access Matrix, HRU, TAM, ACL and capabilities

Unit II
Access Control Models, Chinese Wall, Clark-Wilson, Bell-LaPadula, Non- Interference and Role Base Model. Cryptography, Secret Key and Public Key Cryptosystems, Symmetric Ciphers, Block Ciphers and Stream Ciphers, DES, IDEA and Key Escrow, RSA and ElGamal.

Unit III
Secure Hash and Key management, Digital Signature and Non-repudiation, cryptanalysis. Network Security, Objectives and Architectures, Internet Security Protocols, IP encapsulating Security Protocol, Network and Transport Layer Security.

Unit IV
Network Security Applications, Authentication Mechanisms: a) Passwords, b) Cryptographic authentication protocol, c) Smart Card, d) Biometrics,e) Digital Signatures and seals, f) Kerberos, g) X.509 LDAP Directory. Web Security : a) SSL Encryption b) TLS, SET, E-mail Security, PGPs / MIME, IP Security, Access and System Security , Intruders, Intrusion Detection and Prevention , Firewall a) Hardware Firewall b) Software Firewall c) Application Firewall d) Packet Filtering. e). Packet Analysis, Proxy Servers, Firewall setting in Proxy, ACL in Proxy

BOOKS

1. William Stallings, "Network Security Essentials", Prentice-Hall.
2. Edward Amoroso, "Fundamentals of Computer Security Technology", Prentice-Hall.

References :

1. 3 Dorothy E. Denning, "Cryptography and Data Security", Addison-Wesley.
2. 4 Peter J. Denning, "Computers under Attack", Addison-Wesley.
3. 5 Douglas R. Stinson, "Cryptography: Theory and Practice", CRC Press.
4. 6 D. Brent Chapman and Elizabeth D. Zwicky, "Building Internet Firewalls",
5. O'Reilly and Associates

B. Sc. (IT) Final Semester -V
Paper IV
Data Warehousing

Unit I

Introduction, Definition, Components, Warehousing databases, Users, Advantages, Features, Data Granularity, Information Flow Mechanism, Metadata, Classes of Data, Lifecycle of Data, Data Flow. Architecture of Data Warehouse, characteristics, Goals, Data Marts, Building Data Marts, Pushing and Pulling Data,

Unit II

Data Warehousing Schema, Dimensional Modeling, Star Schema, Snowflake Schema, Aggregate Tables, Fact Constellation Schema, Data Modeling, Dimensional Modeling: Dimension Table, Fact Tables, Fatless Fact Tables, Updates to Dimension Tables, other types of dimension table, Performance of Data Warehouse. ELT Process: Data Extraction, Data Transformation, Data Loading, Data Quality

Unit III

Data warehousing design Review, Developing data warehouse, Testing, Monitoring, Tuning, Feedback Loops. OLAP in Data warehouse: OLAP, ROLAP, HOLAP, Multidimensional Analysis, OLAP Functions, OLAP Application\s, OLAP Models, OLAP Considerations, Tools and Products, Data Design, Administration and Performance, OLAP Platforms

Unit IV

Building Data Warehouse: Problem Definition, Success Factors, Requirement Analysis, Planning, Design Stage, Building and Implementation of Data Marts, Building Data Warehousing, Backup and Recovery, quality Frameworks, Operating warehouse, Recipe for Successful Warehouse, Pitfalls, factor,

Text Books

1. Rema Thareja Data Warehousing Oxford University Press
2. Alex Berson, S. J. Smith, Data Warehousing, Data Mining & OLAP, TMH
3. George M Marakas, Modern Data Warehousing, Mining and Visualization, Pearson Education

B. Sc. (IT) Final Semester -V
Paper V
VB Programming

UNIT-I :
Working with Visual Basic Window Components: Menu Bar, Tool Bar, Project Explorer Window, Form Layout Window, properties Window, Toolbox, Code Editor Window **Working with Forms:** Properties, Events, Methods Working with Basic Controls:Label, CommandButton, TextBox, OptionButton, Frame, CheckBox, ListBox, ComboBox, Image, Scroll, Picture, Timer, DriveListBox, DirListBox, FileListBox and Shape Controls. **Basic Programming Fundamentals:** Variables, Data types, Constant, Conversion Function. Scope of Variable: Public, Private Static. Operators: Logical, Arithmetic, Concatenation, Comparison. Decision Structure: If.. Then, If..Then..Else, Select Case.. End Case. Loop Structure: Do..While, While.. Wend, For.. Next, With..EndWith. DoEvents()

UNIT-II :
Arrays: Dynamic Array, Preserve and Control arrays. **Procedure:** General procedure, General Methods for Passing Arguments to a Procedure, **Functions:** User-Interaction, String, Math, Date, Conversion Functions. **Modules:** Form, Standard.

UNIT-III :
Menus: Creating, Adding Menu Items, Creating Shortcut, Adding Separators Bars, Submenus, Code for Menus. Creating Popup Menu: System, Custom. **Database Handling:** Database Concepts, Creating and Accessing Database, Using Data Control. **Using DAO:** Creating Search Programs, Numeric Search and Complex Search Programs.

UNIT-IV :
Using ADO Data Control, Data Link, ODBC Data Source name, Using Connection String, Creating Navigating buttons. Working with Advanced Data Controls **:** DataList Control, DataCombo Control, DataGrid Control and Msflexgrid Control. **Handling Errors** : Run Time, Trapping and Handling Error, ERR Object. Data Environment and Data Reports.

Reference Books:

1. VISUAL BASIC – to Advance by Soma Dasgupta [BPB Publication]
2. Evangelos Petroutsos, Mastering Visual Basic 6.0 BPB Publication.
3. VISUAL BASIC 6 COMPLETE REFRENCE (TMH PUB)
4. Visual Basic 6 Deitel & Deitel (Pearson Education)
5. Mastering VB 6.0 Black Book -Peter - Norton-Techmedia.

B. Sc. (IT) Final Semester -V
Paper VI
Graph Theory

Unit 1 : Graphs and operations on graphs
Definition and elementary results, Types of graphs, Isomorphism, Matrix representation of graphs: Adjacency matrix and incidence matrix, Subgraphs and induced graphs, Complement of a graph, Self complementary graphs, Union, intersection of graphs, Ring sum of two graphs.

Unit 2 Connected Graphs
Definitions: walk, trail, tour, path and circuit, Definitions of connected, disconnected graphs, Dijkstra's shortest path algorithm, Connectivity: cut-vertex, vertex connectivity.

Unit 3 : Tree Graphs
Tree : Definition, Theorem : A tree with n vertices has n -1 edges, Theorem : A connected graph G with n vertices and n – 1 edges is a tree, Theorem : A graph with n vertices is a tree if and only if it is circuit free and has n – 1 edges, Theorem : A graph G is a tree if and only if it is minimally connected, Center of a tree, Spanning tree: Definition and examples, Fundamental circuit and cut – set : Definition, Binary trees and elementary results, Kruskal's algorithm.

Unit 4 : Directed Graphs
Definition, types of directed graphs, Directed (rooted) trees, arborescence and Polish notation, Isomorphism of digraphs, Connectedness in digraphs, Euler digraph, Network and flows: Definition, examples, Maximal flow algorithm.

Reference Books:

1. Elements of Discrete Mathematics by C.L. Liu
2. Discrete Mathematics by Olympia Nicodemi
3. Discrete Mathematical Structure for Computer Science by Alan Doer and K. Levasicur.
4. Discrete and Combinatorial Mathematics by R.M. Grassl
5. Discrete Mathematics by Kenneth Rosen, Tata McGraw Hill
6. Graph Theory with Applications to Computer Science and Engineering by
7. Narsing Deo, Prentice Hall, India.
8. A First Step in Graph Theory by Raghunathan, Nimkar and Solapurrkar
9. Discrete mathematics by S.R.Patil and others, NIRALI Prakashan.
10. Discrete mathematics by Bhopatkar, Nimbkar, Joglekar, VISION
11. Publication.
12. Discrete mathematics by Naik and Patil, PHADAKE Prakashan.

B. Sc. (IT) Final Semester -VI
Paper I
Enterprise Resource Planning

Unit I
INTRODUCTION Business needs and ERP, ERP as an overview, entries as an overview, Benefits of ERP, ERP and related technologies, ERP architecture, business process reengineering, data warehousing, data mining, on line analytical processing supply choice management.

Unit II
ERP: Client server architecture and ERP, ERP implementation life cycle, implementation m~hodologies, ER? implementation – The hidden cost, organizing implementations, vendors, consultants and users, contracts with vendors, consultants and employees, project management and monitoring. After ERP implementation.

Unit III
THE BUSINESS MODULE : Business models in an ER? package, finance, manufacturing human resource, plant maintenance, materials management, quality management sales and distribution.

Unit IV
Selection of ERP, SWOT analysis of various ER? products supply chain enabled ERP. ER? and Electronic Data Interchange (EDI) integration, ERP in manufacturing and non manufacturing industries.

BOOKS:
1. ERP Demystifled by Aleris Leon (TMH Pub.)
2. Enterprise Resource Planning by Parag Diwan and Sunil Sharma (Pentageon Pren.)

B. Sc. (IT) Final Semester -VI
Paper II
Advance Java Programming

Unit I
Core Java: Introduction, Operators, Data types, Variables, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Applets
Java swing: Creating a swing Applet and Application, Programming using Panes, Pluggable Look and feel, Labels, Text fields, Buttons, Toggle Buttons, Checkboxes, Radio Buttons, View Ports, Scroll Panes, Scroll Bars, List, Combo Box, Progress bars, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows, Dialog Boxes, Inner frame.

Unit II
JDBC: The connectivity Model, JDBC/ODBC Bridge, Java.sql package, connectivity to remote database, navigating through multiple rows retrieved from a database.

Unit III
Java Beans: Application Builder tools, The bean developer kit(BDK), JAR files, Introduction, Developing a simple bean, using bound properties, The java Beans API, Session Beans, Entity Beans, Introduction to Enterprise Java Beans(EJB), Introduction to RMI(Remote Method Invocation): A simple client-server application using RMI.

Unit IV
Java Servlets: Servlet basic, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlet, Thread-safe Servlet, HTTP Redirects, Cookies, Introduction to Java server pages(JSP).

References:

1. Margaret Levine Young, “The Complete Reference Internet”, TMH.
2. Naughton, Schidt, “The Complete Reference JAVA2”, TMH.
3. Balagurusamy E., “Programming in Java”, TMH.
4. Dustin R. Callway, “Inside Servlets”, Addison Wesley.
5. Mark Wutica, “Java Enterprise Edition”, QUE.
6. Setven Holzner, “Java2 Black Book”, dreamtech.

B. Sc. (IT) Final Semester -VI
Paper III
Cloud Computing

Unit I
Introduction to Cloud Computing, The Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-asa-Service, Infrastructure-as-a-Service, Monitoring-as-aService, Platform-as-a-Service, Software-as-aService, Building Cloud Network

Unit II
Federation in the Cloud, Presence in the Cloud, Privacy and its Relation to Cloud-Based Information Systems, Security in the Cloud, Common Standards in the Cloud, End-User Access to the Cloud Computing

Unit III
Introduction, Advancing towards a Utility Model, Evolving IT infrastructure, Evolving Software Applications, Continuum of Utilities, Standards and Working Groups, Standards Bodies and Working Groups, Service Oriented Architecture, Business Process Execution Language, Interoperability Standards for Data Center Management, Utility Computing Technology, Virtualization, Hyper Threading, Blade Servers, Automated Provisioning, Policy Based Automation, Application Management, Evaluating Utility Management Technology, Virtual Test and development Environment, Data Center Challenges and Solutions, Automating the Data Center

Unit IV
Software Utility Application Architecture, Characteristics of an SaaS, Software Utility Applications,Cost Versus Value, Software Application Services Framework, Common Enablers, Conceptual view to Reality, Business Profits, - Implementing Database Systems for Multitenant Architecture

Books:
1. John W. Rittinghouse and james F. Ransome, "Cloud Computing Implementation, Management and Security", 2010, CRC Press, Taylor & Francis Group, Boca Raton London New York
2. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC,
3. 2007. [Unit -11I to Unit V]
4. Bunker and Darren Thomson, "Delivering Utility Computing", 2006, John Wiley & Sons Ltd.
5. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.

B. Sc. (IT) Final Semester -VI
Paper IV
Data Mining

Unit I
Data Mining: Introduction, Definitions, KDD Vs Data Mining, DBMA Vs Data Mining, Data Mining Problems, Data Models, OLAP, User Perspectives, Issues, Challenges, Trends, Application Areas and Applications
Frequent Pattern Mining: Basic Problem Definition, Association Rule, Mining Association Rule, Applications, Variations, Interestingness, Methods of Discovering Association Rule, Priori Algorithm, Frequent Itemset Mining (FIM) Algorithm, Comparison of FIM Algorithm, Optimal FIM Algorithm, Incremental Mining, Conciseness of Results, Sequential Rule

Unit II
Classification, Definition, Applications, Evaluations of Classifiers, Issues, Classification Techniques, Optimal Classification Algorithm, Regression
Decision Tree, Tree Construction Principal, Best Split, Speliting Indices, Splitting Criteria, Decision Tree Construction Algorithm

Unit III
Clustering, Definition, Applications, Measurement of Simplicity, Evaluation of Clustering Algorithm, Classification of Clustering Algorithm, Partition Method, Hierarchical Method, Density Base Method, Grid Base Method, Outlier Detection,

Unit IV
Partition Discovery, Relational Data, Transactional Data, Distributed Data, Spatial Data, Data Stream, Time Series Data, Text and Web Data, Multidimensional Data

Books
1. Vikram Pudi, Data Mining Oxford University Press
2. Arun K Pujari Data Minig Technique, University Press (India) Private Limited
3. Alex Berson, S. J. Smith, Data Warehousing, Data Mining & OLAP, TMH

B. Sc. (IT) Final Semester -VI
Paper V
Animation Techniques

Unit I
What is mean by Animation, Why we need Animation, of Animation, Uses of Animation, Types of Animation, Principles of Animation, Some Techniques of Animation, Animation on the WEB, 3D Animation, Special Effects, Creating Animation.

Unit II
Creating Animation in Flash: Introduction to Flash Animation, Introduction to Flash, Working with the Timeline and Frame-based Animation, Working with the Timeline and Tween-based Animation, Understanding Layers, Actionscript.

Unit III
3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.

Unit IV
Motion Caption, Formats, Methods, Usages, Expression, Motion Capture software's, Script Animation Usage – Different Language of Script Animation Among the Software.
Concept Development, Story Developing, Audio & Video, Color Model, Device Independent Color Model, Gamma and Gamma Correction, Production Budgets, 3D Animated Movies.

TEXT BOOK:
1. Ranjan Parekh, PRINCIPLES OF MULTIMEDIA, TMH
2. Ashok Banerji, Ananda Mohan Ghosh, Multimedia Technologies, McGraw Hill Publication

B. Sc. (IT) Final Semester -VI
Paper VI
Operation Research

Unit 1
Overview of operations Research: OR models, OR Techniques
Linear Programming : Introduction, Graphical solution; Graphical sensitivity analysis, The standard form of linear programming problems, Basic feasible solutions, unrestricted variables, simplex algorithm , artificial variables, Big M and two phase method, Degeneracy, alternative optima, unbounded solutions, infeasible solutions.

Unit 2
Dual problems: Relation between primal and dual problems – Dual simplex method
Transportation model: starting solutions. North West corner Rule, lowest cost method, Vogels approximation method – Transportation algorithms – Assignment problem – Hungarian Method.

Unit 3
Network Models: Definitions, CPM and PERT, Their Algorithms Integer Programming : Branch and Bound Algorithms cutting plan algorithm.
Dynamic Programming: Recursive nature of dynamic programming, Forward and Backward Recursion.

Unit 4
Assignment Problem – Zero-One Programming Model for Assignment Problem, Types of Assignment Problem, Hungarian Method, Branch and Bound Technique for Assignment Problem.

Text Books:

1. Operation Research by Kanti Swarup, P. K. Gupta, Man Mohan [Sultan]
2. Operation Research by R. Panneerselvam [PHI}
3. Introduction to Operation Research by Billy E. Gillet [TMH]
4. Operation Research by Hira Gupta
5. Operation Research Problems and Solutions by Sharma J. K. [MacMillan]
6. Operation Research Theory and Application by Sharma J. K., [MacMillan]

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 3rd SEMESTER (CBCS) EXAMINATION OF WINTER 2023

(College Level Examination)

Note :-, This Time Table is applicable to Regular Students of B.A. 3RD Semester (CBCS) Examination

=: PROGRAMME (WRITTEN) :=

TIME : - 1.30. P.M. To 4.30. P.M.

Day	Date	Subject	Paper
Thursday	21-12-2023	Compulsory English	
Saturday	23-12-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Wednesday	27-12-2023	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Friday	29-12-2023	Sociology / Ancient Indian History, Culture and Archaeology	
Monday	01-01-2024	History / Buddhist Studies / Library and Information Science	
Wednesday	03-01-2024	Political Science / Public Administration / Mathematics	
Friday	05-01-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	

TIME : - 1.30. P.M. To 3.30. P.M.

Tuesday	09-01-2024	Home Economics / Drama / Statistics	
Thursday	11-01-2024	Geography / Military Science / Fashion Design	
Saturday	13-01-2024	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 20th November 2023

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 1st SEMESTER (CBCS) EXAMINATION OF SUPPLEMENTARY 2023

(College Level Examination)

Note : - This Time Table is applicable for Ex-Students who appeared for College level examination and also for those students who appeared previously at University level examination. This examination is carried out at the college level only as per the schedule mentioned below.

=: PROGRAMME (WRITTEN) :=

TIME : - 2.30. P.M. To 5.30. P.M.

Day	Date	Subject	Paper
Wednesday	10-04-2024	Compulsory English	
Friday	12-04-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Monday	15-04-2024	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Monday	22-04-2024	Sociology / Ancient Indian History, Culture and Archaeology	
Wednesday	24-04-2024	History / Buddhist Studies / Library and Information Science	
Monday	29-04-2024	Political Science / Public Administration / Mathematics	
Thursday	02-05-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	
		TIME : - 2.30. P.M. To 4.30. P.M.	
Saturday	04-05-2024	Home Economics / Drama / Statistics	
Monday	06-05-2024	Geography / Military Science / Fashion Design	
Wednesday	08-05-2024	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th March 2024

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 2nd SEMESTER (CBCS) EXAMINATION OF SUMMER 2024

=: PROGRAMME (WRITTEN) :=

Day	Date	Subject	Paper
		TIME : - 9.30. A.M. To 11.30. A.M.	
Wednesday	15-05-2024	Home Economics / Drama / Statistics	
Friday	17-05-2024	Geography / Military Science / Fashion Design	
Monday	20-05-2024	Psychology / Music	
		TIME : - 9.30. A.M. To 12.30. P.M.	
Wednesday	22-05-2024	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Friday	24-05-2024	Compulsory English	
Monday	27-05-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Wednesday	29-05-2024	Sociology / Ancient Indian History, Culture and Archaeology	
Friday	31-05-2024	History / Buddhist Studies / Library and Information Science	
Monday	03-06-2024	Political Science / Public Administration / Mathematics	
Wednesday	05-06-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 26th March 2024

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 3rd SEMESTER (CBCS) EXAMINATION OF SUPPLEMENTARY 2023

(College Level Examination)

Note : - This Time Table is applicable for Ex-Students who appeared for College level examination and also for those students who appeared previously at University level examination. This examination is carried out at the college level only as per the schedule mentioned below.

=: PROGRAMME (WRITTEN) :=

TIME : - 2.30. P.M. To 5.30. P.M.

Day	Date	Subject	Paper
Saturday	13-04-2024	Compulsory English	
Tuesday	16-04-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Tuesday	23-04-2024	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Tuesday	30-04-2024	Sociology / Ancient Indian History, Culture and Archaeology	
Friday	03-05-2024	History / Buddhist Studies / Library and Information Science	
Tuesday	07-05-2024	Political Science / Public Administration / Mathematics	
Thursday	09-05-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	

TIME : - 2.30. P.M. To 4.30. P.M.

Saturday	11-05-2024	Home Economics / Drama / Statistics	
Monday	13-05-2024	Geography / Military Science / Fashion Design	
Tuesday	14-05-2024	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th March 2024

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 4th SEMESTER (CBCS) EXAMINATION OF WINTER 2023

=: PROGRAMME (WRITTEN) :=

TIME : - 2.00. P.M. To 5.00. P.M.

Day	Date	Subject	Paper
Tuesday	17-10-2023	Compulsory English	
Thursday	19-10-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Saturday	21-10-2023	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Thursday	26-10-2023	Sociology / Ancient Indian History, Culture and Archaeology	
Saturday	28-10-2023	History / Buddhist Studies / Library and Information Science	
Tuesday	31-10-2023	Political Science / Public Administration / Mathematics	
Thursday	02-11-2023	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	
Saturday	04-11-2023	Home Economics / Drama / Statistics	
Tuesday	07-11-2023	Geography / Military Science / Fashion Design	
Thursday	09-11-2023	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 4th SEMESTER (CBCS) EXAMINATION OF SUMMER 2024

=: PROGRAMME (WRITTEN) :=

Day	Date	Subject	Paper
		TIME : - 2.30. P.M. To 5.30. P.M.	
Thursday	16-05-2024	Compulsory English	
Saturday	18-05-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Tuesday	21-05-2024	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Saturday	25-05-2024	Sociology / Ancient Indian History, Culture and Archaeology	
Tuesday	28-05-2024	History / Buddhist Studies / Library and Information Science	
Thursday	30-05-2024	Political Science / Public Administration / Mathematics	
Saturday	01-06-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	
		TIME : - 2.30. P.M. To 4.30. P.M.	
Thursday	06-06-2024	Home Economics / Drama / Statistics	
Friday	07-06-2024	Geography / Military Science / Fashion Design	
Saturday	08-06-2024	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 26th March 2024

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 4th SEMESTER (OLD) EXAMINATION OF SUMMER 2024

=: PROGRAMME (WRITTEN) :=

Day	Date	Subject	Paper
		TIME : 2.30 P.M. TO 5.30 P.M.	
Thursday	16-05-2024	Compulsory English	
Saturday	18-05-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Tuesday	21-05-2024	**Modern Literature (Optional) :-** English /Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian/ Sanskrit Litt. / Pali-Prakrit Litt./ Persian Litt. / Arabic Litt./ Mathematics I	
Saturday	25-05-2024	Sociology/Gandhian Thought / Ambedkar Thought / Military Science / Mathematics II / Functional-Hindi	
Tuesday	28-05-2024	History/ Public Administration /Statistics I/ Library and Information Science	
Thursday	30-05-2024	Political Science	
Saturday	01-06-2024	Economics	
Thursday	06-06-2024	Philosophy/ Ancient Indian History, Culture and Archaeology / Statistics II / Buddhist Studies	
		TIME : 2.30 P.M. TO 4.30 P.M.	
Friday	07-06-2024	Psychology / Linguistics / Communicative-English / Functional English	
Saturday	08-06-2024	Indian Music / Tabla/ Home Economics (General Home Science) / Fashion Designing / Geography	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 26th March 2024

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 5th SEMESTER (CBCS) EXAMINATION OF WINTER 2023

Note :- College Level Examination, This Time Table is applicable to Regular Students of B.A. 5th Semester (CBCS).

=: PROGRAMME (WRITTEN) :=

TIME : - 1.30. P.M. To 4.30. P.M.

Day	Date	Subject	Paper
Thursday	23-11-2023	Compulsory English	
Saturday	25-11-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Tuesday	28-11-2023	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Thursday	30-11-2023	Sociology / Ancient Indian History, Culture and Archaeology	
Saturday	02-12-2023	History / Buddhist Studies / Library and Information Science	
Monday	04-12-2023	Political Science / Public Administration / Mathematics	
Thursday	07-12-2023	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	

TIME : - 1.30. P.M. To 3.30. P.M.

Saturday	09-12-2023	Home Economics / Drama / Statistics	
Monday	11-12-2023	Geography / Military Science / Fashion Design	
Wednesday	13-12-2023	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 27th October 2023

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 5th SEMESTER (OLD) EXAMINATION OF SUPPLEMENTARY 2023

(College Level Examination)

Note : - This Time Table is applicable for Ex and Old Ex-Students who are appeared previously for University level examination. This examination is carried out at college level only as per the schedule mentioned below.

=: PROGRAMME (WRITTEN) :=

Day	Date	Subject	Paper
		TIME : 2.30 P.M. TO 5.30 P.M.	
Wednesday	10-04-2024	Compulsory English	
Friday	12-04-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Monday	15-04-2024	**Modern Literature (Optional) :-** English /Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian/ Sanskrit Litt. / Pali-Prakrit Litt./ Persian Litt. / Arabic Litt./ Mathematics I	
Monday	22-04-2024	Sociology/ Gandhian Thought / Ambedkar Thought / Military Science / Mathematics II/ Functional-Hindi	
Wednesday	24-04-2024	History/ Ancient Indian History, Culture and Archaeology / Statistics I / Buddhist Studies	
Monday	29-04-2024	Political Science	
Thursday	02-05-2024	Economics	
Saturday	04-05-2024	Philosophy/ Public Administration /Statistics II/ Library and Information Science	
		TIME : 2.30 P.M. TO 4.30 P.M.	
Monday	06-05-2024	Psychology / Linguistics/ Communicative-English / Functional English	
Wednesday	08-05-2024	Indian Music / Tabla / Home Economics (General Home Science)/ Fashion Designing / Geography	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 11th March 2024

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 6th SEMESTER (OLD) EXAMINATION OF SUMMER 2024

=: PROGRAMME (WRITTEN) :=

Day	Date	Subject	Paper
		TIME : 2.30 P.M. TO 4.30 P.M.	
Wednesday	15-05-2024	Indian Music / Tabla / Home Economics (General Home Science)/	
		Fashion Designing	
Friday	17-05-2024	Psychology / Linguistics/ Communicative-English / Functional English/	
		Geography	
		TIME : 2.30 P.M. TO 5.30 P.M.	
Monday	20-05-2024	Philosophy/ Public Administration /Statistics I/ Library and Information Science	
Wednesday	22-05-2024	**Modern Literature (Optional) :-** English /Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian/ Sanskrit Litt. / Pali-Prakrit Litt./	
		Persian Litt. / Arabic Litt./ Mathematics I	
Friday	24-05-2024	Compulsory English	
Monday	27-05-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Wednesday	29-05-2024	Sociology/ Gandhian Thought / Ambedkar Thought / Military Science /	
		Mathematics II/ Functional-Hindi	
Friday	31-05-2024	History/ Ancient Indian History, Culture and Archaeology / Statistics II /	
		Buddhist Studies	
Monday	03-06-2024	Political Science	
Wednesday	05-06-2024	Economics	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 26th March 2024

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.COM.-V SEMESTER EXAMINATION OF WINTER 2023
(College Level Examination)

Note :-, This Time Table is applicable to Regular Students of B.Com. 5th Semester Examination

-:PROGRAMME (WRITTEN):-

TIME:-1.30 P.M. TO 4.30 P.M.

Day	Date	Subject	Paper
Saturday	02-12-2023	Financial Accounting – IV	
Monday	04-12-2023	Cost Accounting	
Thursday	07-12-2023	Indian Economy – I	
Saturday	09-12-2023	Marketing Management **OR** Computerized Accounting	
Monday	11-12-2023	Business Finance – I	
Wednesday	13-12-2023	Auditing	
Friday	15-12-2023	Management Process	
Monday	18-12-2023	**Vocational Subjects** Entrepreneurship Development-V	
Wednesday	20-12-2023	**Vocational Subjects** (**Group – I- Computer Applications – V)** Web Designing using HTML (WD)-V **OR** **(Group – II- Principles and Practice of Insurance – V)** Insurance and Acturial Science **OR** Advertising, Sales Promotion and Sales Management - V	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 1st November 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B. Sc. (INFORMATION TECHNOLOGY) 5TH SEMESTER EXAMINATION OF WINTER 2023

Note :- College Level Examination, This Time Table is applicable to Regular Students of B.Sc. (Information Technology) 5th Semester

-:PROGRAMME (WRITTEN):-

TIME:-1.30 P.M. TO 4.30 P.M.

Day	Date	S U B J E C T	Paper
Thursday	23-11-2023	Software Project Management	I
Saturday	25-11-2023	Dot Net Framework and C#	II
Tuesday	28-11-2023	Network Security	III
Thursday	30-11-2023	Data Warehousing	IV
Saturday	02-12-2023	VB Programming	V
Monday	04-12-2023	Graph Theory	VI

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 27th October 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.Sc. FIFTH SEMESTER EXAMINATION OF WINTER 2023

Note :- College Level Examination, This Time Table is applicable to Regular Students of Bachelor of Science 5th Semester.

-:PROGRAMME (WRITTEN):-

TIME:-1.30 P.M. TO 4.30 P.M.

Day	Date	Subject	Paper
Thursday	23-11-2023	Statistics / Microbiology / Geology	I
Saturday	25-11-2023	Bio-Chemistry / Electronics / Environmental Science	I
Tuesday	28-11-2023	Statistics / Microbiology / Geology	II
Thursday	30-11-2023	Bio-Chemistry / Electronics / Environmental Science	II
Saturday	02-12-2023	Physics / Zoology / Industrial Chemistry	I
Monday	04-12-2023	Physics / Zoology / Industrial Chemistry	II
Thursday	07-12-2023	Computer Science / Bio-Technology	I
Saturday	09-12-2023	Chemistry	I
Monday	11-12-2023	Botany / Mathematics	I
Wednesday	13-12-2023	Chemistry	II
Friday	15-12-2023	Computer Science / Bio-Technology	II
Monday	18-12-2023	Botany / Mathematics	II

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The examination Centre for college-level examination is the respective college where the student is admitted.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 27th October 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 5th SEMESTER (OLD) EXAMINATION OF WINTER 2023

-:PROGRAMME (WRITTEN):-

Note :- This Time Table is applicable for Old Ex Students & Ex Students of RTMNU

Day	Date	Subject	Paper
		TIME : 9.30 A.M. TO 12.30 P.M.	
Friday	08-12-2023	Ancient Indian History, Culture and Archaeology / Statistics I / Buddhist Studies/	
Monday	11-12-2023	Public Administration /Statistics II/ Library and Information Science	
Wednesday	13-12-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Friday	15-12-2023	Compulsory English	
Monday	18-12-2023	Economics	
Wednesday	20-12-2023	Political Science	
Friday	22-12-2023	**Classical Literature :-** Sanskrit Litt. / Pali-Prakrit Litt. / Persian Litt. / Arabic Litt./ Mathematics I	
Tuesday	26-12-2023	History	
Thursday	28-12-2023	Sociology	
Saturday	30-12-2023	**Modern Literature (Optional) :-** Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian	
Tuesday	02-01-2024	English Literature	
Thursday	04-01-2024	Philosophy	
Saturday	06-01-2024	Gandhian Thought / Ambedkar Thought / Military Science / Mathematics II Functional-Hindi	
		TIME : 9.30 A.M. TO 11.30 A.M.	
Monday	08-01-2024	Indian Music / Tabla	
Wednesday	10-01-2024	Psychology / Linguistics	
Friday	12-01-2024	Communicative-English / Functional English	
Monday	15-01-2024	Home Economics (General Home Science)	
Wednesday	17-01-2024	Geography	
Friday	19-01-2024	Fashion Designing	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the college centre is already printed on the Admission Card of each candidate. However, It is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately within seven days prior to the commencement of the written examination at the respective College/ Centre. The concerned candidates will also be able to get the necessary information from that chart of seating arrangement sent to the respective Colleges by the University.

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 30th October 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 1st SEMESTER (CBCS) EXAMINATION OF WINTER 2023

(College Level Examination)

Note :-, This Time Table is applicable to Regular Students of B.A. 1st Semester (CBCS) Examination

=: PROGRAMME (WRITTEN) :=

TIME : - 1.30. P.M. To 4.30. P.M.

Day	Date	Subject	Paper
Friday	12-01-2024	Compulsory English	
Monday	15-01-2024	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit **OR** Latin / Telugu / Bengali / Gujarati / French / German / Russian	
Tuesday	16-01-2024	**Modern Literature (Optional) :-** Marathi Literature / Hindi Literature / Urdu Literature / Bengali Literature / Telugu Literature /Gujarati Literature / French Literature / German Literature/ Russian Literature / Sanskrit Literature. / Pali-Prakrit Literature. / Latin Literature Persian Literature. / Arabic Literature / Communicative-English / Functional English / English Literature / Functional-Hindi	
Wednesday	17-01-2024	Sociology / Ancient Indian History, Culture and Archaeology	
Thursday	18-01-2024	History / Buddhist Studies / Library and Information Science	
Friday	19-01-2024	Political Science / Public Administration / Mathematics	
Saturday	20-01-2024	Economics / Ambedkar Thoughts / Gandhian Thoughts / Philosophy	
		TIME : - 1.30. P.M. To 3.30. P.M.	
Monday	22-01-2024	Home Economics / Drama / Statistics	
Tuesday	23-01-2024	Geography / Military Science / Fashion Design	
Wednesday	24-01-2024	Psychology / Music	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 13th December 2023

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

[Three Year (Six Semesters) Degree Course]

The minutes of the committee for preparing undergraduate semester pattern syllabus along with examination scheme in Faculty of Science and the Board of studies in **Physics** unanimously resolved as under.

1. There shall be total six semesters.
2. Each semester shall comprise of 90 teaching days per subject.
3. Every subject in each semester will comprise of
   a) Two theory papers - 50 Marks each
   b) One internal assignment based on two theory papers for 10 marks each. Total 20 Marks
   c) One practical/laboratory work- Total 30 marks.
4. All theory papers shall be divided into four units. Each unit shall be covered in 7.5 hours.
5. The theory question papers shall be of 3 hours duration and comprise of 5 questions with internal choice and with equal weightage to all units (as per the previous pattern) where as practical examination shall be of 6 hours duration.
6. The internal assignments shall be conducted by the university approved teachers in the subject which could be done by the respective college one month prior to the final examination of each semester. The marks shall be sent to the university immediately after the internal assessment is over.
7. The candidate has to pass individually in each theory paper/ practical/ internal assignments.
8. Teaching and examination scheme-

S. No	Subject /Paper	Teaching scheme			Examination scheme										
					Theory							Practical			
		Th+Tu (periods)	Pr (periods)	Total Periods	Duration Hrs.	Max. Marks	Min. passing Marks	Max. Marks in Int. Assessment	Min. passing IA	Total	Min passing marks	Duration Hrs.	Max. practical Marks	Min. passing Marks	Total Marks/ Credits
1.	Physics Paper-I	3+ @	-	6+ @	3	50	18	10	04	120	22	-	-	-	150
2.	Physics Paper-II	3+ @	-		3	50	18	10	04		22	-	-	-	
3.	Practical	-	6	6	-	-	-	-	-	-	-	6	30	11	

Th- Theory, Pr - Practical, IA- Internal Assessment, @- Tutorials

SETH KESARIMAL PORWAL COLLEGE, KAMPTEE
TIME TABLE FOR THE SESSION 2023-24
COMMERCE FACULTY M.COM

DAY	PERIODS	TIME	M. COM PART I		M. COM PART II	
			SEM-1	SEM-2	SEM-3	SEM-4
MON	1	7:30	BL	IFS	ST	---
	2	8:20	--	--	SSM	CL
	3	9:10	FFM	AFM	---	OR
	4	10:00	ME	CL	---	---
	5	10:50	OB	---	CAC	IBE
TUE	1	7:30	RM	PM	ST	---
	2	8:20	OB	---	CAC	IBE
	3	9:10	BL	IFS	AMA	CTDC
	4	10:00	FFM	---	SSM	CL
	5	10:50	ME	CL	--------	---
WED	1	7:30	RM	PM	SSM	CL
	2	8:20	BL	IFS	ST	---
	3	9:10	--	AFM	---	OR
	4	10:00	ME	CL	AMA	CTDC
	5	10:50	FFM	--	CAC	IBE
THU	1	7:30	---	---	AMA	CTDC
	2	8:20	RM	PM	ST	--
	3	9:10	FFM	AFM	CAC	IBE
	4	10:00	BL	IFS	--	OR
	5	10:50	OB	---	--	--
FRI	1	7:30	BL	IFS	--	OR
	2	8:20	RM	PM	CAC	IBE
	3	9:10	OB	---	AMA	CTDC
	4	10:00	---	AFM	SSM	CL
	5	10:50	ME	CL	--	--
SAT	1	7:30	OB	---	--	---
	2	8:20	ME	CL	AMA	CTDC
	3	9:10	--	AFM	ST	OR
	4	10:00	FFM	---	SSM	CL
	5	10:50	RM	PM	--	--

POST GRADUATE PROGRAM IN SOCIOLOGY

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

POST GRADUATE (CBCS) (NEP) SEMESTER SYLLABUS

2023-2024

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester I

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/ point (40%)	Total
						Internal Evaluation	End SEM Exam.		
6.0	Major	Mandatory	PGSO1M01	Classical Sociological Thinkers	4	20	80	B/6	100
			PGSO1M02	Perspective on Indian Society -I	4	20	80	B/6	100
			PGSO1M03	Constitution and Social Change in India	4	20	80	B/6	100
			PGSO1M04	Sociology of Religion - I	4	20	80	B/6	100
		Elective	PGSO1E05	G1P1: Family, Kinship and Marriage	2		50	B/6	50
			PGOS1E06	G2P1: Gender and Society	4	20	80		100
			PGSO1E07	G3P1: Sociology of Social Movement					
			PGSO1E08	G4P1: Sociology of Education					
	RM		PGSO1M09	Quantitative Research Methodology **OR** Qualitative Research Methodology	4	20	80	B/6	100
	Cumulative Credit/ Marks				**22**				**550**

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RM: Research Methodology, RP: Research Project, CS: 40%

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POST GRADUATE PROGRAM IN SOCIOLOGY
Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester II

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.0	Major	Mandatory	PGSO2M01	Contemporary Sociological Theory	4	20	80	B/8	100
			PGSO2M02	Perspectives on Indian Society-II	4	20	80	B/8	100
			PGSO2M03	Sociology of Change and Development	4	20	80	B/8	100
			PGSO2M04	Sociology of Religion - II	2		50	B/8	50
		Elective	PGSO2E05	G1P2: Rural and Urban Transformation	4	40	60	B/8	100
			PGSO2E06	G2P2: Women in Indian Society					
			PGSO2E07	G3P2: Social Movements in India					
			PGSO2E08	G4P2: Education and Society in India					
	OJT/FP		PGSO2M09	Field project FP	4	100		B/8	100
	Cumulative Credit/ Marks				22				550
	Cumulative Credit for PG diploma (Sem. 1+2)				44				

Exit option: PG Diploma (40 Credits) after three years UG Degree

Note: For **Elective** Department offers 4 **Groups or Specializations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters. **RM: Research Methodology OJT: On Job Training: Internship/Apprenticeship CS: 40 %**

9/9/23

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester III

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Exam		
6.5	Major	Mandatory	PGSO3M01	Modern Sociological Theories	4	20	80	B/6	100
			PGSO3M02	Feminist Sociological Thinkers	4	20	80	B/6	100
			PGSO3M03	Globalization and Society	4	20	80	B/6	100
			PGSO3M04	Social Problems in Contemporary India	2		50	B/6	50
		Elective	PGSO3E05	G1P3: Sociology of Social Stratification	4	40	60	B/6	100
			PGSO3E06	G2P3: Sociology of Social Exclusion					
			PGSO3E07	G3P3: Media and Society					
			PGSO3E08	G2P3: Environment and Society					
	RP		PGSO3M09	Research Project	4	100		B/6	100
	Cumulative Credit/ Marks				66				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project

C5: 40%

17/07/23

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester IV

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.5	Major	Mandatory	PGSOSM01	Postmodern Social Theories	4	20	80	B/6	100
			PGSOSM02	Recent trends in Social Theories	4	20	80	B/6	100
			PGSOSM03	Economy and Society	4	20	80	B/6	100
		Elective	PGSOME04	G1P4: Sociology of Marginalized Communities	4	20	80	B/6	100
			PGSOME05	G2P4: Science, Technology and Society					
			PGSOME06	G3P4: Culture and Symbolic Transformation					
			PGSOME07	G4P4: State, Politics and Development					
	RP		PGSOSM08	Research Project	6	150		B/6	150
	Cumulative Credits/ Marks				22				550
	Cumulative Credit for 2-year PG degree				88				

2 Year - 4 Semester PG Degree (88 credits) after three-year UG degree

OR

3 Year- 2 Sem PG Degree (44 credits) after four year of UG degree

Note: For Elective Department offers 4 Groups or Specialisations. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project, CSc 60%

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

P.G. CBCS (NEP) Semester Pattern Syllabi of SOCIOLOGY

STRUCTURE OF THE CBCS (NEP) SEMESTER PATTERN P.G. PROGRAM

The P.G. CBCS semester pattern shall come into force from the academic year2023 - 2024 for the students seeking enrollment in semester I. While the students of semester III and semester IV shall go through the CBCS semester pattern examinations.

1. The CBCS (NEP) semester pattern P.G. PROGRAM shall give sufficient opportunity to the students of all departments for choice of subjects as shown in major electives.
2. The whole course shall be of full-time course of two years duration.
3. The semester I, II and III shall have four major mandatory papers (compulsory papers) and one core elective paper (optional papers) in four groups offering wider choice to the students to opt for any one group of them. The semester IV shall have three major mandatory papers (compulsory papers). There shall be again one core elective paper, which is in continuation of the group, which opt in first semester.
4. In semester I, students shall have a choice to choose any one of the course from RM (Research methodology) which he want to use in research projects of semester III & IV. RM is mandatory course.
5. In semester II, student himself shall engage in fieldwork and submit a fieldwork report to the institution/department. Based on hours engage in fieldwork and report submitted to institution/department, his/her credits will be evaluated. University will provide the direction time to time on the process of evaluation of fieldwork and other issues related to this course.
6. In semester III and IV, student shall avail a course RP (Research Project) which is mandatory and divided into two parts. The courses Research Project - I and Research Project - II, which shall opt by students, are the part of Semester III and Semester IV simultaneously. Student in the guidance of supervisor shall decide the topic of this course. The conditions of supervisor-ship and other issues will be decided by university time to

time.

7. 2100 marks, i.e. 88 credits in order to be awarded M.A. degree in Sociology by RTM Nagpur University.
8. The CBCS P.G. course shall be based on continuous internal evaluation of the students out of 20 marks in each paper (except 2 credits paper), along with the external evaluation based on a descriptive written examination of 80 marks by the university.

   Regarding 2 credits papers, University or Board of studies will declare the policy as per further notifications.

CODE OF EXAMINATION

Written Examination:

1. There shall be a written external examination of descriptive type in each paper at the end of every semester.
2. Each 4-credit paper shall be of 80 marks of external examination of 3 hours duration and 2-credit papers shall be of 50 marks of external examination of 2 hours duration.
3. The question paper shall contain 5 questions (four long questions and one short question) with an internal choice except for the short question. The short question shall be put like A, B, C and D at the question No. 5 i.e. the last question of the paper. The students shall have to answer all questions including all A, B, C and D of Q.No.5.
4. Each question shall carry an equal value of 16 marks in 4-credit course and 10 marks in 2-credit course.

Nature of Internal Evaluation:

1. There shall be an internal evaluation of each student of 20 marks in each theory paper at the end of every semester in 4-credit course. It should be note that there is no internal evaluation in 2-credit courses.
2. Out of 20 internal marks in each theory paper, 10 marks shall be for Home Assignment and another 10 marks for daily attendance, viva-voce test and seminar presentation of the students based on the course content. The viva-

voce tests and seminar presentations shall be conducted by a committee consisting of the Head of the Department/Principal of the college/Director of the Institute or Centre running the P.G. Course and the teacher of the concerned subject.

3. The teacher of the concerned subject shall decide the task to be assigned to the students for home assignment, viva-voce test and seminar presentation. The students' evaluation shall be done on consensus among all the members of the committee conducting the viva-voce test and seminar presentation.

Passing Marks

1. The students shall be required to score a minimum of 40 marks in each paper out of 100 including internal marks in order to pass in the examination.
2. Scheme of Marking for Research Paper - I and II

A. Examination and Evaluation scheme for field Project)FP)

Sr.	Contents	hours	Marks Distribution
1	Orientation of Field Project	10 (2*5)	-
2	Field Work	96hours (16*6)	40
3	Field Diary	Related to FW	10
4	Report Writing	12 hours (2*6)	20
5	Presentation	2 hours	10
6	Internal Viva-voce	---	20

Internal Viva-voce conducted on the objectives of Field project with Power point Presentation. Its Field Diary and Field Report should be consider a basic document for viva-voce.

M.A. Third Sem.(CBCS) Winter 2023
(707 to 733)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. THIRD SEMESTER (C.B.C.S.) EXAMINATION OF WINTER, 2023
-:PROGRAMME (WRITTEN):-

TIME:-9.30 A.M. TO 12.30 P.M.

Sr. No.	Subject	Day	Date	Paper
1.	**English (NEW COURSE)**	Saturday	16 -12- 2023	Romantic and Victorian Poetry
		Tuesday	19 -12- 2023	Literary Criticism and Theory-I
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	A) Nineteenth Century American Literature **OR**
				B) Trauma Studies and Literature **OR**
				C) Pandemic Studies and Literature **OR**
				D) English Comedies
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Saturday	23 -12- 2023	A) Communicative English -I **OR**
				B) Postcolonial Literature –I **OR**
				C) Research Writing and Presentation Skills in English Studies-I **OR**
				D) Dalit Literature -I
1.	**English (OLD COURSE)**	Saturday	16 -12- 2023	Literary Criticism and Theory-I
		Tuesday	19 -12- 2023	Romantic and Victorian Poetry
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	A) English Comedies **OR**
				B) Twentieth Century American Literature **OR**
				C) The English Novel –III **OR**
				D) Post Colonialism and Literature-II
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Saturday	23 -12- 2023	A) Communication English -I **OR**
				B) History of English Literature –I **OR**
				C) English Language Teaching-I **OR**
				D) European Fiction and Drama
2.	**Marathi (NEW COURSE)**	Saturday	16 -12- 2023	प्राचीन मध्ययुगीन कविता
		Tuesday	19 -12- 2023	मराठी भाषा, बोली आणि व्याकरण
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	(क) ग्रामीण साहित्य
				(ख) दलित– आंबेडकरवादी साहित्य
				(ग) आदिवासी साहित्य
				(घ) वैदर्भीय साहित्याचा अभ्यास
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Saturday	23 -12- 2023	(क) वाङ्मयीन चळवळी
				(ख) प्रसारमाध्यमे आणि साहित्यव्यवहार
				(ग) पर्यावरण आणि साहित्य
				(घ) उपयोजित मराठी आणि कौशल्ये
2.	**Marathi (OLD COURSE)**	Saturday	16 -12- 2023	मध्ययुगीन कविता
		Tuesday	19 -12- 2023	मराठीचा भाषिक अभ्यास
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	(क) ग्रामीण साहित्य
				(ख) आदिवासी साहित्य
				(ग) विदर्भातील साहित्याचा अभ्यास
				(घ) पर्यावरण आणि साहित्य
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Saturday	23 -12- 2023	(क) भाषिक व्यवहार आणि कौशल्ये
				(ख) साहित्य चळवळी
				(ग) दलित–आंबेडकरवादी साहित्य
				(घ) अनुवादित विश्वसाहित्याचा अभ्यास

3.	**Hindi**	Saturday	16 -12- 2023	हिंदीभाषा
		Tuesday	19 -12- 2023	पाश्चात्य काव्यशास्त्र
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	A) प्रयोजन मुलक हिंदी
				B) हिंदीका लोकसाहित्य
				C) भारतीय साहित्य
				D) दलितविमर्श
				E) स्त्री विमर्श
				F) आदिवासीविमर्श
				Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
		Saturday	23 -12- 2023	A) भाषा और संप्रेषण कौशल
				B) हिंदी काव्यास्वादन
				C) हिंदी कहानी
				D) हिंदी रचनात्मक लेखन
				E) हिंदी मीडिया लेखन
4.	**Urdu**	Saturday	16 -12- 2023	Literary Criticism in Urdu
		Tuesday	19 -12- 2023	Modern Poetry Since 1857 till date
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	A) Script-O-Sahafati Mawad
				B) Tarseel-e-Amma
				C) a) Urdu mein Tanz-o-Mizah b) Inshaiya
				D) Urdu Adab ki Tahreekein
				Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
		Saturday	23 -12- 2023	A) Urdu Zaban Ka Buniaydi Mutalla **OR**
				B) Urdu Zaban Ka Ibtedayi Mutalla
				Optional – Any One out of the following **Core Subject**
				C) Urdu Tahqeeq **OR**
				D) Tarjuma Nigari
5.	**Economics**	Saturday	16 -12- 2023	I Economics of Growth and Development-I
		Tuesday	19 -12- 2023	II International Trade & Finance-I
				Optional – Any One out of the following **Elective Course**
		Thursday	21 -12- 2023	III i. Financial Institutions & Markets-I **OR**
				ii. Gender Economics **OR**
				iii. Labour Economics **OR**
				iv. Poverty and Income Distribution **OR**
				v Basic Econometrics **OR**
				Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
		Saturday	23 -12- 2023	IV 1. Basic Statistics
				2. Issues in Indian Economy
				3. Managerial Economics
				4. Research in Social Science
				5. Economics-I
				Optional – Any One out of the following **Core Course**
				A) International Monetary System and Finance **OR**
				B) Research Methodology-I
6.	**History**	Saturday	16 -12- 2023	Emergence of Maratha Power in 17th Century
		Tuesday	19 -12- 2023	State in Ancient & Medieval India
				Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023	A) Economic History of India : 1757 – 1857 **OR**
				B) Ecology and Environment in India
				Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
		Saturday	23 -12- 2023	A) Concept Of History **OR**
				B) Medieval Vidarbha (For the Students of History only) **OR**
				C) India Under the Sultanate Period (1206-1525 A.D.) **OR**
				D) History of Science and Technology in Pre-Colonial India
7.	**Political Science**	Saturday	16 -12- 2023	Research Methodology
		Tuesday	19 -12- 2023	Public Administration
				Optional – Any One out of the following **Elective Course**
		Thursday	21 -12- 2023	i) Politics of Maharashtra **OR**
				ii) Ancient Indian Political Thought **OR**
				iii) Electoral Politics in India **OR**
				iv) Globalization and its Impact on India
				Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
		Saturday	23 -12- 2023	A) Political Science : Ideas and Concepts **OR**
				B) India and the World **OR**
				C) Local Self – Government **OR**
				D) Major Issues in Contemporary Politics **OR**
				E) Public Policy in India **OR**
				F) Reservation Policy in India **OR**
				G) Development and Human Rights **OR**
				H) Human Rights and Indian Constitution

8. Public Administration	Saturday	16 -12- 2023	Financial Administration in India
	Tuesday	19 -12- 2023	Comparative Public Administration
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	i) Public Sector Administration in India **OR**
			ii) Panchayati Raj **OR**
			iii) Industry and Entrepreneurships Development **OR**
			iv) Research Methodology
	Saturday	23 -12- 2023	Administrative Law **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			i) Introduction to Public Administration **OR**
			ii) Introduction to Indian Administration **OR**
			iii) E- Governance
9. Geography	Saturday	16 -12- 2023	Economic Geography
	Tuesday	19 -12- 2023	Geography of Rural Settlement
	Thursday	21 -12- 2023	Natural Disaster Management
			Optional – Any One out of the following **Elective**
	Saturday	23 -12- 2023	i) Urban Geography **OR**
			ii) Agricultural Geography **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			i) Geographic Information System And Computer Mapping
10. Sociology	Saturday	16 -12- 2023	Orientations in Sociological Theory
	Tuesday	19 -12- 2023	Sociology of Change and Development
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	A) Sociology of Education **OR**
			B) Sociology of Social Exclusion **OR**
			C) Globalization and Society
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	A) Rural Society In India **OR**
			B) Urban Society In India **OR**
			C) Social Change in Contemporary India **OR**
			D) Introductory Sociology **OR**
			E) Sociology Of Environmental and Society
11. Women's Studies	Saturday	16 -12- 2023	Gender Discourse in India : Selected Thinkers
	Tuesday	19 -12- 2023	Women and Law
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	i) Gender Economy **OR**
			ii) Gender & Development
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	i) Women's Education in India **OR**
			ii) Issues in Women's Empowerment **OR**
			iii) Women's Health Care in India
12. Arabic	Saturday	16 -12- 2023	Modern Prose
	Tuesday	19 -12- 2023	Modern Poetry
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	A) History and Culture of the Arabs From Pre- Islamic To Umayyad Period **OR**
			B) History Of Modern Arabic Literature **OR**
			C) Special Study Of Syed Abdul Hasan Ali Nadvi
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	A) Advance Grammar **OR**
			B) Communication Skill In Arabic
13. Persian	Saturday	16 -12- 2023	Modern Prose
	Tuesday	19 -12- 2023	Modern Poetry
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	A) Special Study on Indian Persian Poet (Amir Khusrao) **OR**
			B) Special Study on Indian Persian Poet (Ghalib)
			C) Special Study on Indian Persian Poet (Abu Talib Kaleem)
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	A) Communication Skill in Persian **OR**
			B) A Critical Study of Persian Translation works during Mughal Period
14. Sanskrit	Saturday	16 -12- 2023	कल्पसाहित्यम्। **OR**
			सांख्यतत्त्वकौमुदी–योगसूत्र च। **OR**
			काव्यं काव्यशास्त्रं च।
	Tuesday	19 -12- 2023	ऋग्वेदसंहिता–निरुक्तं च। **OR**
			वेदान्त–बौद्ध–जैन–दर्शनं च। **OR**
			नाटयं नाटयशास्त्रं च।
	Thursday	21 -12- 2023	**Elective Course**
	Saturday	23 -12- 2023	**Optional –AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS OR CORE**

15.	**Pali**	Saturday	16 -12- 2023	I	Sutta Literature : Digha Nikaya and Majjhima Nikaya
	(NEW COURSE)	Tuesday	19 -12- 2023	II	Pali Poetry : Thergatha and Therigatha
					Optional – Any One out of the following **Elective I**
		Thursday	21 -12- 2023	III	A) Abhidhamma Literature : Abhidhammatthasangaho **OR**
					B) Vipassana in Modern Age **OR**
					C) Visuddhimaagga
					Optional – Any One out of the following **Core Subject**
		Saturday	23 -12- 2023	IV	A) Vansa Literature **OR**
					B) Pali Thinkers
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
					C) Pali- Prakrit – I (Buddha and His Teachings)
15.	**Pali**	Saturday	16 -12- 2023	I	Sutta Literature : Digha Nikaya and Majjhim Nikaya
	(OLD COURSE)	Tuesday	19 -12- 2023	II	Pali Poetry : Thergatha and Therigatha
					Optional – Any One out of the following **Elective I**
		Thursday	21 -12- 2023	III	A) Abhidhamma Literature : Abhidhammatthasangaho
					B) Vipassana in Modern Age
					C) Psychology in Pali Literature
					Optional – Any One out of the following **Core Subject**
		Saturday	23 -12- 2023	IV	A) Vansa Literature and Buddhist History **OR**
					B) Pali Literature & Thinkers **OR**
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
					C) Buddha and His Teachings
16.	**Linguistics**	Saturday	16 -12- 2023		Structure of English **OR**
					Structure of Indo-Aryan **OR**
					Psycholinguistics
		Tuesday	19 -12- 2023		Historical Linguistics
					Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023		Field Linguistics **OR**
					Pragmatics
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
		Saturday	23 -12- 2023		Communication Strategies **OR**
					Anthropological Linguistics
17.	**Ambedkar Thoughts**	Saturday	16 -12- 2023		Ambedkar on Nation, Nationalism & Democracy
	(NEW COURSE)	Tuesday	19 -12- 2023		Ambedkar's Thoughts on History
					Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023		Educational Status of Marginalised Groups in Contemorary Period **OR**
					Dr. Ambedkar on Political Represenative & Social Religious Minorities
					Optional – Any One out of the following
		Saturday	23 -12- 2023		a) Research Methodology (A) **OR**
					b) Human Right **OR**
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
					Ambedkar Thought I- (B)
17.	**Ambedkar Thoughts**	Saturday	16 -12- 2023		Economic Thought (A)
	(OLD COURSE)	Tuesday	19 -12- 2023		Religious Thought (A)
					Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023		Political Thought (A) **OR**
					Dr. Ambedkar on Historicism (A)
					Optional – Any One out of the following
		Saturday	23 -12- 2023		a) Research Methodology (A)
					b) Thoughts of Tathagat Buddha **OR**
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
					Ambedkar Thought I- (B)
18.	**Gandhian Thoughts**	Saturday	16 -12- 2023		Gandhi and His Contemporaries – I
		Tuesday	19 -12- 2023		Research Methodology
					Optional – Any One out of the following **Elective**
		Thursday	21 -12- 2023		Satyagraha – I **OR**
					Gandhian Life Style
		Optional –	**AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS**		
		Saturday	23 -12- 2023		Gandhian Thought -I **OR**
					Gandhian Approach to Rural Development-I
19.	**Indian Music** ;	Saturday	16 -12- 2023		A) क्रियात्मक व उपयोजीतशास्त्र **OR**
					B) जनसंगीत **OR**
					C) संगीत समिक्षा १
		Tuesday	19 -12- 2023		A) संगीतातील स्थित्यंतरे **OR**
					B) Basic Concepts of Music **OR**
					A) Intervals between notes **OR**
					B) Basic Laya Sadhana Practice of Basic Lessons

20. Home Economics	Saturday	16 -12- 2023	Foods and Nutrition
	Tuesday	19 -12- 2023	Family Dynamics
	Thursday	21 -12- 2023	Home Science Extension Education **OR**
			Housing and Interior
	Saturday	23 -12- 2023	Consumer and the Market **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			a) CB1- Resource Management
			b) CB2- Human Development
			c) CB3- Food and Nutrition
			d) CB4- Textile and Clothing
			e) CB5- Home Science Extension Education
			(GROUP – A) (Archaeology)
21. A.I.H.C. & Arch.	Saturday	16 -12- 2023	Indian Numismatics
	Tuesday	19 -12- 2023	Research Methodology
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	i) Historical Archaeology **OR**
			ii) Harappan Culture
	Saturday	23 -12- 2023	i) Introduction To Indian Archaeology-I **OR**
			ii) Pre Historic World
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			Cultural Heritage Of India
			(GROUP – B) (Indology)
	Saturday	16 -12- 2023	Ancient Civilization of the World
	Tuesday	19 -12- 2023	Contribution of Indian Culture to the World
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	History of Indian Epigraphy **OR**
			History of Indian Architecture
	Saturday	23 -12- 2023	Culture Heritage of India **OR**
			Principles of Museology
22. Buddhist Studies (NEW COURSE)	Saturday	16 -12- 2023	Buddhist Vinaya
	Tuesday	19 -12- 2023	Buddhist Education
	Thursday	21 -12- 2023	i) Revival Of Buddhism in Modern India **OR**
			ii) Buddhist Art and Architecture **OR**
			iii) Buddhism in North East Asia
			Optional – Any One out of the following **Core Elective**
	Saturday	23 -12- 2023	i) Buddhism in South East Asia **OR**
			ii) Dr Ambedkar Thoughts **OR**
			i) Basic Principle of Biddhism
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			A) Buddhism in South East Asia **OR**
			B) Dr. Ambedkar Thoughts **OR**
			Only For Regular Students of Other Dapartment
			C) Buddhist Studies –I
22. Buddhist Studies (OLD COURSE)	Saturday	16 -12- 2023	Buddhist Vinaya
	Tuesday	19 -12- 2023	Buddhist Education
	Thursday	21 -12- 2023	i) Revival Of Buddhism in Modern India **OR**
			ii) Buddhist Art and Architecture **OR**
			iii) Buddhism in North East India
			Optional – Any One out of the following **Core Elective**
	Saturday	23 -12- 2023	i) Buddhism in South East Asia **OR**
			ii) Dr Ambedkar Thoughts **OR**
			i) Basic Principle of Buddhism
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			Basic History of Buddhism
23. Philosophy (NEW COURSE)	Saturday	16 -12- 2023	Analytic Philosophy
	Tuesday	19 -12- 2023	Comparative Religion
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	i) Advanced Symbolic Logic **OR**
			ii) Plato **OR**
			iii) Applied Ethics **OR**
			vi) Phenomenology
			Core Subject
	Saturday	23 -12- 2023	i) Philosophical Theories –I **OR**
			ii) Philosophy of Osho –I **OR**
			iii) Intensive Study of 'Materialism' by M.N. Roy- I
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			General Philosophy
23. Philosophy (OLD COURSE)	Saturday	16 -12- 2023	Analytic Philosophy
	Tuesday	19 -12- 2023	Comparative Religion
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	i) Advanced Symbolic Logic **OR**
			ii) Plato **OR**
			iii) Applied Ethics **OR**

			vi) Phenomenology
			Core Subject
	Saturday	23 -12- 2023	Philosophical Theories –I **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			General Philosophy
	Any One Stream From – A OR B OR C		
	Stream – A : Clinical Psychology		
24. Psychology	Saturday	16 -12- 2023	Abnormal Psychology
	Tuesday	19 -12- 2023	Psycho Diagnosis and Psychotherapy
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	Health Psychology **OR**
			Psychological Assessment And Specific Testing
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	General Psychology **OR**
			Positive Psychology -I
	Stream – B : Organizational Psychology Human and Resource Management		
	Saturday	16 -12- 2023	Management of Personnel and Human Resources
	Tuesday	19 -12- 2023	Organizational Behavior
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	Consumer Behavior **OR**
			Industrial Psychology
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	General Psychology- **OR**
			Positive Psychology -I
	Stream – C : Counselling Psychology		
	Saturday	16 -12- 2023	Guidance and Counselling Psychology
	Tuesday	19 -12- 2023	Basic Counselling Skills
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	Educational & Career Guidance **OR**
			Assessment In Counselling and Guidance
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Saturday	23 -12- 2023	General Psychology-I **OR**
			Positive Psychology
25. Travel & Tourism (NEW COURSE)	Saturday	16 -12- 2023	Tourism Marketing
	Tuesday	19 -12- 2023	Tourism Resources - Europe
	Thursday	21 -12- 2023	a) Information Technology in Tourism **OR**
			b) Tourism Finance & Accounts
	Saturday	23 -12- 2023	MICE & Event Management **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			Foundation in Travel & Tourism - I
25. Travel & Tourism (OLD COURSE)	Saturday	16 -12- 2023	Tourism Marketing
	Tuesday	19 -12- 2023	Tourism Resources-Europe
	Thursday	21 -12- 2023	a) Information Technology in Tourism **OR**
			b) Tourism Finance & Accounts
	Saturday	23 -12- 2023	MICE & Event Management **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			1) Introduction to Travel & Tourism **OR**
			2) Tourism Services
26. Mass Communication	Saturday	16 -12- 2023	Print Media – II (Reporting & Editing)
	Tuesday	19 -12- 2023	Electronic Media –II (Radio & Television)
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	Advertising **OR**
			Ecology And Environment of India
			Core Paper
	Saturday	23 -12- 2023	Public Relations & Corporate Communication **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			1 .Introduction to Mass Communication **OR**
			2. Public Relation & Advertising
27. Rashtrasant Tukadoji Maharaj Thought (NEW COURSE)	Saturday	16 -12- 2023	राष्ट्रसंतांची ग्रामविकासाची संकल्पना
	Tuesday	19 -12- 2023	राष्ट्रसंतांचा सामाजिक परिवर्तनाचा विचार
			Optional – Any One out of the following **Elective**
	Thursday	21 -12- 2023	मराठी संतपरंपरा आणि राष्ट्रसंत तुकडोजी महाराज
			अथवा
			भारतीय संतपरंपरा आणि राष्ट्रसंत तुकडोजी महाराज
			Optional – FOUNDATION PAPER
	Saturday	23 -12- 2023	ग्रामगीता नवनीत भाग ३
			अथवा
			राष्ट्रसंताचे जीवन – चरित्र आणि कार्य
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			राष्ट्रसंताचे जीवन आणि साहित्य

27. Rashtrasant Tukadoji	Saturday	16 -12- 2023	राष्ट्रसंताचे तत्वज्ञान
Maharaj Thought	Tuesday	19 -12- 2023	ग्रामगीता : वाङ्.मयीन महात्मता
(OLD COURSE)	Thursday	21 -12- 2023	राष्ट्रसंताची ग्रामविकासाची संकल्पना
			Optional – Any One out of the following **Elective**
	Saturday	23 -12- 2023	मराठी संतपरंपरा आणि तुकडोजी महाराज
			अथवा
			महाराष्ट्राबाहेरील संत आणि राष्ट्रसंत तुकडोजी **OR**
			Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS
			राष्ट्रसंताचे जीवन आणि साहित्य

List of Foundation Subjects for P.G.

Sr.No.	Subject	4th Papers of Semester- 3
1	Mathematics	Mathematics-I
2	Physics	Physics-I
3	Chemistry	Chemistry-I
4	Bio-Technology (Ad-hoc)	Bio-Technology-I
5	Computer Science	Computer Science-I
6	Environmental Science	Environmental Science-I
7	Botany	Botany-I
8	Zoology	Zoology-I
9	Statistic	Statistics-I
10	Business Management	Business Management -I
11	Accountancy	Account & Statistics-I
12	Managerial Skill	Managerial Skills-I
13	Education Technology & Management Skills	Education Technology & Management Skills-I
14	Communication Skill	Communication Skills-I
15	Sanskrit	Sanskrit-I
16	German	German-I
17	French	French-I
18	Law	Law-I
19	Pharmaceutical Sciences	Pharmaceutical Sciences-I
20	Life skills	Life Skills-I
21	Economics	Economics-I
22	Political Science	Political Science-I
23	Sociology	Sociology-I
24	Psychology	Psychology-I
25	Philosophy	Philosophy-I
26	History	History-I
27	Public Admn	Public Admn -I
28	Buddhist Studies	Buddhist Studies-I
29	Gandhian Thought	Gandhian Thought-I
30	Dr. Ambedkar Thought	Dr. Ambedkar Thought-I
31	Rashtrasant Tukdoji Maharaj Thought	Rashtrasant Tukdoji Maharaj Thought-I
32	Travel & Tourism	Travel & Tourism-I
33	Personality Development	Personality Development-I
34	Cosmetic Technology	Cosmetic Technology-I
35	Hospitality Management	Hospitality Mgt. -I
36	Chemical Engineering	Chemical Engineering-I
37	Chemical Technology	Chemical Technology-I
38	Civil Engineering	Civil Engineering-I
39	Electrical Engineering	Electrical Engineering-I
40	Mechanical	Mechanical Engineering-I

	Engineering	
41	Electronics Engineering	Electronics Engineering-I
42	Pali Prakrit	Pali Prakrit-I

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 20th November 2023

POST GRADUATE PROGRAM IN SOCIOLOGY

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

POST GRADUATE (CBCS) (NEP) SEMESTER SYLLABUS

2023-2024

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

First Year: Semester I

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/ point (40%)	Total
						Internal Evaluation	End SEM Exam.		
6.0	Major	Mandatory	PGSO1M01	Classical Sociological Thinkers	4	20	80	B/6	100
			PGSO1M02	Perspective on Indian Society -I	4	20	80	B/6	100
			PGSO1M03	Constitution and Social Change in India	4	20	80	B/6	100
			PGSO1M04	Sociology of Religion - I	2		50	B/6	50
		Elective	PGSO1E05	G1P1: Family, Kinship and Marriage	4	20	80		100
			PGOS1E06	G2P1: Gender and Society.					
			PGSO1E07	G3P1: Sociology of Social Movement					
			PGSO1E08	G4P1: Sociology of Education					
	RM		PGSO1M09	Quantitative Research Methodology **OR** Qualitative Research Methodology	4	20	80	B/6	100
	Cumulative Credit/ Marks				22				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RM: Research Methodology, RP: Research Project, CS: 40%

POST GRADUATE PROGRAM IN SOCIOLOGY
Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.
First Year: Semester II

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter/point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.0	Major	Mandatory	PGSO2M01	Contemporary Sociological Theory	4	20	80	B/6	100
			PGSO2M02	Perspectives on Indian Society-II	4	20	80	B/6	100
			PGSO2M03	Sociology of Change and Development	4	20	80	B/6	100
			PGSO2M04	Sociology of Religion - II	2		50	B/6	50
		Elective	PGSO2E05	G1P2: Rural and Urban Transformation	4	40	60	B/6	100
			PGSO2E06	G2P2: Women In Indian Society					
			PGSO2E07	G3P2: Social Movement in India					
			PGSO2E08	G4P2: Education and Society in India					
	OJT/FP		PGSO2M09	Field project FP	4	100		B/6	100
	Cumulative Credit/ Marks				22				550
	Cumulative Credit for PG diploma (Sem. 1+2)				44				
Exit option: PG Diploma (40 Credits) after three years UG Degree									

Note: For **Elective** Department offers 4 **Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters. **RM: Research Methodology** **OJT: On Job Training: Internship/Apprenticeship** **CS: 40 %**

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester III

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Exam		
6.5	Major	Mandatory	PGSO3M01	Modern Sociological Theories	4	20	80	B/6	100
			PGSO3M02	Feminist Sociological Thinkers	4	20	80	B/6	100
			PGSO3M03	Globalisation and Society	4	20	80	B/6	100
			PGSO3M04	Social Problems in Contemporary India	2		50	B/6	50
		Elective	PGSO3E05	G1P3: Sociology of Social Stratification	4	40	60	B/6	100
			PGSO3E06	G2P3: Sociology of Social Exclusion					
			PGSO3E07	G3P3: Media and Society					
			PGSO3E08	G3P3: Environment and Society					
	RP		PGSO3M09	Research Project	4	100		B/6	100
	Cumulative Credit/ Marks				66				550

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project

CS: 40%

POST GRADUATE PROGRAM IN SOCIOLOGY

Structure and Credit Distribution of PG Degree Programme (Two Years) w.e.f. 2023-24.

Second Year: Semester IV

Level	Course type		Course Code	Title of Course	Credit scheme	Examination and Assessment Scheme		Minimum Passing grade letter / point (40%)	Total
						Internal Evaluation	End SEM Examination		
6.5	Major	Mandatory	PGSO4M01	Postmodern Social Theories	4	20	80	B/6	100
			PGSO4M02	Recent trends in Social Theories	4	20	80	B/6	100
			PGSO4M03	Economy and Society	4	20	80	B/6	100
		Elective	PGSO4E04	G1P4: Sociology of Marginalized Communities	4	20	80	B/6	100
			PGSO4E05	G2P4: Science, Technology and Society					
			PGSO4E06	G3P4: Culture and Symbolic Transformation					
			PGSO4E07	G4P4: State, Politics and Development					
	RP		PGSO4M08	Research Project	6	150		B/6	150
	Cumulative Credits/ Marks				22				550
	Cumulative Credit for 2-year PG degree				88				

2 Year - 4 Semester PG Degree (80 credits) after three-year UG degree

OR

1 Year- 2 Sem PG Degree (40 credits) after four year of UG degree

Note: For **Elective** Department offers **4 Groups or Specialisations**. Student should select any group from these and follow the same till the end of program. There is no choice for selecting paper from other group in upcoming semesters.

RP: Research Project, C5: 40%

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

P.G. CBCS (NEP) Semester Pattern Syllabi of SOCIOLOGY

STRUCTURE OF THE CBCS (NEP) SEMESTER PATTERN P.G. PROGRAM

The P.G. CBCS semester pattern shall come into force from the academic year2023 - 2024 for the students seeking enrollment in semester I. While the students of semester III and semester IV shall go through the CBCS semester pattern examinations.

1. The CBCS (NEP) semester pattern P.G. PROGRAM shall give sufficient opportunity to the students of all departments for choice of subjects as shown in major electives.
2. The whole course shall be of full-time course of two years duration.
3. The semester I, II and III shall have four major mandatory papers (compulsory papers) and one core elective paper (optional papers) in four groups offering wider choice to the students to opt for any one group of them. The semester IV shall have three major mandatory papers (compulsory papers). There shall be again one core elective paper, which is in continuation of the group, which opt in first semester.
4. In semester I, students shall have a choice to choose any one of the course from RM (Research methodology) which he want to use in research projects of semester III & IV. RM is mandatory course.
5. In semester II, student himself shall engage in fieldwork and submit a fieldwork report to the institution/department. Based on hours engage in fieldwork and report submitted to institution/department, his/her credits will be evaluated. University will provide the direction time to time on the process of evaluation of fieldwork and other issues related to this course.
6. In semester III and IV, student shall avail a course RP (Research Project) which is mandatory and divided into two parts. The courses Research Project - I and Research Project - II, which shall opt by students, are the part of Semester III and Semester IV simultaneously. Student in the guidance of supervisor shall decide the topic of this course. The conditions of supervisor-ship and other issues will be decided by university time to

time.

7. 2100 marks, i.e. 88 credits in order to be awarded M.A. degree in Sociology by RTM Nagpur University.
8. The CBCS P.G. course shall be based on continuous internal evaluation of the students out of 20 marks in each paper (except 2 credits paper), along with the external evaluation based on a descriptive written examination of 80 marks by the university.

   Regarding 2 credits papers, University or Board of studies will declare the policy as per further notifications.

CODE OF EXAMINATION

Written Examination:

1. There shall be a written external examination of descriptive type in each paper at the end of every semester.
2. Each 4-credit paper shall be of 80 marks of external examination of 3 hours duration and 2-credit papers shall be of 50 marks of external examination of 2 hours duration.
3. The question paper shall contain 5 questions (four long questions and one short question) with an internal choice except for the short question. The short question shall be put like A, B, C and D at the question No. 5 i.e. the last question of the paper. The students shall have to answer all questions including all A, B, C and D of Q.No.5.
4. Each question shall carry an equal value of 16 marks in 4-credit course and 10 marks in 2-credit course.

Nature of Internal Evaluation:

1. There shall be an internal evaluation of each student of 20 marks in each theory paper at the end of every semester in 4-credit course. It should be note that there is no internal evaluation in 2-credit courses.
2. Out of 20 internal marks in each theory paper, 10 marks shall be for Home Assignment and another 10 marks for daily attendance, viva-voce test and seminar presentation of the students based on the course content. The viva-

voce tests and seminar presentations shall be conducted by a committee consisting of the Head of the Department/Principal of the college/Director of the Institute or Centre running the P.G. Course and the teacher of the concerned subject.

3. The teacher of the concerned subject shall decide the task to be assigned to the students for home assignment, viva-voce test and seminar presentation. The students' evaluation shall be done on consensus among all the members of the committee conducting the viva-voce test and seminar presentation.

Passing Marks

1. The students shall be required to score a minimum of 40 marks in each paper out of 100 including internal marks in order to pass in the examination.
2. Scheme of Marking for Research Paper - I and II

A. Examination and Evaluation scheme for field Project)FP)

Sr.	Contents	hours	Marks Distribution
1	Orientation of Field Project	10 (2*5)	-
2	Field Work	96hours (16*6)	40
3	Field Diary	Related to FW	10
4	Report Writing	12 hours (2*6)	20
5	Presentation	2 hours	10
6	Internal Viva-voce	---	20

Internal Viva-voce conducted on the objectives of Field project with Power point Presentation. Its Field Diary and Field Report should be consider a basic document for viva-voce.

RE- REVISED
M.A. 3rd SEM (CBCS) (NEP) WINTER 2023
(707 to 713, 715, 716, 718, 720,721, 725,726, 729,730)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 3rd SEMESTER (CBCS) (NEP) EXAMINATION OF WINTER 2023
(As Per NEP 2020 Examination Scheme)
=: PROGRAMME (WRITTEN) :=

TIME : - 9.30. A.M. To 12.30. P.M.

Sr. No. Subject	Day	Date	Paper
1.English	Saturday	16 -12- 2023	Romantic and Victorian Poetry
	Tuesday	19 -12- 2023	Literary Criticism and Theory-I
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Nineteenth Century American Literature **OR**
			B) Trauma Studies and Literature **OR**
			C) Pandemic Studies and Literature **OR**
			D) English Comedies
			Optional – Any One out of the following
	Saturday	23 -12- 2023	A) Communicative English -I **OR**
			B) Pasteolonialism and Literature **OR**
			C) History of English Language -I- **OR**
			D) Dalit Literature –I
2. Marathi	Saturday	16 -12- 2023	प्राचीन व मध्ययुगीन कविता
	Tuesday	19 -12- 2023	मराठी भाषा, बोली आणि व्याकरण
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	(क) ग्रामीण साहित्य
			(ख) दलित– आंबेडकरवादी साहित्य
			(ग) आदिवासी साहित्य
			(घ) वैदर्भीय साहित्याचा अभ्यास
			Optional – Any One out of the following
	Saturday	23 -12- 2023	(क) वाङ्मयीन चळवळी
			(ख) प्रसारमाध्यमे आणि साहित्यव्यवहार
			(ग) पर्यावरण आणि साहित्य
			(घ) उपयोजित मराठी आणि कौशल्ये
3. Hindi	Saturday	16 -12- 2023	I हिंदी भाषा
	Tuesday	19 -12- 2023	II पाच्यात काव्यशास्त्र
			Optional – Any One out of the following two
	Thursday	21 -12-2023	III A) अनुसंधान प्रविधी **किंवा**
			B) आधुनिक काव्य
			Optional – Any One out of the following two
	Saturday	23 -12- 2023	IV (A) हिंदी का लोकसाहित्य **किंवा**
			(B) तुलनात्मक साहित्य
4. Urdu	Saturday	16 -12- 2023	Adabi Tanqeed
	Tuesday	19 -12- 2023	Urdu Mktoob Nigari
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Urdu Novel
			B) Urdu Nazm
	Saturday	23 -12- 2023	Tarjuma Nigari
5. Economics	Saturday	16 -12- 2023	I Economics of Development and Growth - I
	Tuesday	19 -12- 2023	II International Trade : Theory and Policy
			Optional – Any One out of the following two electives
	Thursday	21 -12-2023	III i. Research Methods in Economics **OR**
			ii. Financial Econometrics
			Optional – Any One out of the following two electives
	Saturday	23 -12- 2023	IV i. Economics of Money and Banking **OR**
			ii. Indian Public Finance
6. History	Saturday	16 -12- 2023	History of the Marathas – I : 1630- 1707 A.D.
	Tuesday	19 -12- 2023	Indian National Movement : 1885- 1947 A.D.
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Economic History of India : 1757 – 1857 A.D. **OR**
			B) Ancient Intellectual Heritage – I **OR**
			C) Political History of South India Till 16th C.A.D.

			Optional – Any One out of the following
	Saturday	23 -12- 2023	A) History of Medieval Vidarbha : 1200 – 1857 A.D. **OR** B) Women in Indian History (Ancient & Medieval Period) **OR** C) History of U.S.A. : 1776 to 1945 A.D.
7. Political Science	Saturday	16 -12- 2023	Comparative Politics (With reference to political Systems in UK, USA, Switzerland)
	Tuesday	19 -12- 2023	Public Administration
			Optional – Any One out of the following **Elective Course**
	Thursday	21 -12-2023	i) Modern Political Ideologies **OR** ii) Politics of Maharashtra
			Optional – Any One out of the following
	Saturday	23 -12- 2023	A) Political Journalism **OR** B) Election Management in India
8. Geography	Saturday	16 -12- 2023	I Economic Geography
	Tuesday	19 -12- 2023	II Geography of Rural Settlement
			Optional – Any One out of the following two electives
	Thursday	21 -12-2023	III i) Town and Country Planning **OR** ii) Natural Disaster Management
			Optional – Any One out of the following two electives
	Saturday	23 -12- 2023	IV i) Urban Geography **OR** ii) Agricultural Geography
9. Sociology	Saturday	16 -12- 2023	Orientations in Sociological Theory
	Tuesday	19 -12- 2023	Indian Constitution and Social Change
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Economy and Society **OR** B) Sociology of Education **OR** C) Research Paper- I (For Regular Student Only)
			Optional – Any One out of the following
	Saturday	23 -12- 2023	A) Science, Technology and Society **OR** B) Sociology of Social Exclusion **OR** C) Globalization and Society
10. Arabic	Saturday	16 -12- 2023	Fundamentals of Research
	Tuesday	19 -12- 2023	Classical and Modern Poetry
	Thursday	21 -12-2023	Special Study of Poet : Hassan ibne Thabit
	Saturday	23 -12- 2023	Grammar, Composition and Translation
11. Pali	Saturday	16 -12- 2023	I Sutta Literature : Digha Nikaya and Majjhima Nikaya
	Tuesday	19 -12- 2023	II Pali Poetry : Thergatha and Therigatha
			Optional – Any One out of the following **Elective I**
	Thursday	21 -12-2023	III A) Abhidhamma Literature : Abhidhammatthasangaho **OR** B) Vipassana in Modern Age
			Optional – Any One out of the following
	Saturday	23 -12- 2023	IV A) Vansa Literature **OR** B) Pali Thinkers
12. Ambedkar Thought	Saturday	16 -12- 2023	Ambedkar on Nation, Nationalism & Democracy
	Tuesday	19 -12- 2023	Ambedkar's Thoughts on History
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Economics Discrimination and Caste Economic Inequalities B) Dr. Ambedkar on Political Representation & Social Religious Minorities
			Optional – Any One out of the following
	Saturday	23 -12- 2023	a) Dr. Ambedkar's Religious Thoughts **OR** b) Research Methodology (A)
13. Gandhian Thoughts	Saturday	16 -12- 2023	Gandhi and His Contemporaries – I
	Tuesday	19 -12- 2023	Gandhian Approach to Rural Development-I
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	A) Satyagraha – I **OR** B) Literary Works of Gandhi
			Optional – Any One out of the following
	Saturday	23 -12- 2023	Nonviolent Movement after Gandhi-I **OR** Gandhian Thought-I
14. Indian Music	Saturday	16 -12- 2023	I क्रियात्मक व उपयोजीत शास्त्र
	Tuesday	19 -12- 2023	II संगीतातील स्थित्यंतरे

15. Home Economics	Saturday	16 -12- 2023	Foods and Nutrition
	Tuesday	19 -12- 2023	Consumer and the Market
			Optional – Any One out of the following
	Thursday	21 -12-2023	a) Home Science Extension Education **OR**
			b) Housing and Interior **OR**
			c) Gender and Development
	Saturday	23 -12- 2023	**Optional – Any One** out of the following
			a) Family Dynamics
			b) Communication Technologies in Extension
16. Buddhist Studies	Saturday	16 -12- 2023	Buddhist Vinaya
	Tuesday	19 -12- 2023	Buddhist Education
			Optional – Any One out of the following
	Thursday	21 -12-2023	i) Buddhist Art and Architecture **OR**
			ii) Revival Of Buddhism in Modern India
			Optional – Any One out of the following
	Saturday	23 -12- 2023	i) Buddhism in North East Asia **OR**
			ii) Buddhism in South East Asia
17. Philosophy	Saturday	16 -12- 2023	Ethics (Indian)
	Tuesday	19 -12- 2023	Philosophy of Language (Indian)
			Optional – Any One out of the following **Elective**
	Thursday	21 -12-2023	i) Phenomenology **OR**
			ii) Plato
			Optional – Any One out of the following
	Saturday	23 -12- 2023	i) Applied Ethics **OR**
			ii) Philosophy of Value Education
			Stream A (Clinical Psychology)
18. Psychology	Saturday	16 -12- 2023	I Abnormal Psychology
	Tuesday	19 -12- 2023	II Psycho-diagnosis and Psychotherapy
			Optional – Any One out of the following
	Thursday	21 -12-2023	III Health Psychology **OR**
			Psychological Testing in Clinical Psychology- I
			Optional – Any One out of the following
	Saturday	23 -12- 2023	IV Introduction to SPSS **OR**
			Positive Psychology
			Stream B (Counselling Psychology)
	Saturday	16 -12- 2023	I Guidance and Counselling Psychology
	Tuesday	19 -12- 2023	II Basic Counselling Skills
			Optional – Any One out of the following
	Thursday	21 -12-2023	III Educational and Career Guidance **OR**
			Psychological Testing in Counselling- I
			Optional – Any One out of the following
	Saturday	23 -12- 2023	IV Introduction to SPSS **OR**
			Positive Psychology- I
			Stream C (Organizational Psychology)
	Saturday	16 -12- 2023	I Human Resource Management
	Tuesday	19 -12- 2023	II Organizational Behavior
			Optional – Any One out of the following
	Thursday	21 -12-2023	III Industrial Psychology **OR**
			Consumer Behavior
			Optional – Any One out of the following
	Saturday	23 -12- 2023	IV Introduction to SPSS **OR**
			Positive Psychology- I
19. Sanskrit	Saturday	16 -12- 2023	भारतीयदर्शन – योगदर्शनमृ **OR**
			काव्यं काव्यशास्त्रच
	Tuesday	19 -12- 2023	भारतीयदर्शन – तत्वार्थसूत्रमृ **OR**
			नाटयं नाटयशास्त्रं च।
	Thursday	21 -12- 2023	**Elective**
	Saturday	23 -12- 2023	**CORE**

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur
Date: 4th December 2023

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w.e.f. 24/07/2023

SETH KESARIMAL PORWAL COLLEGE, KAMPTEE

TIME TABLE FOR THE SESSION 2023-24

COMMERCE FACULTY

DAY	PERIODS	TIME	B.COM Part I			B.COM Part II			B.COM Part III		
			MAR (33)	HIN (35)	ENG (38)	MAR (39)	HIN (23)	ENG (37)	MAR (36)	HIN (20)	ENG (19)
MON	1	7.30	B. Eco I/II	FA I /SBM	CF/CS	FA I/II	HD/OB	HD/OB	MM/HRM	MP/IL	CA/MA
	2	8.20	ENG.	BS/SD	FA I /SBM	M. Eco I/II	ENG	M. Eco I/II	CA/MA	FA IV/V	FA IV/V
	3	9.10	BS/SD	CF/CS	BS/SD	ENG	FA I/II	ENG	FA IV/V	MM/HRM	MM/HRM
	4	10.00	FA I/SBM	ENG	B. Eco I/II	HD/OB	CL/SP	FA I/II	I. Eco I/II	A/AS	A/AS
	5	10.50	MAR	HIN	M/H/U	CL/SP	M. Eco I/II	CL/SP	A/AS	CA/MA	MP/IL
	6	11.40	Phy. Edu.	Phy. Edu	Phy. Edu	MAR	HIN	M/H/U	Phy. Edu.	Phy. Edu	Phy. Edu
TUE	1	7.30	FA I /SBM	BS/SD	BS/SD	HD/OB	CL/SP	M. Eco I/II	I. Eco I/II	MM/HRM	I. Eco I/II
	2	8.20	B. Eco I/II	FA I /SBM	ENG	FA I/II	ENG	FA I/II	A/AS	MP/IL	CA/MA
	3	9.10	CF/CS	B. Eco I/II	CF/CS	ENG	HD/OB	ENG	CA/MA	I. Eco I/II	MP/IL
	4	10.00	ENG	CF/CS	FA I /SBM	CL/SP	M. Eco I/II	HD/OB	FA IV/V	CA/MA	MM/HRM
	5	10.50	MAR	HIN	M/H/U	EVS	FA I/II	CL/SP	MP/IL	FA IV/V	A/AS
WED	1	7.30	FA I /SBM	BS/SD	BS/SD	FA I/II	CL/SP	CL/SP	A/AS	FA IV/V	MM/HRM
	2	8.20	B. Eco I/II	ENG	ENG	HD/OB	FA I/II	FA I/II	CA/MA	MP/IL	FA IV/V
	3	9.10	CF/CS	B. Eco I/II	B. Eco I/II	CL/SP	HD/OB	ENG	MP/IL	I. Eco I/II	I. Eco I/II
	4	10.00	ENG	FA I /SBM	CF/CS	M. Eco I/II	EVS	EVS	FA IV/V	A/AS	CA/MA
	5	10.50	BS/SD	CF/CS	FA I /SBM	MAR	HIN	M/H/U	MM/HRM	MM/HRM	MP/IL
	6	11.40	--	--	--	Phy. Edu.	Phy. Edu	Phy. Edu	--	--	--

Principal
S.K.P. College, Kamptee

THU	1	7.30	ENG	B. Eco I/II	BS/SD	CL/SP	FA I/II	M. Eco I/II	FA IV/V	CA/MA	MM/HRM
	2	8.20	BS/SD	FA I /SBM	FA I /SBM	ENG	ENG	HD/OB	MM/HRM	I. Eco I/II	I. Eco I/II
	3	9.10	CF/CS	ENG	ENG	M. Eco I/II	HD/OB	FA I/II	I. Eco I/II	MP/IL	CA/MA
	4	10.00	FA I /SBM	CF/CS	B. Eco I/II	FA I/II	EVS	EVS	MP/IL	FA IV/V	FA IV/V
	5	10.50	MAR	HIN	M/H/U	EVS	M. Eco I/II	CL/SP	CA/MA	A/AS	A/AS
	6	11.40	Phy. Edu.	Phy. Edu	Phy. Edu	MAR	HIN	M/H/U	Phy. Edu.	Phy. Edu	Phy. Edu
FRI	1	7.30	B. Eco I/II	FA I /SBM	ENG	CL/SP	CL/SP	M. Eco I/II	FA IV/V	A/AS	FA IV/V
	2	8.20	FA I /SBM	BS/SD	FA I /SBM	M. Eco I/II	FA I/II	ENG	I. Eco I/II	MM/HRM	I. Eco I/II
	3	9.10	BS/SD	B. Eco I/II	CF/CS	ENG	ENG	HD/OB	A/AS	CA/MA	A/AS
	4	10.00	CF/CS	ENG	B. Eco I/II	MAR	HIN	M/H/U	MP/IL	FA IV/V	MM/HRM
	5	10.50	MAR	HIN	M/H/U	HD/OB	M. Eco I/II	FA I/II	MM/HRM	I. Eco I/II	MP/IL
	6	11.40	--	--	--	Phy. Edu.	Phy. Edu	Phy. Edu	--	--	--
SAT	1	7.30	BS/SD	B. Eco I/II	ENG	FA I/II	CL/SP	M. Eco I/II	CA/MA	A/AS	MP/IL
	2	8.20	B. Eco I/II	CF/CS	CF/CS	HD/OB	ENG	CL/SP	MP/IL	CA/MA	FA IV/V
	3	9.10	ENG	ENG	B. Eco I/II	M. Eco I/II	HD/OB	HD/OB	I. Eco I/II	MP/IL	I. Eco I/II
	4	10.00	CF/CS	BS/SD	BS/SD	MAR	HIN	M/H/U	MM/HRM	I. Eco I/II	A/AS
	5	10.50	MAR	HIN	M/H/U	ENG	M. Eco I/II	ENG	A/AS	MM/HRM	CA/MA

Principal
S.K.P. College, Kamotee

SETH KESARIMAL PORWAL COLLEGE OF ARTS & SCIENCE & COMMERCE, KAMPTEE

TIME-TABLE 2023-24

B.Sc. Part – I (Semester-I + Semester-II)

WEF- 24/07/2023

Days/Periods	1	2	3	4	5	6	7	8	9	10	11
	7.30-8.18	8.20-9.08	9.10-9.58	10.00-10.48	10.50-11.38	11.40-12.28	12.30-1.18	1.20-2.08	2.10-2.58	3.00-3.48	3.50-4.38
MONDAY		Chem-2/Bio Chem-2/Zoo-2			Bot-35	Chem-18	Math-18	Eng -18	Chem-4/Phy-1/Bot-1		
				Phy-18	Micro-L	Comp. Sc.-IT	Biochem-36		Comp. Sc-1		
	Physical Education			Elect-L	Phy-18/Elec-L		Zoo-35		Physical Education		
TUESDAY		Chem-2/Bio Chem-2/Zoo-2			Bot-35	Chem-18	Math-18	Eng -18	Chem-4/Phy-1/Bot-1		
				Maths-18	Micro-L	Comp Sc-IT	Biochem-36		Comp. Sc-1		
	Physical Education				Phy-18/Elec-L		Zoo-35		Physical Education		
WEDNESDAY		Bot-2			Bot-35	Chem-18	Math-18	Eng -18	Chem-6/Phy-2/Zoo-1		
	Chem-1/Phy-3/Elc-1				Micro-L	Comp Sc-IT	Biochem-36		Bio Chem-1		
				Maths-18	Phy-18/Elec-L		Zoo-35		Comp.Sc.-2/Elc-2		
THURSDAY	Bot-2			S/E-EL	Bot-35	Chem-18	Math-18	Eng -18	Chem-6/Phy-2/Zoo-1		
	Chem-1/Phy-3/Elc-1			Mar-37	Micro-L	Comp Sc-IT	Biochem-36		Bio Chem-1		
				Urdu-22	Phy-18		Zoo-35		Comp.Sc.-2/Elc-2		
				Hin-34	Elec-L						
FRIDAY		Chem-5/Bio Chem-3/Zoo-3/Bot-3			Bot-35	Chem-18	Math-18	S/E-EL	Micro-2		
		Micro-1+Micro-3			Micro-L	Comp Sc-IT	Biochem-36	Mar-37	Phy-5		
	Phy-4				Phy-18		Zoo-35	Urdu-18	Chem-3		
			Comp Sc-IT	Maths-18	Elec-L			Hin-34	Comp. Sc-3		
SATURDAY		Chem-5/Bio Chem-3/Zoo-3/Bot-3			Bot-35	Chem-18	Math-18	S/E-EL	Micro-2		
		Micro-1+Micro-3			Micro-L	Comp Sc-IT	Biochem-36	Mar-37	Phy-5		
	Phy-4				Phy-18		Zoo-35	Urdu-18	Chem-3		
			Comp Sc-IT	Maths-18	Elec-L			Hin-34	Comp. Sc-3		

22/07/23

22/7/23

Principal
S.K.P. College, Kamptee

SETH KESARIMAL PORWAL COLLEGE OF ARTS & SCIENCE & COMMERCE, KAMPTEE

TIME-TABLE 2023-2024

B.Sc. Part–II (Semester -III + Semester-IV)

WEF- 24/07/2023

Days/Periods	1	2	3	4	5	6	7	8	9	10	11
	7.30-8.18	8.20-9.08	9.10-9.58	10.00-10.48	10.50-11.38	11.40-12.28	12.30-1.18	1.20-2.08	2.10-2.58	3.00-3.48	3.50-4.38
MONDAY	Comp. Sc-1			Env. Sc-19	Chem-19	Bot-L	Zoo-L	Maths-19	Chem-3/Phy-3		
	Phy-2/Bot-2				Comp. Sc-IT	Biochem-L	Micro-L	Micro-1+ Micro-2			
							Phy-19/Elec-L	Zoo-1			
TUESDAY	Comp. Sc-1			Env. Sc-19	Chem-19	Bot-L	Zoo-L	Maths-19	Chem-3/Phy-3		
	Phy-2/Bot-2				Comp. Sc-IT	Biochem-L	Micro-L	Micro-1+ Micro-2			
							Phy-19/Elec-L	Zoo-1			
WEDNESDAY		Chem-1/Biochem-2/Zoo-2			Chem-19	Bot-L	Zoo-L	Maths-19	Physical Education		
	Phy-1			Comp. Sc-IT	Comp. Sc-IT	Biochem-L	Micro-L		Chem-4		
						Maths-19	Phy-19/Elec-L		Comp Sc-2		
THURSDAY		Chem-1/Biochem-2/Zoo-2			Chem-19	Bot-L	Zoo-L	Maths-19	Physical Education		
	Phy-1			Comp. Sc-IT	Comp. Sc-IT	Biochem-L	Micro-L		Chem-4		
						Maths-19	Phy-19/Elec-L		Comp Sc-2		
FRIDAY				Phy-19	Chem-19	Bot-L	Zoo-L	Maths-19	Chem-2/Phy-4/Elc-1		
				Elec-L	Comp. Sc-IT	Biochem-L	Micro-L	Biochem-1/Bot-1			
						Maths-19	Phy-19/Elec-L	Phy Edu			
SATURDAY				Phy-19	Chem-19	Bot-L	Zoo-L	Maths-19	Chem-2/Phy-4/Elc-1		
				Elec-L	Comp. Sc-IT	Biochem-L	Micro-L	Biochem-1/Bot-1			
						Maths-19	Phy-19/Elec-L	Phy Edu			

Principal
S.K.P. College, Kamptee

22/07/23

22/7/23

SETH KESARIMAL PORWAL COLLEGE OF ARTS & SCIENCE & COMMERCE, KAMPTEE

TIME-TABLE 2023-24

B.Sc. Part –III (Semester-V + Semester-VI)

WEF- 24/07/2023

Days/Periods	1 7.30-8.18	2 8.20-9.08	3 9.10-9.58	4 10.00-10.48	5 10.50-11.38	6 11.40-12.28	7 12.30-1.18	8 1.20-2.08	9 2.10-2.58	10 3.00-3.48	11 3.50-4.38
MONDAY	Phy-1			Maths-25	Bot-L	Zoo-L	Chem-25	Biochem-1			
		Chem-2			Biochem-L	Micro-L	Comp Sc-IT	Chem-4			
	Elec-1				Maths-25	Phy-25/Elec-L		PE-1			
TUESDAY	Phy-1			Maths-25	Bot-L	Zoo-L	Chem-25	Biochem-1			
		Chem-2			Biochem-L	Micro-L	Comp Sc-IT	Chem-4			
	Elec-1				Maths-25	Phy-25/Elec-L		PE-1			
WEDNESDAY	Phy-3			Maths-25	Bot-L	Zoo-L	Chem-25	Comp Sc-IT	Chem-3		
					Biochem-L	Micro-L	Comp Sc-IT	Bot-1/Micro-1			
					Maths-25	Phy-25/Elec-L		PE-2	Phy-2		
THURSDAY	Phy-3			Maths-25	Bot-L	Zoo-L	Chem-25	Comp Sc-IT	Chem-3		
					Biochem-L	Micro-L	Comp Sc-IT	Bot-1/Micro-1			
					Maths-25	Phy-25/Elec-L		PE-2	Phy-2		
FRIDAY		Phy-4			Bot-L	Zoo-L	Chem-25	Phy-25	Copm. Sc		
		Chem-1			Biochem-L	Micro-L	Comp Sc-IT	Elec-L			
					Maths-25	Phy-25/Elec-L		Zoo-1			
SATURDAY		Phy-4			Bot-L	Zoo-L	Chem-25	Phy-25	Copm. Sc		
		Chem-1			Biochem-L	Micro-L	Comp Sc-IT	Elec-L			
					Maths-25	Phy-25/Elec-L		Zoo-1			

22/07/23

22/7/23

w.e.f. 24/07/2023

SETH KESARIMAL PORWAL COLLEGE OF ARTS & SCIENCE & COMMERCE, KAMPTEE
TIME TABLE 2023-2024

		B.A.I Marathi	B.A.I Hindi	B.A.II Marathi	B.A.II Hindi	B.A.III Marathi	B.A.III Hindi
MONDAY	4		ECO(33A)		SOC(34)		
	5		URD (34)		H. Eco. Lab./ ECO(33A)	H.ECO. Pract.Lab.	ULT(19)
	6	SOC (33)	SOC(20)	ECO (38)	ENG (19)		HIS(34)
	7	ECO(33)/ H.Eco.Lab	POL (20)	ENG M1 M2 (38) (34)	EVS B.A. II HIN(23)	MAR(39)	HIN/URD (34) (19)
	8	ENG M1 M2 (33)(35)	HIS(20)	HIS (38)	POL. (23)	SOC(39)	ECO/H.ECO (34) (Lab.)
	9	HIS (33)	ENG (37)	MARM1 M2 (38) (37)	HIN/URD (23) (19)	POL(39)	POL(34)
	10		HIN /ULT (25) (18)	POL.(38)		ENGTut.39	
	11					H.ECO.Lab.	
TUESDAY	4				ULT(34)	SOC(33A)	
	5	H.ECO (Lab)		HIS (33A)	SOC (34)		H.ECO. Practical Lab./
	6	SOC (33)	HIS (20)	ECO. / H.ECO (38) (Lab)	HIS (23)	MAR (39)	
	7	ENG M1 M2 (33) (35)	ENG(20)	EVS B.A.II Mara. 38	ECO. /H.ECO (23) (Lab.)	HIS (39)	HIS. (34)
	8	MAR M1 M2 (33) (35)	ECO (20)/ Home.Eco. Lab	SOC (38)	POL.(23)	POL. (39)	HIN/URD (34) (18)
	9	HIS (33)	SOC(20)	ENG M1 M2 (38) (37)	ENG(25)	H.ECO (Lab.) ECO (39)	POL. (34)
	10	POL.(33)	ULT(18)	MAR M1 M2 (38) (37)	HIN/URD (23) (18)		ENG Tut.(34)
	11						SOC(34)

S.R. Dahat

Principal
S.K.P. College, Kamptee

w.e.f. 24/07/2023

		B.A.I Marathi	B.A.I Hindi	B.A.II Marathi	B.A.II Hindi	B.A.III Marathi	B.A.III Hindi
WEDNESDAY	4						HIN/URD (34) (33A)
	5		ECO(34)	H.ECO. Pract. Lab. /	H. Eco. Lab.	SOC(33A)	ENG(Lab.)
	6	SOC (33)	SOC (20)	ECO (38)	HIN/URD (35) (33A)	ENG(39)	HIS(34)
	7	ENG M1 M2 (33) (35)	ENG(20)	HIS. (38)	HIS (23)	ECO(39)	ECO/ULT (34) (33A)
	8	HIS (33)	HIN/URD (20) (18)	POL (38)	ULT/ECO (34) (23)	H.ECO (Lab)	SOC(34)
	9	ECO (33)	ULT(18)	ENG Tut.(38)	SOC(23)	HIS (39)	POL. (34)
	10	POL.(33)	POL.(20)	MARM1 M2 (38) (37)			Home Eco.Lab
	11	MAR M1 M2 (33) (35)		SOC(38)			
						SOC(34)	
THURSDAY	4		ULT(33A)			POL(34)	ULT(18)
	5		URD (33A)		H.ECO. Pract. Lab./ ECO(36)	HIS.(35)	ECO (34) H. Eco. Lab.
	6	POL. (33)	POL. (20)	ECO.38			
	7	ENG Tut.(33)	SOC (20)	Home Eco. Lab	ULT(18)	ECO(39)	POL. (34)
	8	HIS (33)	Home Eco.Lab /ECO (20)	SOC (38)	POL.(23)	ENG(39)	SOC(34)
	9	ECO (33)	HIS (20)	POL (38)	SOC(23)	MAR (39)	ENG (34)
	10	MARM1 M2 (33) (35)	HIN (20)	ENGM1 M2 (38) (37)	ENG (23)		HIS (34)
	11	Home Eco(Lab)			HIS. (23)		

Coordinator
S.R. Dahat

Principal
S.K.P. College, Kampti

W.e.f. 24/07/2023.

		B.A.I Marathi	B.A.I Hindi	B.A.II Marathi	B.A.II Hindi	B.A.III Marathi	B.A.III Hindi
FRIDAY	4		ULT(33A)	SOC(34)			
	5	H.ECO. Practical Lab.	ECO (34)		HIS (39)		SOC(33A)
	6		HIS (20)	POL(38)	ENG Tuto. (23)	H.Eco.Lab. ECO(39)	HIS(34)
	7	ENG M1 M2 (33) (35)	ENG(20)	H.ECO (Lab)	EVS B.A.II Hin. 23	HIS (39)	ULT/ ECO (19) (34)
	8	SOC (33)	SOC (20)	HIS (38)	Home Eco.(Lab) ECO. (23)	POL.(39)	POL.(34)
	9	POL (33)	POL (20)	MAR(38)	ULT (23)	ENG (39)	ENG (34)
	10	ECO (33)	Home Eco.(Lab)		POL (23)		
	11						
SATURDAY	4				HIN/URD (34) (33A)		
	5		H.ECO. Pract. Lab.	HIS (34)	ULT(33A)		H. Eco. Lab./
	6	H.ECO. Lab ECO.(33)		POL (38)	POL (23)	HIS (39)	HIN/URD (33A) (34)
	7	HIS. (33)	POL (20)	EVS B.A.II MAR.38	ENG (23)	POL (39)	SOC (34)
	8	POL.(33)	HIS(20)	SOC(38)	SOC(23)	ECO(39)	ENG (34)
	9	SOC.(33)	HIN/URD (18) (25)	ECO/H.ECO (38) (Lab)	HIS (23)	ENG (39)	ULT / ECO (19) (20)
	10	MAR M1 M2 (33) (35)	ENG Tutorials (20)	ENG M1 M2 (38) (37)	HIN (34)	SOC (39)	
	11		H.ECO (Lab.)			MAR (39)	

Coordinator
S.R. Dahat.

Principal
S.K.P. College, Kamptee

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 4th SEMESTER (OLD) EXAMINATION OF WINTER 2023

-:PROGRAMME (WRITTEN):-

Note :- This Time Table is applicable for Old Ex Students & Ex Students of RTMNU

Day	Date	Subject	Paper
		TIME : 2.00 P.M. TO 5.00 P.M.	
Tuesday	17-10-2023	Ancient Indian History, Culture and Archaeology / Statistics I / Buddhist Studies/	
Thursday	19-10-2023	Public Administration /Statistics II/ Library and Information Science	
Saturday	21-10-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Thursday	26-10-2023	Compulsory English	
Saturday	28-10-2023	Economics	
Tuesday	31-10-2023	Political Science	
Thursday	02-11-2023	**Classical Literature :-** Sanskrit Litt. / Pali-Prakrit Litt. / Persian Litt. / Arabic Litt./ Mathematics I	
Saturday	04-11-2023	History	
Tuesday	07-11-2023	Sociology	
Thursday	09-11-2023	**Modern Literature (Optional) :-** Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian	
Friday	17-11-2023	English Literature	
Tuesday	21-11-2023	Philosophy	
Thursday	23-11-2023	Gandhian Thought / Ambedkar Thought / Military Science / Mathematics II Functional-Hindi	
		TIME : 2.00 P.M. TO 4.00 P.M.	
Saturday	25-11-2023	Indian Music / Tabla	
Wednesday	29-11-2023	Psychology / Linguistics	
Friday	01-12-2023	Communicative-English / Functional English	
Monday	04-12-2023	Home Economics (General Home Science)	
Tuesday	05-12-2023	Geography	
Thursday	07-12-2023	Fashion Designing	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the college centre is already printed on the Admission Card of each candidate. However, It is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately within seven days prior to the commencement of the written examination at the respective College/ Centre. The concerned candidates will also be able to get the necessary information from that chart of seating arrangement sent to the respective Colleges by the University.

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.A. 6th SEMESTER EXAMINATION OF WINTER 2023

-:PROGRAMME (WRITTEN):-

Day	Date	Subject	Paper
		TIME : 2.00 P.M. TO 5.00 P.M.	
Monday	16-10-2023	Ancient Indian History, Culture and Archaeology / Statistics I / Buddhist Studies/	
Wednesday	18-10-2023	Public Administration /Statistics II/ Library and Information Science	
Friday	20-10-2023	**Other Compulsory Languages :-** Marathi / Hindi /Suppl. English / Urdu / Persian / Arabic / Sanskrit / Pali & Prakrit / Telugu / Bengali / Gujarathi / French / German / Russian	
Monday	23-10-2023	Compulsory English	
Wednesday	25-10-2023	Economics	
Friday	27-10-2023	Political Science	
Monday	30-10-2023	**Classical Literature :-** Sanskrit Litt. / Pali-Prakrit Litt. / Persian Litt. / Arabic Litt./ Mathematics I	
Wednesday	01-11-2023	History	
Friday	03-11-2023	Sociology	
Monday	06-11-2023	**Modern Literature (Optional) :-** Marathi / Hindi / Urdu / Bengali / Telugu / Gujarathi / French / German / Russian	
Wednesday	08-11-2023	English Literature	
Thursday	16-11-2023	Philosophy	
Saturday	18-11-2023	Gandhian Thought / Ambedkar Thought / Military Science / Mathematics II Functional-Hindi	
		TIME : 2.00 P.M. TO 4.00 P.M.	
Monday	20-11-2023	Indian Music / Tabla	
Wednesday	22-11-2023	Psychology / Linguistics	
Friday	24-11-2023	Communicative-English / Functional English	
Tuesday	28-11-2023	Home Economics (General Home Science)	
Thursday	30-11-2023	Geography	
Saturday	02-12-2023	Fashion Designing	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the college centre is already printed on the Admission Card of each candidate. However, It is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately within seven days prior to the commencement of the written examination at the respective College/ Centre. The concerned candidates will also be able to get the necessary information from that chart of seating arrangement sent to the respective Colleges by the University.

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

BACHELOR OF COMMERCE (OB & CBCS) 2ND SEMESTER EXAMINATION OF WINTER 2023

=: PROGRAMME (WRITTEN) :=

TIME : - 9.30. A.M. To 12.30. P.M.

Day	Date	Subject	Paper
Tuesday	28-11-2023	Statistics and Business Mathematics	
Thursday	30-11-2023	Business Economics –II	
Saturday	02-12-2023	Compulsory English	
Tuesday	05-12-2023	**Second Languages :-** Suppl. English / Marathi / Hindi / Urdu / Sanskrit / Pali & Prakrit / Gujarathi **OR** **Vocational Courses**	
Friday	08-12-2023	Commercial Services **OR** Fundamentals of Banking **OR** **Vocational Courses**	
Tuesday	12-12-2023	Financial Markets Operations **OR** Skill Development	
Thursday	14-12-2023	**Vocational Subjects** Entrepreneurship Development	
Saturday	16-12-2023	Computer Application- II **OR** Principles and Practice of Insurance –II **OR** Advertising, Sales Promotion & Sales Management - II	

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 1st November 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.Sc. SIXTH SEMESTER EXAMINATION OF WINTER 2023

-:PROGRAMME (WRITTEN):-

TIME:-9.30 A.M. TO 12.30 P.M.

Day	Date	Subject	Paper
Monday	16-10-2023	Chemistry	I
Wednesday	18-10-2023	Physics / Zoology / Industrial Chemistry	I
Friday	20-10-2023	Chemistry	II
Monday	23-10-2023	Botany / Mathematics	I
Wednesday	25-10-2023	Physics / Zoology / Industrial Chemistry	II
Friday	27-10-2023	Statistics / Microbiology / Geology	I
Monday	30-10-2023	Botany / Mathematics	II
Wednesday	01-11-2023	Statistics / Microbiology / Geology	II
Friday	03-11-2023	Bio-Chemistry / Electronics / Environmental Science	I
Monday	06-11-2023	Computer Science / Bio-Technology	I
Wednesday	08-11-2023	Bio-Chemistry / Electronics / Environmental Science	II
Thursday	16-11-2023	Computer Science / Bio-Technology	II

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B. Sc. (INFORMATION TECHNOLOGY) 4TH SEMESTER EXAMINATION OF WINTER, 2023

-:PROGRAMME (WRITTEN):-

TIME:-9.30 A.M. TO 12.30 P.M.

Day	Date	S U B J E C T	Paper
Tuesday	17-10-2023	Software Engineering	I
Thursday	19-10-2023	Java Programming	II
Saturday	21-10-2023	Data Communication & Network – II	III
Thursday	26-10-2023	Oracle	IV
Saturday	28-10-2023	Compiler Construction	V
Tuesday	31-10-2023	Numerical Methods	VI

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

B.Sc. FOURTH SEMESTER EXAMINATION OF WINTER 2023

-: PROGRAMME (WRITTEN) :-

TIME : 2.00 P.M. TO 5.00 P.M.

Day	Date	Subject	Paper
Tuesday	17-10-2023	Chemistry	I
Thursday	19-10-2023	Botany / Mathematics	I
Saturday	21-10-2023	Chemistry	II
Thursday	26-10-2023	Botany / Mathematics	II
Saturday	28-10-2023	Physics / Zoology / Industrial Chemistry	I
Tuesday	31-10-2023	Statistics / Microbiology / Geology	I
Thursday	02-11-2023	Physics / Zoology / Industrial Chemistry	II
Saturday	04-11-2023	Statistics / Microbiology / Geology	II
Tuesday	07-11-2023	Bio-Chemistry / Electronics / Environmental Science	I
Thursday	09-11-2023	Computer Science / Bio-Technology	I
Friday	17-11-2023	Bio-Chemistry / Electronics / Environmental Science	II
Tuesday	21-11-2023	Computer Science / Bio-Technology	II

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

M.A. 2nd SEM (CBCS)(Old/New) Winter 2023
(39 To 65)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 2nd SEMESTER (CBCS) (OLD/NEW) EXAMINATION OF WINTER 2023

-: PROGRAMME (WRITTEN) :-
TIME : 9.30 A.M. TO 12.30 P.M.

Sr. No.	Subject	Day	Date	Paper
1.	**English (NEW COURSE)**	Saturday	25-11-2023	I Restoration and Eighteenth Century English Literature
		Wednesday	29-11-2023	II Modern English Drama
				Optional – Any One out of the following four
		Friday	01-12-2023	III A) Indian Writing in English - II **OR** B) Indian Diasporic Fiction - II **OR** C) European Fiction and Drama **OR** D) Asian Literature
				Optional – Any One out of the following four
		Monday	04-12-2023	IV A) The English Novel-II **OR** B) Comparative Literature **OR** C) Cultural Studies- II **OR** D) English Language Teaching
1.	**English (OLD COURSE)**	Saturday	25-11-2023	I Restoration and Eighteenth Century English Literature
		Wednesday	29-11-2023	II Modern English Drama
				Optional – Any One out of the following four
		Friday	01-12-2023	III A) Nineteenth Century American Literature **OR** B) Post Colonialism and Literature-I **OR** C) African Literature **OR** D) Literature and Gender
				Optional – Any One out of the following four
		Monday	04-12-2023	IV A) The English Novel-II **OR** B) Cultural Studies **OR** C) The History of English Language-II **OR** D) The English Prose-II
2.	**Marathi (NEW COURSE)**	Saturday	25-11-2023	I आधुनिक मराठी साहित्याचा ईतिहास
		Wednesday	29-11-2023	II आधुनिक मराठी कविता
				Optional – Any One out of the following three
		Friday	01-12-2023	III A) मराठी निबंध वाङ्मय **किंवा** B) ललित निबंध **किंवा** C) वैचारिक मराठी साहित्य
				Optional – Any One out of the following three
		Monday	04-12-2023	IV A) साहित्यसमिक्षा **किंवा** B) संशोधनशास्त्र **किंवा** C) पाश्चात्य साहित्यसिद्धांत
2.	**Marathi (OLD COURSE)**	Saturday	25-11-2023	I आधुनिक मराठी साहित्याचा ईतिहास
		Wednesday	29-11-2023	II आधुनिक कविता
				Optional – Any One out of the following three
		Friday	01-12-2023	III A) निबंधवाङ्मय **किंवा** B) ललितगद्यप्रकार **किंवा** C) वैचारिक साहित्य
				Optional – Any One out of the following three
		Monday	04-12-2023	IV A) साहित्यसमिक्षा **किंवा** B) संशोधनशास्त्र **किंवा** C) पाश्चात्य साहित्यसिद्धांत
3.	**Hindi**	Saturday	25-11-2023	I हिंदी साहित्य का इतिहास (आधुनिककाल)
		Wednesday	29-11-2023	II हिंदीआलोचना : दृष्टि एवंप्रवृत्तियॉ
		Friday	01-12-2023	III आधुनिककाव्य
				Optional – Any One out of the following four
		Monday	04-12-2023	IV (A) कबीरदास (B) जयशंकरप्रसाद (C) प्रेमचंद (D) सुर्यकांत त्रिपाठी 'निराला (E) अज्ञेय (F) मुक्तिबोध

4. Urdu	Saturday	25-11-2023	I	Urdu Zaban-O-Adab Ka Ahed-e-Zarrin
	Wednesday	29-11-2023	II	Urdu Qasida-O-Marsiya Nigari
				Optional – Any One out of the following four electives
	Friday	01-12-2023	III	(A) Special Study Nazeer Akbarabadi **OR** (B) Special Study Allama Iqbal **OR** (C) Special Study Josh Malihabadi **OR** (D) Special Study Firaque Gorakhpuri
				Optional – Any One out of the following four electives
	Monday	04-12-2023	IV	(A) Urdu Novel Ka Taruf Aur Fan **OR** (B) Urdu Novel Nigari Ke Awwalin Nuqoosh **OR** (C) Novel “Aag Ka Dariya " Ek Mutalla **OR** (D) Novel “Shab Gazeeda " Ek Mutalla
5. Economics	Saturday	25-11-2023	I	Micro Economic Anylysis II
	Wednesday	29-11-2023	II	Macro Economic Anylysis II
				Optional – Any One out of the following five electives
	Friday	01-12-2023	III	i. Statistics for Economic-II **OR** ii. Indian Economic Policy II **OR** iii. Agricultural Economics II **OR** iv. Urban Economics **OR** v. Rural Economy and Social Change
				Optional – Any One out of the following five electives
	Monday	04-12-2023	IV	i. Mathematical Economics-II **OR** ii. Industrial Economics-II **OR** iii. Public Economics-II **OR** iv. Environmental Economics **OR** v. History of Economic Thought
6. History	Saturday	25-11-2023	I	Trends and Theories of History
	Wednesday	29-11-2023	II	India Under Britesh Rule : 1857-1905
	Friday	01-12-2023	III	Independent India : 1948-2000 **OR** History Of Tribal Movement in India 1765-1947
	Monday	04-12-2023	IV	Contemporary World : 1951-2000
7. Political Science	Saturday	25-11-2023	I	Comparative Politics
	Wednesday	29-11-2023	II	Western Political Thought
	Friday	01-12-2023	III	International Relation
				(Choose Any One Paper From The Following Elective Papers)
	Monday	04-12-2023	IV	A) Political Sociology **OR** B) Political Anthropology **OR** C) Western Political Theory **OR** D) South Asian Political System (Pakistan, Sri Lanka, Nepal,and Bangladesh)
8. Public Administration	Saturday	25-11-2023	I	Theories of Administration
	Wednesday	29-11-2023	II	Indian Administration - II
	Friday	01-12-2023	III	Administration and Management
	Monday	04-12-2023	IV	Development Administration
9. Geography	Saturday	25-11-2023	I	Research Methodology
	Wednesday	29-11-2023	II	Environmental Geography
	Friday	01-12-2023	III	Climatology
	Monday	04-12-2023	IV	Geography Of India
10. Sociology	Saturday	25-11-2023	I	Classical Theoretical Foundations
	Wednesday	29-11-2023	II	Qualitative Methods In Social Research
				Optional – Any One out of the following three electives
	Friday	01-12-2023	III	A) Social Movement In India B) Sociology of Aging C) Media And Society
				Optional – Any One out of the following three electives
	Monday	04-12-2023	IV	A) Women In Indian Society B) Sociology Of Social Stratification C) Industry And Society In India
11. Women’s Studies	Saturday	25-11-2023	I	Feminist Intervention In Knowledge Making Process
	Wednesday	29-11-2023	II	Planning & Policies for Women’s Development in India
	Friday	01-12-2023	III	Theoretical Perspective In Feminism
	Monday	04-12-2023	IV	Eminent Women Reformers in India
12. Arbic	Saturday	25-11-2023	I	Classical Prose
	Wednesday	29-11-2023	II	Classical Poetry
	Friday	01-12-2023	III	History of Abbasid Literature
	Monday	04-12-2023	IV	Quran and Hadith Literature

13. Persian	Saturday	25-11-2023	I	Classical and Ornate Prose
	Wednesday	29-11-2023	II	Classical Poetry
	Friday	01-12-2023	III	Sufi Literature Poetry
	Monday	04-12-2023	IV	History Of Persian Language and Literature (From Tatari, Taimuri & Mughal (India) up to Qachari Period)
14. Sanskrit	Saturday	25-11-2023	I	वैदिकसाहित्यम् !
	Wednesday	29-11-2023	II	व्याकरणं भाषाविज्ञानं च!
	Friday	01-12-2023	III	भारतीयदर्शनम्!
	Monday	04-12-2023	IV	काव्यशास्त्रं आधुनिक-संस्कुत-काव्यं च!
15. Pali (NEW COURSE)	Saturday	25-11-2023	I	Anupltak Literature- MilindPanho
	Wednesday	29-11-2023	II	Sutta Literature : Sanyutta Nikaya and Anguttara Nikaya
	Friday	01-12-2023	III	Vinaya Literature : Cullavagga
	Monday	04-12-2023	IV	Pali Grammar and Translation
15. Pali (OLD COURSE)	Saturday	25-11-2023	I	Anupltak Literature- MilindPanho
	Wednesday	29-11-2023	II	Sutta Litrature : Sanyutta Nikay and AnguttarNikay
	Friday	01-12-2023	III	Vinaya Litrature : Cullavagga
	Monday	04-12-2023	IV	Visuddhvagga (SilaNiddesa): Anupitak Literature
16. Linguistics	Saturday	25-11-2023	I	Phonology
	Wednesday	29-11-2023	II	Syntax
	Friday	01-12-2023	III	Semantics
	Monday	04-12-2023	IV	Computational Linguistics
17. Ambedkar Thought (NEW COURSE)	Saturday	25-11-2023	I	Dr. Ambedkar's Constitutional Thought
	Wednesday	29-11-2023	II	Policies, Caste Discrimination & Untouchability
	Friday	01-12-2023	III	Group-A : Pre Ambedkar Social & Cultural Movement **OR** Group-B : Impact Of Dr. Ambedkar on Literature
	Monday	04-12-2023	IV	Group-A : Dr. Ambedkar's Religious Thoughts **OR** Group-B : Post Ambedkar Movement
17. Ambedkar Thought (OLD COURSE)	Saturday	25-11-2023	I	Dr. Ambedkar : Dynamics Of Social Change
	Wednesday	29-11-2023	II	Educational Thought (B)
	Friday	01-12-2023	III	Group-A : Pre Ambedkar Social & Culture Movement **OR** Group-B : Impact Of Dr. Ambedkar on Literature
	Monday	04-12-2023	IV	Group-A : Constitutionalism & Indian Constutution **OR** Group-B : Human Rights
18. Gandhian Thought	Saturday	25-11-2023	I	Basic Works Of Mahatma Gandhi- II
	Wednesday	29-11-2023	II	Philosophical Foundation Of Gandhian Thought-II
	Friday	01-12-2023	III	Gandhian Economic Thought – II
	Monday	04-12-2023	IV	Social Thought Of Mahatma Gandhi
19. Indian Music	Saturday	25-11-2023	III	क्रियात्मक शास्त्र
	Wednesday	29-11-2023	IV	संगीतातील विज्ञान व ग्रंथाभ्यास
20. Home- Economics	Saturday	25-11-2023	I	Resource Management
	Wednesday	29-11-2023	II	Human Development
	Friday	01-12-2023	III	Textile & Clothing
	Monday	04-12-2023	IV	Research Methods and Statistics
21. A.I.H.C. & Arch (Group A) (Archaeology)	Saturday	25-11-2023	I	Epigraphy and Palaeography
	Wednesday	29-11-2023	II	Indian Architecture
	Friday	01-12-2023	III	Pre- History Of India **OR** Science and Archaeology
	Monday	04-12-2023	IV	Methods Of Archaeology **OR** Post Excavation Analysis and Report Writing
A.I.H.C. & Arch (Group B) (Indology)	Saturday	25-11-2023	I	Ancient Indian Art Practices
	Wednesday	29-11-2023	II	Traditional Knowledge Systems
	Friday	01-12-2023	III	Indian Polity (Up to 13th Century CE) **OR** Founders Of Indian Sciences
	Monday	04-12-2023	IV	Religious History of India (Up to 13th Century CE) **OR** Ancient World Religions

22. Buddhist Studies	Saturday	25-11-2023	I	History Of Buddhism in India
(NEW COURSE)	Wednesday	29-11-2023	II	History Of Buddhist Philosophy in India
	Friday	01-12-2023	III	Group-A- Anupitak Sahitya **OR** Group-B- Buddhist Sanskrit Literature
	Monday	04-12-2023	IV	Group-A- Abhidhamma Philosophy **OR** Group-B- Buddhist Logic
22. Buddhist Studies	Saturday	25-11-2023	I	History Of Buddhism in India- Part-II
(OLD COURSE)	Wednesday	29-11-2023	II	History Of Buddhist Philosophy in India- Part-II
	Friday	01-12-2023	III	Group-A- Anupitak Sahitya Group-B- Buddhist Sanskrit Literature
	Monday	04-12-2023	IV	Group-A- Abhidhamma Philosophy Group-B- Buddhist Logic
23. Philosophy	Saturday	25-11-2023	I	Ethics (Western)
(NEW COURSE)	Wednesday	29-11-2023	II	Epistemology (Western)
	Friday	01-12-2023	III	Metaphysics (Western) **OR** Philosophical Problems **OR** Philosophy Of Mind **OR** Philosophy Of Value Education
	Monday	04-12-2023	IV	History Of Western Philosophy (Modern Western) **OR** Philosophy Of Religion **OR** Modern Indian Thought **OR** Aesthetics
23. Philosophy	Saturday	25-11-2023	I	Ethics (Western)
(OLD COURSE)	Wednesday	29-11-2023	II	Epistemology (Western)
	Friday	01-12-2023	III	Metaphysics (Second) **OR** Philosophical Problems **OR** Philosophy Of Mind **OR** Philosophy Of Value Education
	Monday	04-12-2023	IV	History Of Western Philosophy **OR** Philosophy Of Religion **OR** Modern Indian Thought **OR** Aesthetics
24. Psychology	Saturday	25-11-2023	I	Advanced General Psychology
	Wednesday	29-11-2023	II	Research Designs
	Friday	01-12-2023	III	Personality Theories-II
	Monday	04-12-2023	IV	Issues In Social Behavior
25. Travel & Tourism	Saturday	25-11-2023	I	Tourism Transport Services
(NEW & OLD)	Wednesday	29-11-2023	II	Tourism Resources - Asia & Pacific
	Friday	01-12-2023	III	A- Hospitality Services Management **OR** B- Human Resources Development
	Monday	04-12-2023	IV	A- Tour Operation & Travel Agency Management **OR** B- Sustainable & Eco-Tourism
26. Mass Communication	Saturday	25-11-2023	I	Development Communication
	Wednesday	29-11-2023	II	Communication Research
	Friday	01-12-2023	III	Media Management & Media Laws
	Monday	04-12-2023	IV	International Communication
27. Rashtrasant Tukadoji	Saturday	25-11-2023		राष्ट्रसंताचे जीवन–चरित्र आणि व्यक्तिमत्व– भाग –२
Maharaj Thought	Wednesday	29-11-2023		राष्ट्रसंतांच्या कार्याची पार्श्वभूमी : स्वातंत्र्योत्तर कालखंड
(NEW COURSE)	Friday	01-12-2023		राष्ट्रसंताचे हिंदी साहित्य
	Monday	04-12-2023		ग्रामगीता नवनीत भाग २ **किंवा** राष्ट्रसंताचे धर्म, अध्यात्म आणि विज्ञानविषयक विचार
27. Rashtrasant Tukadoji	Saturday	25-11-2023		राष्ट्रसंताचे चरित्र आणि व्यक्तिमत्व– भाग –२
Maharaj Thought	Wednesday	29-11-2023		राष्ट्रसंतांच्या जीवनकार्याची पार्श्वभूमी : स्वातंत्र्योत्तर कालखंड
(OLD COURSE)	Friday	01-12-2023		राष्ट्रसंताचे हिंदी काव्य
	Monday	04-12-2023		राष्ट्रसंतांच्या साहित्याची समीक्षा **किंवा** राष्ट्रसंताचे आध्यात्मीक आणि भक्तीपर साहित्य

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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NAGPUR.

Date: 1st November, 2023.

Sd/-
Director
Board of Examinations & Evaluation,
RashtrasantTukadoji Maharaj
Nagpur University.

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M.A.1st SEM (CBCS) WINTER 2023
(680 to 686, 688,689, 691 to 696, 698,699, 703,706)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 1st SEMESTER (CBCS) EXAMINATION OF WINTER 2023
-:PROGRAMME (WRITTEN):-

TIME:-9.30 A.M. TO 12.30 P.M.

Sr. No.	Subject	Day	Date	Paper	
1.	**English**	Tuesday	16-01-2024	I	English Poetry From Chaucer To Milton
		Thursday	18-01-2024	II	The Renaissance Drama
				Optional – Any One out of the following four	
		Tuesday	23-01-2024	III	i. Indian Writing In English I **OR** ii. Indian Diasporic Fiction- I **OR** iii.Indian Writing In Translation **OR** iv.Indian Literary Criticism
				Optional – Any One out of the following four	
		Thursday	25-01-2024	IV	i. The English Novel-I **OR** ii. Literature and Gender **OR** iii. Cultural Studies -I **OR** iv The English Prose
2.	**Marathi**	Tuesday	16-01-2024	I	प्राचीन व मध्ययुगीन मराठी साहित्याचा ईतिहास
		Thursday	18-01-2024	II	साहित्यशास्त्र
				Optional – Any One out of the following three	
		Tuesday	23-01-2024	III	i. कादंबरी (विशेष वाङ्मय प्रकार) **किंवा** ii. नाटक (विशेष वाङ्मयप्रकार) **किंवा** iii.कथा (विशेष वाङ्मयप्रकार)
				Optional – Any One out of the following three	
		Thursday	25-01-2024	IV	i. संत ज्ञानेश्वर (विशेष ग्रंथकार) **किंवा** ii . वि. वा शिरवाडकर (विशेष ग्रंथकार) **किंवा** iii. यशवंत मनोहर (विशेष ग्रंथकार)
3.	**Hindi**	Tuesday	16-01-2024	I	हिंदी साहित्य का इतिहास (आदिकाल से रीतीकाल तक)
		Thursday	18-01-2024	II	भारतीय काव्यषास्त्र
		Tuesday	23-01-2024	III	मध्यकालीन काव्य
				Optional – Any One out of the following four	
		Thursday	25-01-2024	IV	(A) हिंदी नाटक एवं रंगमंच (B) हिंदी निबंध साहित्य (C) हिंदी एकांकी (D) हिंदी व्यंग साहित्य (E) जीवनी और आत्मकथा (F) संस्मरण, रेखाचित्र और रिपोर्ताज
4.	**Urdu**	Tuesday	16-01-2024	I	Tareek – E- Urdu Adab
		Thursday	18-01-2024	II	Classic Prose & Poetry
				Optional – Any One out of the following four electives	
		Tuesday	23-01-2024	III	i. Special Study Hazrat Ameer Khusro **OR** ii. Special Study Meer Taqi Meer **OR** iii. Special Study Mirza Ghalib **OR** iv. Special Study Sir Sayyad Ahmad Khan
				Optional – Any One out of the following four electives	
		Thursday	25-01-2024	IV	i. Urdu Drama **OR** ii. Yak Babi Urdu Drama **OR** iii. Urdu Drama of IPTA (Indian People's Theatre) **OR** iv. Urdu Opera
5.	**Economics**	Tuesday	16-01-2024	I	Micro Economic Anylysis I
		Thursday	18-01-2024	II	Macro Economic Anylysis I
				Optional – Any One out of the following five electives	
		Tuesday	23-01-2024	III	i. Statistics for Economic-I **OR** ii. Indian Economic Policy I **OR** iii. Ecinomics of Infrastructure **OR** iv. Trade Cycle **OR** v. Regional Economics **OR** VI Agricultural Economics - I
				Optional – Any One out of the following five electives	

	Thursday	25-01-2024	IV	i. Mathematical Economics-I **OR** ii. Industrial Economics-I **OR** iii. Public Economics-I **OR** iv. Economics of Education and Health **OR** v. Human Development
6. History	Tuesday	16-01-2024	I	Historiography
	Thursday	18-01-2024	II	India Under Company's Rule : 1757-1856
	Tuesday	23-01-2024	III	Indian National Movement : 1905-1947 **OR** Tribal History of Central India : 1200-1800
	Thursday	25-01-2024	IV	Modern World : 1914-1950
7. Political Science	Tuesday	16-01-2024	I	Modern Indian Political Thought
	Thursday	18-01-2024	II	Indian Government and Politics
	Tuesday	23-01-2024	III	Modern Political Ideologies
				(Choose Any One From The Following Elective Papers)
	Thursday	25-01-2024	IV	A) Politics of Developing Countries **OR** B) Fundamentals of Foreign Policy **OR** C) International Law **OR** D) Theory and Practice of Diplomacy
8. Geography	Tuesday	16-01-2024	I	History Of Geographical Thoughts
	Thursday	18-01-2024	II	Oceanography
	Tuesday	23-01-2024	III	Geomorphology
	Thursday	25-01-2024	IV	Biogeography
9. Sociology	Tuesday	16-01-2024	I	Classical Sociological Thinking
	Wednesday	23-03-2022	II	Quantitative Methods In Social Research
	Tuesday	23-01-2024	III	**Optional – Any One** out of the following three electives A) Sociology of Social Movement B) Sociology of Religion C) Sociology of Migration
	Thursday	25-01-2024	IV	**Optional – Any One** out of the following three electives A) Gender and Society B) Social Problems in Contemporary India C) Sociology of Minority Groups
10. Arbic	Tuesday	16-01-2024	I	Classical Prose
	Thursday	18-01-2024	II	Classical Poetry
	Tuesday	23-01-2024	III	History of Arabic Literature Pre-Islamic to Umayyad period
	Thursday	25-01-2024	IV	Grammer
11. Persian	Tuesday	16-01-2024	I	Classical and Ornate Prose
	Thursday	18-01-2024	II	Classical Poetry
	Tuesday	23-01-2024	III	Sufi Literature Poetry
	Thursday	25-01-2024	IV	History of Persian Language and Literature (From origin up to Saljooqui Period)
12. Sanskrit	Tuesday	16-01-2024	I	Veda
	Thursday	18-01-2024	II	Grammar
	Tuesday	23-01-2024	III	Indian Philosophy
	Thursday	25-01-2024	IV	Sanskrit Drama & Dramaturgy
13. Pali	Tuesday	16-01-2024	I	History of Pali Language & Literature
	Thursday	18-01-2024	II	Sutta Literature : Dhammapad and Suttanipat
	Tuesday	23-01-2024	III	Vinaya Lietrature : Mahavagga
	Thursday	25-01-2024	IV	Pali Grammar and Translation
14. Ambedkar Thought	Tuesday	16-01-2024	I	Sociologist Dr. Ambedkar
	Thursday	18-01-2024	II	Economic System & Economic Development
	Tuesday	23-01-2024	III	(A) Economic Discrimination & Caste Economic Inequalities **OR** (B) Dr. Ambedkar on Literature
	Thursday	25-01-2024	IV	(A) Dr. Ambedkar's Views on Ancient Education to British Period **OR** (B) Dr. Ambedkar's & Gender Issue
15. Indian Music	Tuesday	16-01-2024	III	क्रियात्मक शास्त्र
	Thursday	18-01-2024	IV	इतिहास व शास्त्राभ्यास
16. Home- Economics	Tuesday	16-01-2024	I	Resource Management
	Thursday	18-01-2024	II	Human Development
	Tuesday	23-01-2024	III	Textile & Clothing
	Thursday	25-01-2024	IV	Reasearch Methods and Statistics

17. Philosophy	Tuesday	16-01-2024	I	Ethics (Indian)
	Thursday	18-01-2024	II	Epistemology (Indian)
	Tuesday	23-01-2024	III	Metaphysics (Indian) **OR** Philosophical Problems **OR** Philosophy Of Mind **OR** Philosophy Of Value Education
	Thursday	25-01-2024	IV	History Of Western Philosophy (Early Greek) **OR** Philosophy Of Religion **OR** Modern Indian Thought **OR** Aesthetics
18. Psychology	Tuesday	16-01-2024	I	Cognitive Psychology
	Thursday	18-01-2024	II	Research Method Statistic & Psychological Testing
	Tuesday	23-01-2024	III	Personality Theories-I
	Thursday	25-01-2024	IV	Advanced Social Psychology
19. Mass Communication	Tuesday	16-01-2024	I	Principles Of Mass Communication
	Thursday	18-01-2024	II	Development Of Media
	Tuesday	23-01-2024	III	Print Media-I (Reporting & Editing)
	Thursday	25-01-2024	IV	Electronic Media-I (Radio & Television)

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 6th January 2024

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M.A.1st SEM (CBCS) WINTER 2023
(680 to 686, 688,689, 691 to 696, 698,699, 703,706)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 1st SEMESTER (CBCS) EXAMINATION OF WINTER 2023
-:PROGRAMME (WRITTEN):-

TIME:-9.30 A.M. TO 12.30 P.M.

Sr. No.	Subject	Day	Date	Paper	
1.	**English**	Tuesday	16-01-2024	I	English Poetry From Chaucer To Milton
		Thursday	18-01-2024	II	The Renaissance Drama
				Optional – Any One out of the following four	
		Tuesday	23-01-2024	III	i. Indian Writing In English I **OR** ii. Indian Diasporic Fiction- I **OR** iii.Indian Writing In Translation **OR** iv.Indian Literary Criticism
				Optional – Any One out of the following four	
		Thursday	25-01-2024	IV	i. The English Novel-I **OR** ii. Literature and Gender **OR** iii. Cultural Studies -I **OR** iv The English Prose
2.	**Marathi**	Tuesday	16-01-2024	I	प्राचीन व मध्ययुगीन मराठी साहित्याचा ईतिहास
		Thursday	18-01-2024	II	साहित्यशास्त्र
				Optional – Any One out of the following three	
		Tuesday	23-01-2024	III	i. कादंबरी (विशेष वाङ्मय प्रकार) **किंवा** ii. नाटक (विशेष वाङ्मयप्रकार) **किंवा** iii.कथा (विशेष वाङ्मयप्रकार)
				Optional – Any One out of the following three	
		Thursday	25-01-2024	IV	i. संत ज्ञानेश्वर (विशेष ग्रंथकार) **किंवा** ii . वि. वा शिरवाडकर (विशेष ग्रंथकार) **किंवा** iii. यशवंत मनोहर (विशेष ग्रंथकार)
3.	**Hindi**	Tuesday	16-01-2024	I	हिंदी साहित्य का इतिहास (आदिकाल से रीतीकाल तक)
		Thursday	18-01-2024	II	भारतीय काव्यषास्त्र
		Tuesday	23-01-2024	III	मध्यकालीन काव्य
				Optional – Any One out of the following four	
		Thursday	25-01-2024	IV	(A) हिंदी नाटक एवं रंगमंच (B) हिंदी निबंध साहित्य (C) हिंदी एकांकी (D) हिंदी व्यंग साहित्य (E) जीवनी और आत्मकथा (F) संस्मरण, रेखाचित्र और रिपोर्ताज
4.	**Urdu**	Tuesday	16-01-2024	I	Tareek – E- Urdu Adab
		Thursday	18-01-2024	II	Classic Prose & Poetry
				Optional – Any One out of the following four electives	
		Tuesday	23-01-2024	III	i. Special Study Hazrat Ameer Khusro **OR** ii. Special Study Meer Taqi Meer **OR** iii. Special Study Mirza Ghalib **OR** iv. Special Study Sir Sayyad Ahmad Khan
				Optional – Any One out of the following four electives	
		Thursday	25-01-2024	IV	i. Urdu Drama **OR** ii. Yak Babi Urdu Drama **OR** iii. Urdu Drama of IPTA (Indian People's Theatre) **OR** iv. Urdu Opera
5.	**Economics**	Tuesday	16-01-2024	I	Micro Economic Anylysis I
		Thursday	18-01-2024	II	Macro Economic Anylysis I
				Optional – Any One out of the following five electives	
		Tuesday	23-01-2024	III	i. Statistics for Economic-I **OR** ii. Indian Economic Policy I **OR** iii. Ecinomics of Infrastructure **OR** iv. Trade Cycle **OR** v. Regional Economics **OR** VI Agricultural Economics - I
				Optional – Any One out of the following five electives	

	Thursday	25-01-2024	IV	i. Mathematical Economics-I **OR** ii. Industrial Economics-I **OR** iii. Public Economics-I **OR** iv. Economics of Education and Health **OR** v. Human Development
6. History	Tuesday	16-01-2024	I	Historiography
	Thursday	18-01-2024	II	India Under Company's Rule : 1757-1856
	Tuesday	23-01-2024	III	Indian National Movement : 1905-1947 **OR** Tribal History of Central India : 1200-1800
	Thursday	25-01-2024	IV	Modern World : 1914-1950
7. Political Science	Tuesday	16-01-2024	I	Modern Indian Political Thought
	Thursday	18-01-2024	II	Indian Government and Politics
	Tuesday	23-01-2024	III	Modern Political Ideologies
				(Choose Any One From The Following Elective Papers)
	Thursday	25-01-2024	IV	A) Politics of Developing Countries **OR** B) Fundamentals of Foreign Policy **OR** C) International Law **OR** D) Theory and Practice of Diplomacy
8. Geography	Tuesday	16-01-2024	I	History Of Geographical Thoughts
	Thursday	18-01-2024	II	Oceanography
	Tuesday	23-01-2024	III	Geomorphology
	Thursday	25-01-2024	IV	Biogeography
9. Sociology	Tuesday	16-01-2024	I	Classical Sociological Thinking
	Wednesday	23-03-2022	II	Quantitative Methods In Social Research
	Tuesday	23-01-2024	III	**Optional – Any One** out of the following three electives A) Sociology of Social Movement B) Sociology of Religion C) Sociology of Migration
	Thursday	25-01-2024	IV	**Optional – Any One** out of the following three electives A) Gender and Society B) Social Problems in Contemporary India C) Sociology of Minority Groups
10. Arbic	Tuesday	16-01-2024	I	Classical Prose
	Thursday	18-01-2024	II	Classical Poetry
	Tuesday	23-01-2024	III	History of Arabic Literature Pre-Islamic to Umayyad period
	Thursday	25-01-2024	IV	Grammer
11. Persian	Tuesday	16-01-2024	I	Classical and Ornate Prose
	Thursday	18-01-2024	II	Classical Poetry
	Tuesday	23-01-2024	III	Sufi Literature Poetry
	Thursday	25-01-2024	IV	History of Persian Language and Literature (From origin up to Saljooqui Period)
12. Sanskrit	Tuesday	16-01-2024	I	Veda
	Thursday	18-01-2024	II	Grammar
	Tuesday	23-01-2024	III	Indian Philosophy
	Thursday	25-01-2024	IV	Sanskrit Drama & Dramaturgy
13. Pali	Tuesday	16-01-2024	I	History of Pali Language & Literature
	Thursday	18-01-2024	II	Sutta Literature : Dhammapad and Suttanipat
	Tuesday	23-01-2024	III	Vinaya Lietrature : Mahavagga
	Thursday	25-01-2024	IV	Pali Grammar and Translation
14. Ambedkar Thought	Tuesday	16-01-2024	I	Sociologist Dr. Ambedkar
	Thursday	18-01-2024	II	Economic System & Economic Development
	Tuesday	23-01-2024	III	(A) Economic Discrimination & Caste Economic Inequalities **OR** (B) Dr. Ambedkar on Literature
	Thursday	25-01-2024	IV	(A) Dr. Ambedkar's Views on Ancient Education to British Period **OR** (B) Dr. Ambedkar's & Gender Issue
15. Indian Music	Tuesday	16-01-2024	III	क्रियात्मक शास्त्र
	Thursday	18-01-2024	IV	इतिहास व शास्त्राभ्यास
16. Home- Economics	Tuesday	16-01-2024	I	Resource Management
	Thursday	18-01-2024	II	Human Development
	Tuesday	23-01-2024	III	Textile & Clothing
	Thursday	25-01-2024	IV	Reasearch Methods and Statistics

17. Philosophy	Tuesday	16-01-2024	I	Ethics (Indian)
	Thursday	18-01-2024	II	Epistemology (Indian)
	Tuesday	23-01-2024	III	Metaphysics (Indian) **OR** Philosophical Problems **OR** Philosophy Of Mind **OR** Philosophy Of Value Education
	Thursday	25-01-2024	IV	History Of Western Philosophy (Early Greek) **OR** Philosophy Of Religion **OR** Modern Indian Thought **OR** Aesthetics
18. Psychology	Tuesday	16-01-2024	I	Cognitive Psychology
	Thursday	18-01-2024	II	Research Method Statistic & Psychological Testing
	Tuesday	23-01-2024	III	Personality Theories-I
	Thursday	25-01-2024	IV	Advanced Social Psychology
19. Mass Communication	Tuesday	16-01-2024	I	Principles Of Mass Communication
	Thursday	18-01-2024	II	Development Of Media
	Tuesday	23-01-2024	III	Print Media-I (Reporting & Editing)
	Thursday	25-01-2024	IV	Electronic Media-I (Radio & Television)

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 6th January 2024

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M.A.1st SEM (CBCS) (NEP) (OLD) WINTER 2023
(680 to 686, 688,689, 691, 693,694, 696, 698,699, 702,703)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 1st SEMESTER (CBCS) (NEP) (OLD) EXAMINATION OF WINTER 2023

(As Per NEP 2020 Examination Scheme)

-: PROGRAMME (WRITTEN) :-

TIME : 9.30 A.M. TO 12.30 P.M.

Sr. No.	Subject	Day	Date	Paper	
1.	**English**	Tuesday	16-01-2024	I	English Poetry From Chaucer To Milton
		Thursday	18-01-2024	II	English Renaissance Drama
					Optional – Any One out of the following four
		Tuesday	23-01-2024	III	i. Indian Writing In English I **OR** ii. Indian Diasporic Fiction- I **OR** iii.Indian Writing In Translation **OR** iv.Indian Literary Criticism
					Optional – Any One out of the following four
		Thursday	25-01-2024	IV	i. The English Novel-I **OR** ii. Literature and Gender **OR** iii. Cultural Studies -I **OR** iv The English Prose
2.	**Marathi**	Tuesday	16-01-2024	I	प्राचीन व मध्ययुगीन मराठी साहित्याचा ईतिहास
		Thursday	18-01-2024	II	साहित्यशास्त्र
					Optional – Any One out of the following three
		Tuesday	23-01-2024	III	i. कादंबरी (विशेष वाङ्मय प्रकार) **किंवा** ii. नाटक (विशेष वाङ्मयप्रकार) **किंवा** iii.कथा (विशेष वाङ्मयप्रकार)
					Optional – Any One out of the following three
		Thursday	25-01-2024	IV	i. संत ज्ञानेश्वर (विशेष ग्रंथकार) **किंवा** ii . वि. वा शिरवाडकर (विशेष ग्रंथकार) **किंवा** iii. यशवंत मनोहर (विशेष ग्रंथकार)
3.	**Hindi**	Tuesday	16-01-2024	I	हिंदी साहित्य का इतिहास (आदिकाल से रीतीकाल तक)
		Thursday	18-01-2024	II	मध्यकालीन काव्य
		Tuesday	23-01-2024	III	(A) अनूवाद अध्ययन **OR** (B) हिंदी उपन्यास
		Thursday	25-01-2024	IV	(A) हिंदी कहानी **OR** (B) हिंदी निबंध
4.	**Urdu**	Tuesday	16-01-2024	I	Origin and Development of Urdu Language & Literature upto 1857
		Thursday	18-01-2024	II	Classical Literary Genres of Urdu Poetry
					Optional – Any One out of the following electives
		Tuesday	23-01-2024	III	i. General Linguistics **OR** ii. Urdu Ghazal
					Optional – Any One out of the following electives
		Thursday	25-01-2024	IV	i. Urdu Short Story **OR** ii. Non Functional Prose
5.	**Economics**	Tuesday	16-01-2024	I	Micro Economic Theory- I
		Thursday	18-01-2024	II	Macro Economic Theory- I
					Optional – Any One out of the following electives
		Tuesday	23-01-2024	III	i. Indian Economy- Issues & Policies **OR** ii. Mathematics For Economics
					Optional – Any One out of the following electives
		Thursday	25-01-2024	IV	i. Agricultural Economics **OR** ii. Industrial Economics
6.	**History**	Tuesday	16-01-2024	I	Historiography
		Thursday	18-01-2024	II	Cultural History of Maharashtra
		Tuesday	23-01-2024	III	i) Polity in Acient India (From earliest time to 12th Century A.D)**OR** ii) Polity Medieval India (13th -18th Century A.D.) **OR** iii) India Under Company's Rule : 1757-1857 A.D.
		Thursday	25-01-2024	IV	i) Modern World : 1914 to 1950 A.D. **OR** ii) Heritage Tourism- 1 **OR** iii) Tribal History of Central India : 1200 to 1800 A.D.

7.	**Political Science**	Tuesday	16-01-2024	I	Ancient & Mediaeval Indian Political Thought
		Thursday	18-01-2024	II	Indian Government and Politics
		Tuesday	23-01-2024	III	i) Political Theory **OR** ii) International Law
		Thursday	25-01-2024	IV	A) Research Methodology **OR** B) Public Opinion and Survey Research
8.	**Geography**	Tuesday	16-01-2024	I	Geomorphology
		Thursday	18-01-2024	II	Oceanography
		Tuesday	23-01-2024	III	i) Geographical Thought **OR** ii) Political Geography
		Thursday	25-01-2024	IV	i) Biogeography **OR** ii) Soil Geography
9.	**Sociology**	Tuesday	16-01-2024	I	Classical Sociological Thinking
		Thursday	18-01-2024	II	Quantitative Methods In Social Research
		Tuesday	23-01-2024	III	**Optional – Any One** out of the following three electives A) Family, Kinship and Marriage B) Sociology of Social Movement C) Sociology of Religion
		Thursday	25-01-2024	IV	**Optional – Any One** out of the following electives A) Rural-Urban Transformation B) Gender and Society C) Social Problems in Contemporary India
10.	**Arabic**	Tuesday	16-01-2024	I	Modern Arabic Prose
		Thursday	18-01-2024	II	Modern Arabic Poetry
		Tuesday	23-01-2024	III	Rhetoric & Prosody
		Thursday	25-01-2024	IV	Special Study of Poet : Akhtal
11.	**Sanskrit**	Tuesday	16-01-2024	I	वेद।
		Thursday	18-01-2024	II	व्याकरणम।
		Tuesday	23-01-2024	III	i) भारतीय दर्शनमृ – वेदान्तसार कटोपनिशदृ च **OR** ii) भारतीयदर्शनम– सांख्यकारिका
		Thursday	25-01-2024	IV	i) संस्कृतनाट्यम –मुद्राराक्षसमृ **OR** ii) संस्कृत नाट्यशास्त्रम – धनिकटीकासंहित दषरूपकम
12.	**Pali**	Tuesday	16-01-2024	I	History and Development of Pali Language
		Thursday	18-01-2024	II	Sutta Literature Dhammapada
		Tuesday	23-01-2024	III	i) Study of Pali Literature **OR** ii) Study of Buddhist Council
		Thursday	25-01-2024	IV	i) Pali Grammar and Translation **OR** ii) Buddha and His Teaching
13.	**Ambedkar Thought**	Tuesday	16-01-2024	I	Sociologist Dr. Ambedkar
		Thursday	18-01-2024	II	Economic System & Economic Development
		Tuesday	23-01-2024	III	(A) Pre Ambedkar Social & Cultural Movement **OR** (B) Dr. Ambedkar on Literature
		Thursday	25-01-2024	IV	(A) Dr. Ambedkar's Views on Ancient Education to British Period **OR** (B) Dr. Ambedkar's & Gender Issue
14.	**Indian Music**	Tuesday	16-01-2024	I	क्रियात्मक शास्त्र
		Thursday	18-01-2024	II	इतिहास व शास्त्राभ्यास
		Tuesday	23-01-2024	III	गझल माहिती (Introduction to Ghazal)
15.	**Home- Economics**	Tuesday	16-01-2024	I	Research Methods and Statistics
		Thursday	18-01-2024	II	Textile & Clothing
		Tuesday	23-01-2024	III	i) Resource Management **OR** ii) Residential Interior Design
		Thursday	25-01-2024	IV	i) Human Development **OR** ii) Early Childhood Care and Education
16.	**Philosophy**	Tuesday	16-01-2024	I	Epistemology (Indian)
		Thursday	18-01-2024	II	Metaphysics (Indian)
		Tuesday	23-01-2024	III	i) Political Philosophy **OR** ii) Philosophy Of Mind
		Thursday	25-01-2024	IV	i) History Of Western Philosophy-I **OR** ii) Modern Indian Thought- I

17. Psychology	Tuesday	16-01-2024	I	Cognitive Psychology
	Thursday	18-01-2024	II	Research Method Statistic & Psychological Testing
	Tuesday	23-01-2024	III	i) Personality Theories **OR** ii) Development Psychology
	Thursday	25-01-2024	IV	i) Advanced Social Psychology **OR** ii) Physiological Foundation of Psychological Processes

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 6th January 2024

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.Com. 2ND SEMESTER (CBCS) EXAMINATION OF WINTER 2023

=: PROGRAMME (WRITTEN) :=

TIME : - 2.00. P.M. To 5.00. P.M.

Day	Date	Subject
Tuesday	31-10-2023	Research Methodology
Thursday	02-11-2023	Advanced Cost Accounting
Monday	06-11-2023	Co-operation
Wednesday	08-11-2023	Human Resource Management

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

****

Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 13th October 2023

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M.Sc. 1st Sem(C.B.C.S)., WINTER, 2023
(763 to 780)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.Sc. 1ST SEMESTER (C.B.C.S.) EXAMINATION OF WINTER, 2023
-: PROGRAMME (WRITTEN) :-
TIME : 9.30 A.M. TO 12.30 P.M.

Sr. No	Subject	Day / Date / Paper	Tuesday 16-01-2024 I	Thursday 18-01-2024 II	Tuesday 23-01-2024 III	Thursday 25-01-2024 IV	Saturday 27-01-2024 V
1.	Physics		Mathematical Physics	Complex Analysis and Numerical Method	Electronics	Electrodynamics – I	----
2.	Chemistry		Inorganic Chemistry	Organic Chemistry	Physical Chemistry	Analytical Chemistry	----
3.	Bio-Chemistry		Protein Biochemistry	Advanced Enzymology	Biochemical Research Techniques	Plant Biochemistry	----
4.	Microbiology		Microbial Metabolism (MM)	Enzymology and Techniques (ET)	Advance Techniques in Microbiology (ATM)	Membrane Structure and Signal Transduction (MSST)	----
5.	Botany		Microbiology Algac and Fungi	Bryophytes and Pteridophytes	Gymnosperms and Paleobotany	Cytology and Genetics	----
6.	Zoology		Structure and Function of Inventebrates	General Physiology	Cell Biology and Genetics	Advance Reproductive Biology	
7.	Geology		Mineralogy and Crystallography	Igneous Petrology	Metamorphic Petrology and Geology Mapping	Stratigraphy and Indian Geology	----
8.	Environmental Science		Environmental Chemistry	Atmospheric Science	Environmental Biology, Microbiology and Biotechnology	Climate Change and It's Consequences	----
9.	Electronics		Fundamentals of Semiconductor Devices	Digital Design & Applications	Advanced Microprocessors	Programming in C	----
10.	Computer Science		Discrete Mathematical Structure	Programming in JAVA	Digital Electronics and Microprocessor	Advanced DBMS and Administration	----
11.	Mathematics		Algebra – I	Real Analysis – I	Topology – I	Ordinary Differential Equations **(New Course)** Linear Algebra and Differential Equations **(Old Course)**	Integral Equations
12.	Biotechnology		Cell Biology AND Enzymology	Molecular Biology	Biomolecules	Biophysical Technique	

Sr. No	Subject	Day Date Paper	Tuesday 16-01-2024 I	Thursday 18-01-2024 II	Tuesday 23-01-2024 III	Thursday 25-01-2024 IV	Saturday 27-01-2024 V
13.	Information Technology	Computer Architecture and Organization		Internet Computing with ASP Net.	Distributed Operating System	Advanced DBMS and Administration	
14.	Forensic Science	Criminalistics		Advanced Forensic Science	Forensic Biology and Serology	Forensic Chemistry and Toxicology	Forensic Physics and Ballistics **PAPER – VI** **Monday, 29 - 01 - 2024** Digital and Cyber Forensics **PAPER – VII** **Tuesday, 30 – 01 - 2024** Forensic and Correctional Psychology **PAPER – VIII** **Wednesday 31 – 01 - 2024** Communication and Scientific Report Writing

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 2nd January 2024

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M.Sc. 1st Sem(C.B.C.S)., WINTER, 2023
(763 to 780)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.Sc. 1ST SEMESTER (C.B.C.S.) EXAMINATION OF WINTER, 2023
-: PROGRAMME (WRITTEN) :-
TIME : 9.30 A.M. TO 12.30 P.M.

Sr. No	Subject	Day / Date / Paper	Tuesday 16-01-2024 I	Thursday 18-01-2024 II	Tuesday 23-01-2024 III	Thursday 25-01-2024 IV	Saturday 27-01-2024 V
1.	Physics		Mathematical Physics	Complex Analysis and Numerical Method	Electronics	Electrodynamics – I	----
2.	Chemistry		Inorganic Chemistry	Organic Chemistry	Physical Chemistry	Analytical Chemistry	----
3.	Bio-Chemistry		Protein Biochemistry	Advanced Enzymology	Biochemical Research Techniques	Plant Biochemistry	----
4.	Microbiology		Microbial Metabolism (MM)	Enzymology and Techniques (ET)	Advance Techniques in Microbiology (ATM)	Membrane Structure and Signal Transduction (MSST)	----
5.	Botany		Microbiology Algac and Fungi	Bryophytes and Pteridophytes	Gymnosperms and Paleobotany	Cytology and Genetics	----
6.	Zoology		Structure and Function of Inventebrates	General Physiology	Cell Biology and Genetics	Advance Reproductive Biology	
7.	Geology		Mineralogy and Crystallography	Igneous Petrology	Metamorphic Petrology and Geology Mapping	Stratigraphy and Indian Geology	----
8.	Environmental Science		Environmental Chemistry	Atmospheric Science	Environmental Biology, Microbiology and Biotechnology	Climate Change and It's Consequences	----
9.	Electronics		Fundamentals of Semiconductor Devices	Digital Design & Applications	Advanced Microprocessors	Programming in C	----
10.	Computer Science		Discrete Mathematical Structure	Programming in JAVA	Digital Electronics and Microprocessor	Advanced DBMS and Administration	----
11.	Mathematics		Algebra – I	Real Analysis – I	Topology – I	Ordinary Differential Equations **(New Course)** Linear Algebra and Differential Equations **(Old Course)**	Integral Equations
12.	Biotechnology		Cell Biology AND Enzymology	Molecular Biology	Biomolecules	Biophysical Technique	

Sr. No	Subject	Day Date Paper	Tuesday 16-01-2024 I	Thursday 18-01-2024 II	Tuesday 23-01-2024 III	Thursday 25-01-2024 IV	Saturday 27-01-2024 V
13.	Information Technology	Computer Architecture and Organization		Internet Computing with ASP Net.	Distributed Operating System	Advanced DBMS and Administration	
14.	Forensic Science	Criminalistics		Advanced Forensic Science	Forensic Biology and Serology	Forensic Chemistry and Toxicology	Forensic Physics and Ballistics **PAPER – VI** **Monday, 29 - 01 - 2024** Digital and Cyber Forensics **PAPER – VII** **Tuesday, 30 – 01 - 2024** Forensic and Correctional Psychology **PAPER – VIII** **Wednesday 31 – 01 - 2024** Communication and Scientific Report Writing

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 2nd January 2024

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

M.A. 4TH SEMESTER (CBCS) (NEW/OLD) EXAMINATION OF WINTER 2023

=: PROGRAMME (WRITTEN) :=

TIME : - 2.00. P.M. To 5.00. P.M.

Sr. No.	Subject	Day	Date	Paper
1.	**English (NEW COURSE)**	Thursday	26-10-2023	Twentieth Century English Poetry
		Saturday	28-10-2023	Literary Criticism and Theory – II
				Any One out of Four Electives
		Monday	30-10-2023	A) Twentieth Century American Literature **OR**
				B) African American Literature **OR**
				C) Disability Studies **OR**
				D) Film Studies
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	Communicative English – II
				Any One out of Three Core Papers
				A) Postcolonial Literature **– II OR**
				B) Research Writing and Presentation Skills in English Studies - II **OR**
				C) Dalit Literature - II
1.	**English (OLD COURSE)**	Thursday	26-10-2023	Literary Criticism and Theory – II
		Saturday	28-10-2023	Twentieth Century Poetry
				Any One out of Four Electives
		Monday	30-10-2023	A) African- American Literature **OR**
				B) Dalit Literature **OR**
				C) Indian Writing in English-II **OR**
				D) Film Studies
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	Communicative English – II
				Any One out of Three Core Papers
				A) History of English Literature - II **OR**
				B) English Language Teaching –II **OR**
				C) Research Methodology
2.	**Marathi (NEW COURSE)**	Thursday	26-10-2023	मध्ययुगीन – आधूनिक गद्य
		Saturday	28-10-2023	भाषाविज्ञान
				Any One out of Four Electives
		Monday	30-10-2023	A) लोकसाहित्य
				B) स्त्रीवादी साहित्य
				C) तौलनिक साहित्याभ्यास
				D) अनुवादित विश्वसाहित्याचा अभ्यास
		Foundation -II Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) साहित्याचा सामाजिक, सांस्कृतिक अभ्यास
				B) चित्रपट आणि साहित्य
				C) अनुवादित भारतीय साहित्याचा अभ्यास
				D) मराठीचा भाषिक व्यवहार
2.	**Marathi** (OLD COURSE)	Thursday	26-10-2023	मध्ययुगीन – आधूनिक गद्य
		Saturday	28-10-2023	भाषा विज्ञान
				Any One out of Four Electives
		Monday	30-10-2023	A) लोकसाहित्य
				B) तौलनिक साहित्याभ्यास
				C) साहित्याचा सामाजिक, सांस्कृतिक अभ्यास
				D) संविधानमूल्ये आणि साहित्य
		Foundation -II Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) प्रसारमाध्यमे आणि साहित्यव्यवहार
				B) चित्रपट आणि साहित्य
				C) स्त्रीवादी साहित्य
				D) अनुवादित भारतीय साहित्याचा अभ्यास

3.	**Hindi**	Thursday	26-10-2023	भाषा – विज्ञान
		Saturday	28-10-2023	आधुनिक हिंदी कथा साहित्य
				Any One out of Six Electives
		Monday	30-10-2023	A) अनुसंधान प्रक्रिया और प्रविधि **अथवा**
				B) जनसंचार माध्यम **अथवा**
				C) अनुवाद अध्ययन **अथवा**
				D) साहित्य और सिनेमा **अथवा**
				E) तुलनात्मक अध्ययन **अथवा**
				F) स्थानीय साहित्य
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) हिंदी गजल **अथवा**
				B) यात्रा साहित्य **अथवा**
				C) डायरी और पत्र साहित्य **अथवा**
				D) भारतीय चिंतक **अथवा**
				E) पर्यावरण अध्ययन
4.	**Urdu**	Thursday	26-10-2023	Urdu Adab ka Asri Daur
		Saturday	28-10-2023	Urdu Afsana Nigari
				Any One out of Four Electives
		Monday	30-10-2023	A) Maktoob Nigari ka fun
				B) Sawaneh, Khudnawisht, Khake
				C) Quami Yakjahti Aur Urdu Adab
				D) Ilm-e-Balaghat-o-Urooz
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) Urdu Sheri Adab
				B) Urdu Adab mein Kahani-o-Afsana Nigari
				Any One out of Tow Core Papers
				A) Urdu Adab Aur Maholiyaat
				B) Adab Aur Cinema
5.	**Economics**	Thursday	26-10-2023	Economics of Growth , Development and Planning– II
		Saturday	28-10-2023	International Trade & Finance – II
				Any One out of Five Electives
		Monday	30-10-2023	A) Financial Institutions and Markets-II
				B) Economics of Marketing
				C) Computer Application in Economics
				D) Rural Development
				E) Advanced Econometrics
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	1) Money & Banking **OR**
				2) Economics of Maharashtra **OR**
				3) Urban & Rural Economy **OR**
				4) Entrepreneur Development **OR**
				5) Economics- II
				Any One out of Two Core
				1) Welfare Economics **OR**
				2) Research Methodology – II
6.	**History**	Thursday	26-10-2023	Expansion of Maratha Power : 1707 – 1818
		Saturday	28-10-2023	State in British India
				Any One out of Two Elective II (Only For the Students of History)
		Monday	30-10-2023	A) Economic History of India : 1858 – 1947 **OR**
				B) Ecology and Indian Human Societies
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) India Under the Mughals (1526 – 1707 A.D.) **OR**
				B) History of Science and Technology in Colonial India
				Any One out of Two
				A) Modern India 1857-1947 **OR**
				B) History of Modern Vidarbha (Only for the Students of History)
7.	**Political Science**	Thursday	26-10-2023	State Politics in India
		Saturday	28-10-2023	Indian Administration
				Any One from the following Elective Papers
		Monday	30-10-2023	a) Pressure Groups and Social Movements **OR**
				b) Reservation Policy in India **OR**
				c) International Human Rights-Problems and Prospects **OR**
				d) Public Policy in India
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	a) Indian Constitution and Its Working **OR**
				b) International Organizations **OR**
				c) Development Administration **OR**
				d) Human Rights and Indian Constitution

8.	**Public Administration**	Thursday	26-10-2023	Social Welfare Administration in India
		Saturday	28-10-2023	State and Development Administration in Maharashtra
				Any One from the following Elective Papers
		Monday	30-10-2023	a) Public Policy **OR**
				b) Urban Governance in India **OR**
				c) Women and Governance
		Wednesday	01-11-2023	Safety Management and Administration
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				a) Introduction to Indian Administration **OR**
				b) Emerging Trends in Public Administration **OR**
				c) Contemporary Issues in Indian Administration **OR**
				d) Human Rights Administration
9.	**Geography**	Thursday	26-10-2023	Population Geography
		Saturday	28-10-2023	Geography of Tourism
		Monday	30-10-2023	Regional Planning & Development
				Any One from the following Elective Papers
		Wednesday	01-11-2023	a) Social Geography **OR**
				b) Geography Of Water Resources **OR**
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				Remote Sensing Techniques
10.	**Sociology**	Thursday	26-10-2023	Recent Trends in Sociology Theory
		Saturday	28-10-2023	Perspectives on Indian Society
				Any One from the following Core Elective Papers
		Monday	30-10-2023	A) Education And Society In India **OR**
				B) Sociology Of Marginalized Communities
				Any One from the following Elective Papers
		Wednesday	01-11-2023	A) Rural Society In India: Issues And Problems **OR**
				B) Urbanization In India **OR**
				C) Contemporary Sociology
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				a) Social Psychology
				b) Rural Society in India Issues and Problems
				c) Urbanization in India
				d) Contemporary Sociology
				e) Political Sociology
				f) Sociology of Demograph
11.	**Women's Studies**	Thursday	26-10-2023	Research Methodology
				Any One from the following Elective Papers
		Saturday	28-10-2023	1. Women's Entrepreneurship **OR**
				2. Women's Movement in Capitalistic & Communist Countries
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	i) Capacity Building of Women **OR**
				ii) Women's Movement in Vidarbha **OR**
				iii) Women in Politics and Governance
12.	**Arabic**	Thursday	26-10-2023	Modern Prose
		Saturday	28-10-2023	Modern Poetry
				Any One from the following Elective Papers
		Monday	30-10-2023	A) History and Culture of the Arabs Abbasid Period
				B) Special Study on Arabic Drama & Novel
				C) Special Study of Maulana Syed Sulaiman Nadvi Life & Works
				Core Subject
		Wednesday	01-11-2023	Rhetorics **OR**
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				Essay, Translation & Letter Proceeding
13.	**Persian**	Thursday	26-10-2023	Modern Prose
		Saturday	28-10-2023	Modern Poetry
				Any One from the following Elective Papers
		Monday	30-10-2023	A) Special Study on Persian Short Stories of Jamal Zadeh **OR**
				B) Special Study on Persian Drama of M. Qaraje Daghi **OR**
				C) Special Study on Persian Novels of Mohd. Hejazi
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) Essay Translation and Letter **OR**
				B) Critical Study on Indo Islamic art of Calligraphy During Mughal Period in India
14.	**Sanskrit**	Thursday	26-10-2023	ब्राह्मण–आरण्यक–उपनिषद:।
				OR
				चार्वाक बौद्ध– जैनदर्शनम्।
				OR
				काव्यं काव्यशास्त्रं च।
		Saturday	28-10-2023	यजुर्वेद–शिक्षा च।
				OR
				तर्कभाषा–अर्थसंग्रह:च।
				OR

				नाट्यशास्त्रं चम्पूकाव्यं च।
	Monday	30-10-2023	**Elective Course**	**चयनात्कक पाढयक्रम**
	Wednesday	01-11-2023	**AS PER ENCLOSED LIST OF FOUNDATION COURESE 42 SUBJECTS मुलभुत पाढयक्रम**	
				OR
				Subject Centric
15. Pali	Thursday	26-10-2023	I	Sutta Literature : Digha Nikaya – Majjhima Nikaya
(NEW COURSE)	Saturday	28-10-2023	II	Pali Gatha : Khuddak Nikaya
				Any One from the following Elective Papers
	Monday	30-10-2023	III	A) Vinaypitaka – Patimokkha **OR**
				B) Modern Pali Literature **OR**
				C) Atthakatha Literature
				Any One from the following Core Papers
	Wednesday	01-11-2023	IV	A) Pali Language and Essay **OR**
				B) Propagation of Pali Literature
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS			
				Pali – Prakrit - II (Pali Language and Literature)
15. Pali	Thursday	26-10-2023	I	Sutta Literature : Digha Nikay – Majjhim Nikaya
(OLD COURSE)	Saturday	28-10-2023	II	Pali Poetry : Khuddak Nikay (Pali Gatha)
				Any One from the following Elective Papers
	Monday	30-10-2023	III	A) Vinay Pitaka – Patimokkha **OR**
				B) Modern Pali Literature **OR**
				C) Atthakatha Literature
				Any One from the following Core Papers
	Wednesday	01-11-2023	IV	A) Comparative Linguistics and Essay **OR**
				B) Propagation of Pali Literature
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS			
				Pali Language and Literature
16. Linguistics	Thursday	26-10-2023		Stylistics **OR** Research Methodology
	Saturday	28-10-2023		Language Typology
				Any One from the following Elective Papers
	Monday	30-10-2023		A) Lexicography & Translation
				B) Corpus Linguistics
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS			
	Wednesday	01-11-2023		A) Introduction to Natural Language Processing
				OR
				B) Language Teaching Methods
17. Ambedkar Thoughts	Thursday	26-10-2023		Political Representation & Social & Religious Minority
(NEW COURSE)	Saturday	28-10-2023		Dr. Ambedkar's Thoughts on Buddhism
	Monday	30-10-2023		A) Dr. Ambedkar's Strategies of Economic Development & Policies **OR**
				B) Dr. Ambedkar on India's Defense & Foreign Policy
	Wednesday	01-11-2023		A) Research Methodology (b) **OR**
				B) Gender & Caste in Contemporary Period
17. Ambedkar Thoughts	Thursday	26-10-2023		Economic Thought (b)
(OLD COURSE)	Saturday	28-10-2023		Religious Thought (b)
	Monday	30-10-2023		A) Political Thought (b) **OR**
				B) Dr. Ambedkar on Historicism (b)
	Wednesday	01-11-2023		a) Research Methodology (B) **OR**
				b) Social Movement (Foundation II) **OR**
				c) Ambedkar Thought (Foundation Paper-II)
18. Gandhian Thoughts	Thursday	26-10-2023		Gandhi and His Contemporaries – II
				Any One from the following Core Elective
	Saturday	28-10-2023		A) Satyagraha – II **OR**
				B) Gandhian Way of Management
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS			
	Wednesday	01-11-2023		A) Gandhian Thought-II **OR**
				B) Gandhian Approach to Rural Development-II
				Any One from the following Elective Papers
19. Indian Music	Monday	30-10-2023		A) क्रियात्मक व सौंदर्यशास्त्र **OR**
				B) संगीत निर्देशन **OR**
				C) संगीत समीक्षा-II
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS			
	Wednesday	01-11-2023		A) संगीतातील संशोधन **OR**
				B) Basic Types of Indian Music **OR**
				C) Elementary Study of Classical Music **OR**
				D) Study of Raga Concept, Study of Basic 4 Taals

20. Home Economics	Thursday	26-10-2023	Foods and Nutrition
	Saturday	28-10-2023	Family Dynamics
			Any One from the following Elective Papers
	Monday	30-10-2023	a) Home Science Extension Education **OR**
			b) Housing and Interiors
	Wednesday	01-11-2023	Consumer and The Market **OR**
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			a) Resource Management
			b) Human Development
			c) Food and Nutrition
			d) Textile and Clothing
			e) Home Science Extension Education
			GROUP – A (ARCHAEOLOGY)(FOR REGULAR STUDENTS)
21. A.I.H.C. & Arch.	Thursday	26-10-2023	Art and Iconography
	Saturday	28-10-2023	Heritage Conservation
	Monday	30-10-2023	Iron Age in India **OR**
			Antiquarian Laws
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Wednesday	01-11-2023	Introduction to Indian Archaeology **OR**
			Core
			Museology **OR**
			Ancient Civilization
			GROUP – B (INDOLOGY) (FOR ANY STUDENTS)
	Thursday	26-10-2023	Research Methodology
	Saturday	28-10-2023	Historical Geography of Ancient India
			Any One from the following Elective Papers
	Monday	30-10-2023	History of Indian Coinage **OR**
			Ancient Indian Folklore
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Wednesday	01-11-2023	Cultural Anthropology **OR**
			Principles of Museology **OR**
			Core Paper
			Heritage Conservation
22. Buddhist Studies (NEW COURSE)	Thursday	26-10-2023	Buddhist Vinaya
	Saturday	28-10-2023	Buddhist Education
			Any One from the following Elective Papers
	Monday	30-10-2023	i) Group-A- Revival of Buddhism in Modern India **OR**
			ii) Group-B- Buddhist Art and Architecture **OR**
			iii) Group-C- Buddhism in North East Asia
	Wednesday	01-11-2023	Group-A- Buddhism in South East Asia **OR**
			Group-A- Basic Study of Buddhist Literature
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
			Buddhist Studies – II (Basic History of Buddhism)
22. Buddhist Studies (OLD COURSE)	Thursday	26-10-2023	Buddhist Vinaya
	Saturday	28-10-2023	Buddhist Education
			Any One from the following Elective Papers
	Monday	30-10-2023	i) Group-A- Revival of Buddhism in Modern India **OR**
			ii) Group-B- Buddhist Art and Architecture **OR**
			iii) Group-C- Buddhism in North East India
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Wednesday	01-11-2023	Basic Principle of Buddhism **OR**
			Group-A- Basic Study of Buddhist Literature **OR**
			Group-A- Buddhism in South East Asia **OR**
			Group-B- Buddhist Psychology **OR**
			Group-B- Basic Study of Buddhist Literature
23. Philosophy (NEW COURSE)	Thursday	26-10-2023	Analytic Philosophy
	Saturday	28-10-2023	Comparative Religion
			Any One from the following Elective Papers
	Monday	30-10-2023	i) Advanced Symbolic Logic **OR**
			ii) Plato **OR**
			iii) Applied Ethics **OR**
			vi) Existentialism
	Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
	Wednesday	01-11-2023	**A)** Philosophy II (Philosophy of Conduct)
			OR
			Core Paper
			B) i) Philosophical Theories – II **OR**
			ii) Philosophy of Osho – II **OR**
			iii) Intensive study of ' Materialism' by M. N. Roy – II

23.	**Philosophy (OLD COURSE)**	Thursday	26-10-2023	Analytic Philosophy
		Saturday	28-10-2023	Comparative Religion
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Advanced Symbolic Logic **OR**
				ii) Plato **OR**
				iii) Applied Ethics **OR**
				vi) Existentialism
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	i) Philosophy II (Philosophy of Conduct)
				OR
				Core Paper
				ii) Philosophical Theories – II
		Any One Stream From – A OR B OR C		
		Stream – A : Clinical Psychology		
24.	**Psychology**	Thursday	26-10-2023	Psychopathology
		Saturday	28-10-2023	Therapeutic Intervention Strategies
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Community Mental Health and Medical Psychology **OR**
				ii) Psychological Testing in Clinical Psychology
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	Applied Psychology **OR**
				Core Paper
				Positive Psychology - II
		Stream – B : Organizational Psychology & Human and Resource Management		
		Thursday	26-10-2023	Organization Development
		Saturday	28-10-2023	Employee Counselling
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Leadership and Communication in Organization **OR**
				ii) Organization Culture, Organizational Learning and Organization Change
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	Applied Psychology **OR**
				Core Paper
				Positive Psychology - II
		Stream – C : Counselling Psychology		
		Thursday	26-10-2023	Psychological Disorders
		Saturday	28-10-2023	Intervention Strategies in Counselling
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Social Areas of Counselling **OR**
				ii) Psychological Testing in Counselling and Guidance
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	Applied Psychology **OR**
				Core Paper
				Positive Psychology - II
25.	**Travel & Tourism (NEW COURSE)**	Thursday	26-10-2023	Research Methodology in Tourism
		Saturday	28-10-2023	Tourism Resources – America & Africa
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Entrepreneurship Development in Tourism **OR**
				ii) Tourism Planning & Development
		Wednesday	01-11-2023	i) Tourism Resources of Vidarbha **OR**
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				i) Foundation in Travel & Tourism – II
25.	**Travel & Tourism (OLD COURSE)**	Thursday	26-10-2023	Research Methodology in Tourism
		Saturday	28-10-2023	Tourism Resources – America & Africa
				Any One from the following Elective Papers
		Monday	30-10-2023	i) Entrepreneurship Development in Tourism **OR**
				ii) Tourism Planning & Development
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	i) Travel & Tourism II **OR**
				ii) Tourism Resources
				iii) Tourism Retail Sales Business
				Core Paper
				Tourism Resources of Vidarbha
26.	**Mass Communication**	Thursday	26-10-2023	New Media Applications
		Saturday	28-10-2023	Inter Cultural Communication
		Monday	30-10-2023	**Core Paper**
				Environmental Communication

27.	**Rashtrasant Tukadoji Maharaj Thoughts (NEW COURSE)**	Thursday	26-10-2023	राष्ट्रसंतांचे विचार : आजच्या संदर्भात
		Saturday	28-10-2023	राष्ट्रसंत : जन–सारस्वत
				Any One from the following Elective Papers
		Monday	30-10-2023	A) राष्ट्रसंतांची महिला सक्षमीकरणाची भूमिका
				B) राष्ट्रसंतांच्या साहित्यातील वैचारिकमुल्ये
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
		Wednesday	01-11-2023	A) ग्रामगीता नवनीत भाग ४ **OR**
				B) राष्ट्रसंतांचे साहित्य आणि कार्य

27.	**Rashtrasant Tukadoji Maharaj Thoughts (OLD COURSE)**	Thursday	26-10-2023	राष्ट्रसंतांचे तत्वज्ञान – भाग – २
		Saturday	28-10-2023	ग्रामगीता : विचारसंपदा
		Monday	30-10-2023	भारतीय समाजसुधारक आणि राष्ट्रसंत
				Any One from the following Elective Papers
		Wednesday	01-11-2023	A) राष्ट्रसंतांची कलासाधना
		Optional – AS PER ENCLOSED LIST OF FOUNDATION COURSES OF 42 SUBJECTS		
				B) राष्ट्रसंतांचे साहित्य आणि कार्य

List of Foundation Subjects for P.G.

Sr.No.	Subject	4th Papers of Semester-4
1	Mathematics	Mathematics-II
2	Physics	Physics-II
3	Chemistry	Chemistry-II
4	Bio-Technology (Ad-hoc)	Bio-Technology-II
5	Computer Science	Computer Science-II
6	Environmental Science	Environmental Science-II
7	Botany	Botany-II
8	Zoology	Zoology-II
9	Statistic	Statistics-II
10	Business Management	Business Management -II
11	Accountancy	Account & Statistics-II
12	Managerial Skill	Managerial Skills-II
13	Education Technology & Management Skills	Education Technology & Management Skills-II
14	Communication Skill	Communication Skills-II
15	Sanskrit	Sanskrit-II
16	German	German-II
17	French	French-II
18	Law	Law-II
19	Pharmaceutical Sciences	Pharmaceutical Sciences-II
20	Life skills	Life Skills-II
21	Economics	Economics-II
22	Political Science	Political Science-II
23	Sociology	Sociology-II
24	Psychology	Psychology-II
25	Philosophy	Philosophy-II
26	History	History-II
27	Public Admn	Public Admn -II
28	Buddhist Studies	Buddhist Studies-II
29	Gandhian Thought	Gandhian Thought-II
30	Dr. Ambedkar Thought	Dr. Ambedkar Thought-II
31	Rashtrasant Tukdoji Maharaj Thought	Rashtrasant Tukdoji Maharaj Thought-II
32	Travel & Tourism	Travel & Tourism-II
33	Personality Development	Personality Development-II
34	Cosmetic Technology	Cosmetic Technology-II
35	Hospitality Management	Hospitality Mgt. –II
36	Chemical	Chemical Engineering-II

	Engineering	
37	Chemical Technology	Chemical Technology-II
38	Civil Engineering	Civil Engineering-II
39	Electrical Engineering	Electrical Engineering-II
40	Mechanical Engineering	Mechanical Engineering-II
41	Electronics Engineering	Electronics Engineering-II
42	Pali Prakrit	Pali Prakrit-II

GENERAL INSTRUCTIONS FOR SEATING ARRANGEMENT

The name of the College Centre is already printed on the Admission Card of each candidate. However, it is notified for general information of the candidates that :-

The seating arrangement for the Centre will be notified separately seven days prior to the commencement of the written examination at the respective College / Centre. The candidates concerned will also be able to get the necessary information from that chart of seating arrangement sent to the concerned College by University.

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Sd/-
Director
Board Of Examination & Evaluation
Rashtrasant Tukadoji Maharaj
Nagpur University

Nagpur

Date: 18th September 2023

ShikshanPrasarakMandalKamptee's
Seth Kesarimal Porwal College of Arts and Science and Commerce, Kamptee
Email skpc.principal@gmail.com Visit us at www.skpckamptee.in
Principal Affiliated to RTM Nagpur University, Nagpur
Prof. Dr. Vinay Chavan NAAC Accredited with B++ Grade Ref. No. SKP/DC:

Date: 07 / 11 / 2023

Notice

Following Members are appointed on examination Committee for Winter / 2023 university theory / Practical examination of RTM Nagpur University for Sem. I, Sem. III, Sem. V to be conducted at college level.

Chairperson Dr. Vinay Chavan

Teachers Nominated by Principal

Theory Examination

1. Dr. S. C. Shirpurkar
2. Dr. N. P. Meshram
3. Dr. T. H. Multani

Practicals Examination

1. Dr. Mrs. J. S. Thaware

Examination Incharge

1. Dr. R. G. Chaudhary
2. Dr. Azhar Abrar

Non teaching staff nominated by Principal

1. Shri. R. R. Palewar

07/11/23

Principal
S.K.P. College Kamptee

S.K. PORWAL COLLEGE OF ARTS AND SCIENCE AND COMMERCE,KAMPTEE			
Science Faculty (U.G. Courses)			
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur			
Tentative Dates for Under Graduate Practical Examination Winter- 2023			
Subject	Class	Proposed dates	Name of the Internal Examiner
Physics	B.Sc. I (Semester-I)	5 Feb. 2024 to 6 Feb. 2024	Dr. (Ms) P. D. Bhoyar
Zoology	B.Sc. I (Semester-I)	5 Feb. 2024 to 6 Feb. 2024	Dr. (Mrs.) A. V. Ramteke
Microbiology	B.Sc. I (Semester-I)	5 Feb. 2024 to 6 Feb. 2024	Mr. S. V. Kombe
Biochemistry	B.Sc. I (Semester-I)	7 Feb.2024 to 8 Feb.2024	Dr. (Mrs.) S.J. Chahande
Botany	B.Sc. I (Semester-I)	7 Feb.2024 to 8 Feb.2024	Dr. (Mrs.) R.A. Jachak
Electronics	B.Sc. I (Semester-I)	7 Feb.2024 to 8 Feb.2024	Dr. R.K. Parate
Computer Science	B.Sc. I (Semester-I)	1 Feb.2024 to 3 Feb. 2024	Dr. K. M. Dhole
Chemistry	B.Sc. I (Semester-I)	31 January 2024 to 3 Feb. 2024	Dr. (Ms.) M.S. Nagmote

Principal 10/1/24
S.K.P. College Kamptee

NOTICE

All the internal examiners of practical exams of Winter- 23 of Semester I,III and Vth are hereby informed that they have to take the practical exams of backlog students (Winter-2023(Suppl.)) before 12th June 2024 at the college level, as per schedule. After taking the exam, internal examiner have to upload the marks on university portal. Answer sheets with attendance sheet having the sign of students, rough mark sheet Xerox and 2 hard copies of online mark sheet should be submitted to the Satish Sayam at an earliest.

The list and contact numbers of student are as follows;

Sr.No.	Name of Students	Subject	Contact number
B.Sc. Semester-V			
1	Diksha Dilip Meshram	Botany	9518936532
2	Chandani V. Zade	Physics, CS	9309958945
3	Rushikesh A. Hood	CS	7887577300
B.Sc. Semester-III			
1	Nikky N. Meshram	Chemistry	9119474489
2	Piyush P.Shamkuwar	Physics	8767927934
3	Amol S. Kezarkar	Chem., Physics	8446731208
4	Shailesh P.Girhe	Micro, Biochem.	9146847432
B.Sc. Semester-I			
1	Aastha Pohane	Physics	8261839255
2	Abdul Malik	Physics	8180825120
3	Anusha Paradhi	Physics, CS	7888186245
4	Ayushi Malviya	Chem, Bot, Zoo	7869800446
5	Dakshita Karihar	Physics, Chem.	9022512400
6	Furkan Taj	CS	7744932384
7	Khritij Gajbhiye	CS	8888755903
8	Mohammad A. Khan	Chem., Micro, Biochem	8010594638
9	Omkar Dawande	CS	8421265871
10	Payal Kamat	Chem, Zoo, Bot.	7666489105
11	Priyanshu Bagde	Physics, Chem.	9022752304
12	Saloni Wankhede	Physics, Chem.	8956669816
13	S.S. Srivastava	Bot, Zoo, Chem	9529840081
14	Vaishnavi Rao	CS	9922170429

(1)

Schedule for Practical exams Winter-2023(Suppl.) .

Sr.No.	Subject	Date	Internal examiner
1	Zoology Sem-I	13-6-2024	Dr Asha Ramteke
2	Microbiology Sem-III, Sem-V	13-6-2024	Mr S.V.Kombe
3	Physics Sem-I,III and V	13-6-2024	Dr(Mrs)P. D. Bhoyar
4	Chemistry Sem-III,V	14-6-2024	Dr (Ms)M. S. Nagmote
5	Computer Science	14-6-2024	Dr. K. M. Dhole
6	Botany Sem-I and V	15-6-2024	Dr (Mrs)R. A. Jachak
7	Electronics	15-6-2024	Dr R. K. Parate
8	Biochemistry Sem - III & V	15-6-2024	Dr. S. J. Chahande

(2)

03/06/24

S.K. PORWAL COLLEGE OF ARTS AND SCIENCE AND COMMERCE,KAMPTEE

Science Faculty (U.G. Courses)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Tentative Dates for Under Graduate Practical Examination Summer- 2024

Subject	Class	Proposed dates	Name of the Internal Examiner
Physics	B.Sc. II (Semester-IV)	24 and 25 June 2024	Dr. (Ms) P. D. Bhoyar
Zoology	B.Sc. II (Semester-IV)	24 and 25 June 2024	Dr. N.P. Meshram
Microbiology	B.Sc. II (Semester-IV)	24 and 25 June 2024	Mr. S. V. Kombe
Biochemistry	B.Sc. II (Semester-IV)	26 and 27 June 2024	Dr. (Mrs.) S.J. Chahande
Botany	B.Sc. II (Semester-IV)	26 and 27 June 2024	Dr. (Mrs.) R.A. Jachak
Electronics	B.Sc. II (Semester-IV)	26 and 27 June 2024	Dr. R.K. Parate
Computer Science	B.Sc. II (Semester-IV)	21 and 22 June 2024	Dr. K. M. Dhole
Chemistry	B.Sc. II (Semester-IV)	20 to 22 June 2024	Dr. S. Mondal

Dharwase

02/06/24

S.K. PORWAL COLLEGE OF ARTS AND SCIENCE AND COMMERCE,KAMPTEE

Science Faculty (U.G. Courses)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Tentative Dates for Under Graduate Practical Examination Summer- 2024

Subject	Class	Proposed dates	Name of the Internal Examiner
Physics	B.Sc. I (Semester-II)	21 and 22 June 2024	Dr. (Ms) P. D. Bhoyar
Zoology	B.Sc. I (Semester-II)	21 and 22 June 2024	Dr. (Mrs.) A. V. Ramteke
Microbiology	B.Sc. I (Semester-II)	21 and 22 June 2024	Mr. S. V. Kombe
Biochemistry	B.Sc. I (Semester-II)	24 and 25 June 2024	Dr. (Mrs.) S.J. Chahande
Botany	B.Sc. I (Semester-II)	24 and 25 June 2024	Dr. (Mrs.) R.A. Jachak
Electronics	B.Sc. I (Semester-II)	24 and 25 June 2024	Dr. R.K. Parate
Computer Science	B.Sc. I (Semester-II)	26 and 27 June 2024	Dr. K. M. Dhole
Chemistry	B.Sc. I (Semester-II)	26 to 28 June 2024	Dr. (Ms.) M.S. Nagmote

23/06/24