

# COURSE OUTCOMES FOR BSC BIOCHEMISTRY

## SEM I

### PAPER 1- BIOMOLECULES & HUMAN PHYSIOLOGY

**Course objectives:** To give students a generalized idea about the basic aspects of biomolecules and its involvement in human physiology. This course offers interlinking phenomenon of biomolecules and human physiology so that students can be able develop research ideas to solve physiological related problems. Students will aware about how a complex mechanism of physiology governs by various macromolecules. Course provides practical approach and knowledge about various physiological aspects and biomolecules present in the body.

**Learning outcomes:** On completion of the courses

- Students will be able to know about various biomolecules present in the nature and they will able to classify them into different categories.
- Students will know how complex biomolecules like carbohydrates and lipids have their symmetry, arrangement, stoichiometry and how they modulate themselves in order to get metabolized.
- Students will know that how different biomolecules can be determined with the help of various tests and what should be the concentration in the cell.
- Students will know how good and bad biomolecules can be classified and they can affect the biochemistry of the cell.
- Students will know how cell can maintain its balance and ultimately the complete homeostasis of the human beings.
- Students will know about the different macromolecules involved in the muscle contraction and how its molecular mechanism will govern the complete locomotion.
- Students will understand the basic principle of various ions required to maintain proper ionic concentration in and out of the cell.

- Students will be able to know the complete biochemistry involved in human physiology through the actions of biomolecules.

## **SEM I**

### **PAPER 1I- MICROBIOLOGY & VIROLOGY**

**Course objectives:** This paper will give a generalized idea about various microbiological aspects to students. This course will offer a complete knowledge on microbial history, microscopes, staining, microbial growth, microbial classification etc.

**Learning outcomes:** On completion of the courses

- Students will know about the history and development of microbiology.
- Students will know about the different types of microscopes.
- Students will know about the principle, structural arrangement and applications of various microscopes routinely used in the field of microbiology.
- Students will know the biochemistry of microorganisms in a very simplified way.
- Students will know that how various types of microorganisms can be identified and classified on the basis of temperature, gases and hydrogen ion concentration.
- Students will be aware about the progression of various viruses via lytic and lysogenic cycles.
- Students will know about the basic features of growth and development of various microorganisms.
- Students will know about the gram positive and gram negative microorganisms.

**Practicals:** Students will know about the qualitative analysis of proteins, lipids, carbohydrates etc. Protein estimation method, isolation of Bacteria on nutrient agar plate from water, air, skin, teeth samples etc., simple staining of Bacterial pure culture, Gram staining of bacterial pure culture. Etc.

## **SEM II**

### **PAPER I- HUMAN PHYSIOLOGY**

**Course objectives:** The objective of this course is to provide detailed knowledge to students about excretion, hematology, neurobiology, reproduction and endocrinology. This course offers complete mechanisms of action involved in the human physiology in order to maintain homeostasis of the body.

**Learning outcomes:** On completion of the courses

- Students will know about the mechanism of urine formation and how it maintains the acid and base concentration inside the body.
- Students will know about the various organs and hormones involved in the process of reproduction.
- Students will be aware about the various functions and components of blood and its coagulation with the involvement of many kinds of factors.
- Students will know about the neurons and its structure and function. In addition students will know that how different ions and their concentrations maintain the complete anatomy and the physiology of the brain.
- Endocrine glands perform various functions inside of the body. Students will know about the various endocrine glands and hormones secreted by them with specific functions.

## **SEM II**

### **PAPER II- MICROBIOLOGY & IMMUNOLOGY**

**Course objectives:** This course offers the complete information related to microbial control and immunology. Students will be able to correlate between the pathological role of microorganism and defense mechanism via various cells and organelles. Practicals provide laboratory approaches to understand the basic mechanisms of antigen, antibody and microbial pathology.

**Learning outcomes:** On completion of the course

- Students will know about the nutritional requirement and nutritional classification of microorganisms.
- Students will know about the chemical, physical and various chetherapeutic agents to control microbialgrowth.
- Students will know about the basic concepts of the immunology and its various terminologies.
- Students will know about the various types of antibodies and theirstructures.
- Students will be informed about the production of artificial monoclonal antibodies with their variousapplications.
- Students will be able to correlate microbiology with immunology through various practicals.

**Practicals:** Students will know about the measurement of blood pressure by sphygmomanometer, differential leucocyte count of blood, WBC count, Estimation of urine / serum creatinine, antibiotic sensitivity of bacterial pure culture, oligodynamic activity test of copper / metal, pregnancy test, ouchterlony immunodiffusion etc.

### **SEM III**

#### **PAPER I: MACROMOLECULES**

**Course objectives:** To offer students, knowledge about the macromolecules like protein and nucleic acids. This course provides a better understanding to students about the complex structures and functions of proteins and nucleic acids along with their complete cellular and biochemical aspects. This course allows students to develop research aptitudes required to link these macromolecules with other relevant topics orbranches.

**Learning outcomes:** On completion of the course

- Students will know about properties of proteins and various biochemical reactions involved in the determination of amino acidcomposition.

- Students will know about the primary, secondary, tertiary and quaternary structures of the proteins.
- Students will be able to understand the basics about the DNA and its various forms.
- Students will come to know about the various DNA sequencing techniques with principle, procedure and applications.

### **SEM III**

#### **PAPER II: BIOPHYSICAL TECHNIQUES I**

**Course objectives:** This course offers techniques required to understand biochemistry in different systems. Determination of macromolecules and other physiological molecules can be determined using these techniques. It allows students to measure and quantify different parameters. It provides strong base to students to enter in the field of research.

**Learning outcomes:** On completion of the course

- Students will know about the concepts, principle, working, detection system and applications of various spectrophotometers.
- Students will know about the mechanism of action of buffer and their various types and equations.
- Students will know about the concepts, principle, working, detection system and applications of various chromatography methods.
- Students will know about HPLC and their various applications.
- Students will know about estimations and identification of various biochemical reactions and macromolecules.

**Practicals:** Students will know about the quantitative estimation of amino acids using Ninhydrin reaction, estimation of DNA by diphenylamine reaction, estimation of RNA by orcinol reaction, determination of albumin and A / G ratio in serum the validity of Beer's law for colorimetric estimation of creatinine etc.

## **SEM IV**

### **PAPER I: ENZYMOLOGY**

**Course objectives:** The objective of this course is to have complete information about the fundamentals of enzymes. This course makes students familiar to basic concepts and mechanism of action through which various enzymes work. Course also provides knowledge about kinetics equations and derivations to the students. This course makes students more familiar to enzyme related research at industrial level.

**Learning outcomes:** On completion of the course

- Students will know about various terminologies used in enzymology and will familiar with various models required to explain enzyme substrate complex.
- Students will know about enzyme regulation and their types.
- Students will be able to understand the basic mechanisms underline the action of some specific enzymes like chymotrypsin and ribonuclease.
- Vitamins are required for the proper functioning of the enzymes. Hence students will know about various vitamins required as a precursor for enzymes.
- Students will come to know about different mathematical equations required to explain enzymes through graphs (Lineweaver-Burk plots) and what kind of inhibitors govern them.
- Students will be able to understand the purity and homogeneity of enzymes with their proper uses.

## **SEM IV**

### **PAPER II: BIOPHYSICAL & BIOCHEMICAL TECHNIQUES**

**Course objectives:** This course offers techniques like electrophoresis, centrifugation and isotopic tracer required to understand biochemistry in all kind of living cells. This course allows students to become familiar with isolation, identification and characterization of biochemical compounds. This course offers information about various immunological techniques required to link biochemistry and immunology. In addition, this course also offers knowledge about isotopic tracer techniques required to develop modern and upgraded research aptitude in students.

**Learning outcomes:** On completion of the course

- Students will be able to know about principle, procedure, uses and applications of various electrophoresis techniques.
- Students will know about the SDS PAGE electrophoresis; a most common technique routinely used in laboratories for the identification and determination of proteins.
- Students will know about the various immunological techniques like ELISA and RIA.
- Students will know about radioactive compounds and their uses to treat diseases.
- Students will come to know about the measurement of radioactivity through GM counters.
- Students will know about principle, procedure, uses and applications of various tracer techniques.
- Students will know about principle, procedure, uses and applications of various centrifuges commonly used in clinical and other laboratories.

**Practicals:** Students will know about the isolation of casein by isoelectric precipitation method, estimation of proteins by Folin-Lowry's method, fractionation of proteins by ammonium sulphate and determination of its purity by PAGE electrophoresis, SDS-PAGE of BSA & comparison of results with (PAGE) experiment etc.

## **SEM V**

### **PAPER I: METABOLISM I**

**Course objectives:** The main objective of this course is to offer complete and detailed knowledge about metabolic processes and mechanisms; through bioenergetics, metabolic techniques and glucose oxidation. This course gives an example of carbohydrate to explain metabolism to students at very basic and deep level with the complete physiology of mitochondria and electron transport chain. This course provides a strong research base to students to understand biochemistry in metabolic diseases through good and innovative practical approaches.

**Learning outcomes:** On completion of the course

- Students will know about the concepts of bioenergetics being the basic principle of all kind of metabolism.
- Students will have a detailed knowledge about the high energy compounds like ATP, GTP and creatine phosphate and the association of ATP and ADP cycle.
- Students will know about the principle, procedure, uses and applications of various metabolic techniques in different organisms and cells.
- Students will have detailed knowledge on glucose metabolism through glycolysis, PDH complex and TCA cycle.
- Students will have complete information related to glucose oxidation and its re-synthesis and the account of energy generation and utilization.
- Students will be able to correlate between interlinked metabolic cycles like malate and glycerophosphate shuttle system.
- Students will know about the complete physiology and mechanism of the electron transport chain required to synthesis energy in the form of ATP.

**SEM V**

**PAPER II: MOLECULAR BIOLOGY**

**Course objectives:** The main objective of this course is to provide a detailed knowledge to students regarding very basic concepts of molecular biology i.e replications and transcription in prokaryotes. This course makes the basic concepts clear to students so that they can apply this knowledge in molecular biology research and acquiring complete insights on the fundamentals of genetics. Relevant practicals suitable to topic make students more familiar with replication and transcription.

**Learning outcomes:** On completion of the course

- Students will know about the basic features of replications, semi conservative replications with experimental evidence and different models of replication.



- Students will have a complete knowledge about replication initiation, elongation and termination.
- Students will know about mechanism of action of DNA polymerases and different kinds of DNA damages and repairs.
- Students will know the basics about the process of transcription and the role of RNA.
- Students will know about the initiation, elongation and termination of transcription.
- Students will have detailed information about inhibitors of prokaryotic transcription: e.g. rifamycins, regulation of gene expression in prokaryotes: Lac Operon & Trp operon and reverse transcription.

**Practicals:** Students will know about the concentration of DNA & RNA by UV spectrophotometry, estimation of protein by Bradford method, UV spectrophotometric estimation of a given protein by E 280\260 method, colorimetric estimation of inorganic phosphate in serum by Fiske-Subbarow method, isolation of glycogen from liver source and its estimation by anthrone method, determination of true glucose by Glucometer/Glucose oxidase method, determination of glucose by Folin-Wu method.

## **SEM VI**

### **PAPER I: METABOLISM II**

**Course objectives:** This course provides a detailed knowledge about the metabolism of complex macromolecules like lipids, proteins and nucleic acids. Also, it gives a complete account on mechanism of their metabolism, energy generation and utilization. Along with this students aware about the metabolic disturbances, resulting in diseases. This course not only explains the involvement of Biochemistry in metabolism but also the various interlinked pathways. To train students in metabolic research is also the aim of this course. Relevant practicals mentioned in the course offer fundamental understanding about the topics.

**Learning outcomes:** On completion of the course

- Students will be able to know about triglycerides, Beta oxidation, HMP shunt and its connection with lipid metabolism.
- Students will know the concepts of ketogenesis, ketoacidosis and ketosis with pathology.

- Students will know about the biosynthesis of fatty acids, triglycerides and phospholipids.
- Students will be aware about the Urea cycle, transmethylation, decarboxylation and oxidative and non oxidative de-amination responsible for the protein metabolism.
- Students will know about the linkage between TCA cycle and the urea cycle, which will increase their understanding about the protein metabolism.
- As far as nucleic acid is concerned, students will know about biosynthesis of purines and pyrimidines through D Novo synthesis process.
- Students will have knowledge about gout disease and will know that how ribonucleotide converts into the deoxyribonucleotides.
- Students will know the role of cyclic AMP in the process of metabolism.
- Students will know that how the proteins and lipids which they intake via their food can be metabolized and how the protein can act as a source for the synthesis of nitrogenous bases like purines and pyrimidines.

## **SEM VI**

### **PAPER II: MOLECULAR BIOLOGY & rDNA TECHNOLOGY**

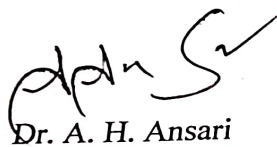
**Course objectives:** The main aim of this course is to offer a scientific technological approach towards the applications of molecular biology and rDNA technology in the field of biological sciences using fundamental principles of biochemistry. This course offers complete information about the genetic code, decoding system, the process of translation, restriction enzymes, vectors, cDNA and genomic DNA required to build a scientific temperament in students. This course fills the gap between the student knowledge and the industries demands. However, topic related practicals mentioned in the course allow students to know subject more scientifically.

**Learning outcomes:** On completion of the course

- Students will know about the features of the genetic code and wobble hypothesis.
- Students will be able to read and decode the genetic code.

- Students will know about the complete process of translation through its initiation, elongation and termination.
- Students will know about the types and use of restriction endonucleases, joining of DNA and types of vectors and their uses in rDNA technology.
- Students will have a complete knowledge about the principle, procedure and applications of PCR.
- Students will be able to know about the maintenance of gene libraries like cDNA and genomic.
- Students will know about the applications of rDNA in genomic research.

**Practicals:** Students will know about the estimation of serum urea by diacetyl monoxime method, assay of activity of SGOT & SGPT, assay of activity of serum acid & alkaline phosphatase, inhibition of alkaline phosphatase activity by EDT, assay of activity of papain, determination of serum phospholipids, determination of serum lipase, demonstration of isolation of genomic DNA etc.

  
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