Seth Kesarimal Porwal College of Arts & Science & Commerce, Kamptee

Department of Mathematics

B. Sc. Mathematics Programme Specific Outcomes

After the successful completion of this course, the student will:

- Be able to cultivate a mathematical attitude and nurture the interests.
- Be able to communicate to lay audiences and arouse their interest in the beauty and precision of mathematical arguments and science.
- Be able to explain the core ideas and techniques of mathematics at the college level.
- Be able to recognize the power of abstraction and generalization in mathematical work.
- Be able to carry out objective analysis and prediction of quantitative information with independent judgment.
- Be able to recognize the importance of Mathematics in the modern era.
- Be able to work independently and to collaborate effectively in team work.
- Be able to continuously enrich themselves through lifelong learning.

Mathematics Course Outcomes

Semester I M – 1 Algebra and Trigonometry

M – 2 Calculus

On completion of this course, successful students will be able to:

- Understand the concepts of Matrices and linear equations.
- Understand the relation between roots and coefficients of an equation.
- Understand De Moivre's theorem and its applications.
- Familiarize real and imaginary parts of a circular and hyperbolic functions of a complex variable.
- Analyze Group, subgroups, cosets and permutations.
- Analyze the limit and continuity of the function of one variable.
- Learn about differentiation, successive differentiation and Lebnitz's theorem.
- Expand a function using Taylor's and Maclaurin's series.
- Conceive the concepts of curvature and asymptotes and obtain their equations.
- Evaluate indeterminate forms by using L'Hospital's Rule.
- Learn about partial derivatives and its applications, Euler's theorem on homogeneous functions and Jacobians.
- Find integrations of irrational algebraic functions and use of reduction formulae.

Semester II M – 3 Geometry, Differential and Difference Equations

M – 4 Vector Calculus and Improper Integrals

On completion of this course, successful students will be able to:

- Learn about sphere, tangent line, tangent plane, right circular cone and right circular cylinder.
- Solve first order exact differential equation and obtain an integrating factor which may reduce a given differential equation into an exact one.
- Identify and obtain the solution of Bernoulli's differential equation and Clairaut's equation.
- Find the complementary function and particular integrals of linear differential equation.
- Solve Euler's equidimensional equation and solve the differential equation by using method of variation of parameters.
- Learn about difference equation and find the CF and PI of difference equations.
- Understand the concepts of vector differentiation, gradient, divergence and curl.
- Evaluate line integral and work done.
- Evaluate double integral for area and evaluation by change of order of integration.
- Evaluate triple integrals.
- Evaluate surface integrals and volume integrals.
- Analyze Green's theorem in a plane, Stoke's theorem and Gauss Divergence theorem.
- Learn about improper integrals and their convergence, comparison tests, Beta and Gamma functions.

Semester III M – 5 Advanced Calculus, Sequence and Series

M – 6 Differential Equations and Group Homomorphism

On completion of this course, successful students will be able to:

- Analyze mean value theorems, limit and continuity of function of two variables and Taylor's theorem for function of two variables.
- Learn about Envelopes, Maxima, Minima and Saddle points of functions of two variables and Lagrange's multiplier method.
- Understand the concepts of convergence of sequences.
- Analyze monotonic sequences, Cauchy's sequence and Cauchy's convergence criterion.
- Determine convergence of series of non – negative terms using different tests.
- Learn about alternating series and absolute and conditional convergence of series.
- Analyze Bessel's and Legendre's functions and their properties.
- Understand Laplace transforms and its properties.

- ❖ Evaluate Laplace transform of derivatives and integrals.
- ❖ Solve differential equation using the Laplace transform technique.
- ❖ Analyze Fourier transform, Sine and Cosine transforms.
- ❖ Learn the concept of Normal subgroup, Quotient subgroup, Cyclic group, Group Homomorphism and Isomorphism.

Semester IV M – 7 Partial Differential Equations and Calculus of Variation

M – 8 Mechanics

On completion of this course, successful students will be able to:

- ❖ Solve simultaneous differential equations of the first order and the first degree in three variables.
- ❖ Learn about Pfaffian differential equation in three variables and first order partial differential equation.
- ❖ Use Lagrange's method for solving the first order linear partial differential equation.
- ❖ Use of Charpit's method and Jacobi's method for solving partial differential equation.
- ❖ Determine the solution of partial differential equation of second and higher order with constant coefficients.
- ❖ Familiarize the concepts of Functional and Euler's differential equation and applications.
- ❖ Analyze analytical conditions of equilibrium of coplanar forces, virtual work and catenary.
- ❖ Analyze velocities and accelerations along radial and transverse directions, and along tangential and normal directions and simple harmonic motion.
- ❖ Learn about Constraints, D'Alembert's principle, Lagrange's equations of motion and Lagrangian.
- ❖ Analyze reduction to the equivalent one body problem, Virial theorem and Central orbits.

Semester V M – 9 Analysis

M – 10 Metric Space, Complex Integration and Algebra

On completion of this course, successful students will be able to:

- ❖ Define and analyze Fourier series.
- ❖ Learn about Riemann – Stieltjes integral and its properties.
- ❖ Conceive the concepts of analytic functions, Cauchy – Riemann equations and harmonic functions.
- ❖ Analyze Mobius transformation, fixed points and conformal mapping.

- Understand the concepts of Countable and Uncountable sets, Metric spaces, and Open and Closed sets.
- Understand the theory of Completeness, Compactness and Connectedness.
- Analyze the concepts of Rings, Integral Domains, Ideals, Fields and Quotient Ring.
- Understand the theory and techniques of complex integration.
- Analyze Cauchy's integral theorem and formula, singularity and residue theorem.

Semester VI M – 11 Abstract Algebra

M – 12 Special Theory of Relativity

On completion of this course, successful students will be able to:

- Analyze the concepts of Group Automorphisms, Inner Automorphisms and Normalizer.
- Understand the concepts of Vector Spaces and subspaces over a field and their properties including the basis structure of vector spaces.
- Conceive the concepts of linear transformations including range, rank, kernel, nullity and inverse.
- Learn about matrices of linear maps, inner product space and Gram – Schmidt orthogonalisation process.
- Analyze Newtonian relativity, Galilean transformations and Michelson – Morley experiment.
- Learn about Lorentz transformations, its geometrical interpretation and Group properties.
- Understand the concepts of event, particle, simultaneity, length contraction and time dilation.
- Learn about transformation of particle velocities, transformation of acceleration and transformation of Lorentz contraction factor.
- Understand the concepts of Tensors, Riemannian metric, Minkowski space, four vectors and four tensors.
- Analyze equivalence of mass and energy, transformation formula for mass, and transformation formula for momentum and energy.
- Understand the concepts of four velocity, four acceleration, the energy momentum tensor, Maxwell's equations of electromagnetic theory in vacuum, and four potential.