UG SEMESTER- I
(For students with Mathematics as a minor subject)

Applicable Mathematics– I

Credit: 4 T:04

Course Outcomes:

1. To compute the rank of a matrix and its applications in finding solutions of system of equations, computing Eigen values and Eigen vectors and their applications.
2. To Know the concepts of calculus, namely, limits, continuity, differentiability of functions and their applications in the form of mean value theorem and Taylor's theorem.
3. To understand the concept of double and triple integration and their applications in finding length surfaces and volumes etc.
4. To understand the concepts of vector calculus.

UNIT I

Types of matrices, elementary operations on matrices, rank of a matrix, echelon and normal forms of a matrix, inverse of a matrix by elementary operations, systems of linear homogeneous and non - homogeneous equations, consistency of linear system of equations, eigenvalues, eigenvectors and characteristic equation of a square matrix, Cayley - Hamilton theorem and its application in finding the inverse of a matrix.

UNIT II

Limit, continuity and differentiability of functions of single variable, successive differentiation, Leibnitz's theorem, Rolle's theorem, Lagrange's and Cauchy's mean value theorems, Taylor's and Maclaurins's series with various forms of remainders.

UNIT III

Limit, continuity and differentiability of functions of two variables, partial derivatives, Euler's theorem for homogeneous functions, total derivative, Taylor's and Maclaurins's theorem for functions of two variables, extrema of functions of two variables, Lagrange's method of unknown multipliers, Jacobian.

UNIT IV

Double and triple integration, change of order of integration, application of integration to length, surface and volumes (only Cartesian coordinates), beta, gamma and Dirichlet's integral – basic properties with applications, vector differentiation, gradient,

divergence and curl with their physical interpretations, tangent and normal on a surface, directional derivative, line, surface and volume integrals, applications of Green's, Stoke's and Gauss' divergence theorems (without proofs).

References:

Textbooks

1. Linear Algebra by K. Hoffman and R. Kunze.

2. Calculus, Volumes I & II by T. M. Apostol.

3. Mathematical Analysis by S.C. Malik and S. Arora, New Age International Limited, New Delhi.

Suggested Books

1. R. R. Goldberg : Methods of Real Analysis, Oxford & IBH Pub. Co. Pvt. Ltd.

2. R. G. Bartle, The Elements of Real Analysis, Wiley International Edition.

UG SEMESTER- II
(For students with Mathematics as a minor subject)

Applicable Mathematics– II

Credit: 4 T:04

Course Outcomes:

1. To understand the concepts of groups, subgroups, cyclic groups, quotient groups and homomorphism of groups.
2. To Know the concepts of rings, subrings, ideals, quotient rings and homomorphism of rings.
3. To know the concept of vector spaces, its basis and dimension, quotient space and linear transformations.
4. To learn sequences and various tests to check convergence of an infinite series.

UNIT I

Equivalence relations and partitions, congruence modulo n, groups, subgroups, cyclic groups, coset decomposition, Lagrange's theorem, Fermat's & Euler's theorems, normal subgroups, quotient groups, homomorphism and homomorphism theorems.

UNIT II

Rings, types of rings - commutative rings, rings with unity, division rings, integral domains and fields, subrings, ideals and quotient rings, ring homomorphism and homomorphism theorems, characteristic of a ring, Polynomial rings.

UNIT III

Vector spaces, subspaces, linear independence and dependence, basis and dimension, quotient space, linear transformations and their representation as matrices, rank - nullity theorem.

UNIT IV

Sequences, limit of a sequence, convergence, divergence and oscillation of a sequence, infinite series and its convergence, geometric and harmonic series, tests for convergence and divergence - comparison test, Cauchy integral test, D'alembert's ratio test, Cauchy's nth root test, Raabe's logarithmic test, DeMorgan and Bertrand's test, alternating series, absolute and conditional convergence, Leibnitz's theorem (without proof).

References:

Textbooks

1. V. Sahai & V. Bist : Algebra, Narosa.
2. J.A. Gallian : Contemporary Abstract Algebra, Narosa.
3. R.G. Bartle : Introduction to Real Analysis, Wiley.

Suggested books

1. J.B. Fraleigh : A First course in Abstract Algebra, Pearson.
2. D.S. Dummit & R.M. Foote : Abstract Algebra, Wiley International edition.

UG SEMESTER- III
(For students with Mathematics as a minor subject)

Applicable Mathematics– III

Credit: 4 T:04

Course Outcomes:

1. To know the basic concepts of complex analysis including Cauchy's integral formula, derivative of analytic functions, Taylor's and Laurent's series.
2. To understand various methods for numerical solutions of equations.
3. To know how to do numerical differentiation and integration.
4. To solve systems of linear equations by standard methods.

UNIT I

Functions of complex variables - analytic functions, Cauchy - Riemann equations, harmonic functions, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, formulae for first, second and nth derivatives, Taylor's and Laurent's series, singularities, zeroes and poles of order n.

UNIT II

Numerical solutions of equations - bisection method, secant method, regula -falsi method, Newton - Raphson method and interpolation with equispaced points.

UNIT III

Finite differences, Newton's forward and backward interpolation formula, Lagrange interpolation formula, divided differences and Newton's formula, numerical differentiations and integration - trapezoidal and Simpson's rules, Newton-Cotes integration formula, Ramberg integration, Gaussian quadrature.

UNIT IV

Systems of linear equations - Gauss elimination method, Gauss-Jordan method, LU decomposition, Jacobi method, Gauss - Seidel method, the algebraic eigenvalue problem - Jacobi's method and power method.

References:

Textbooks

1. J.W. Brown and R.V. Churchill : Complex Variables and Applications, Mc Graw Hill.

2. M.K. Jain, S.R.K. Iyengar and R.K. Jain : Numerical methods for scientific and engineering computations, New Age International, New Delhi.

Suggested Books:

1. S.S. Sastry : Introductory Methods of Numerical Analysis, Prentice Hall of India.
2. Complex Variables, Schaum's Outline Series

UG SEMESTER- IV
(For students with Mathematics as a minor subject)

Applicable Mathematics– IV

Credit: 4 T:04

Course Outcomes:

1. To understand application and techniques of solving various types of ordinary differential equations.
2. To understand the Laplace transforms and its applications in solving differential equations.
3. To understand Fourier series and Fourier transforms.
4. To understand standard techniques for finding numerical solution of ordinary differential equations.

UNIT I

Ordinary differential equations - Bernoulli's equation, exact differential equations and integrating factors, special integrating factors and transformations, differential equations of order one and degree more than one, Clairaut's equation, singular solutions and orthogonal trajectories, Linear differential equations with constant coefficients, homogeneous Linear differential equations, series solutions of Legendre's, Bessel's and hypergeometric equations and their basic properties.

UNIT II

Laplace transforms - existence theorem, Laplace transforms of derivatives and integrals, inverse Laplace transform, convolution theorem, applications to simple linear differential equations.

UNIT III

Periodic functions, Fourier series, Fourier expansion of piecewise monotonic functions, half and full range expansions, Fourier transforms (finite and infinite), Fourier integral.

UNIT IV

Numerical solution of ordinary differential equations - Taylor series method, Euler's method, Runge - Kutta method, Milne's method, Adam's method.

References:

Textbooks

1. G. F. Simmons : Differential Equations with Applications and Historical Notes, Tata McGraw Hill.

2. M.K. Jain, S.R.K. Iyengar and R.K. Jain : Numerical methods for scientific and engineering computations, New Age International, New Delhi.

3. T. M. Apostol : Mathematical Analysis.