B.Sc. Sem-III

DSC-3

Paper-I (Partial Differential Equations & Calculus of Variations)

Unit I

Origin of first order partial differential equation, formation of partial differential equations by eliminating arbitrary function and arbitrary constants. Lagrange's linear equation of order one, Integral surface passing through given curve, Nonlinear partial differential equation of order one, Charpit's method, special types of nonlinear partial differential equations, Jacobi's method.

Unit II

Linear partial differential equation of second order with constant coefficients, solution of homogeneous and non-homogeneous linear partial differential equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.

Unit III

Partial differential equation of order two with variable coefficients, Classification of second order partial differential equations, characteristics of equations, Reduction to canonical form.

Unit IV

Functional, Continuity of functional, Linear functional, Extremum of a functional, Euler's differential equation and applications, Invariance of Euler's equations.

Text Books:

1. Elements of Partial Differential Equations,I.N. Sneddon, McGraw- Hill Book Company, 1986
2. Lectures on Partial Differential Eqations, T. M. Karade: SonuNilu, Einstein Foundation International
3.Mathematics, B.Sc. Sem III, V.M.Soni, R.K.Agrawal, N.T.Katre, R.T.Katre, N. L. Khobragade, Himalaya Publishing House, Nagpur.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Willey and Son's,Inc.,1999.
2. Differential Equations with Applications & Historical Notes (Second Editions), G. F. Simmons: McGraw-Hill,1991.
3. Theory and Problems of Differential Equations, Frank Ayres, McGraw-Hill Book Co., 1998.
4. Mathematics for Degree Students (B.Sc. Second year), Dr. P. K.Mittal, S.Chand and Co. Ltd.
5. Calculus of Variations with Applications, A. S. Gupta, Prentice Hall of India Pvt. Ltd., 1997.
6. Ordinary and partial differential equations, M. D. Raisinghania,S.Chand and Company Ltd.

List of Practicals:

1) Determination of integral curves of PDE
2) Determination of integral surface passing through a given curve
3) Determination of the solution of linear partial differential equation with constant coefficients
4) Determination of the solution of partial differential equation with variable coefficients
5) Determination of characteristics of partial differential equation
6) Determination of curve at which the functional is extremum
7) Determination of shortest distance between two points in a plane
8) Determination of shape of closed curve of given perimeter enclosing maximum area.

Paper-II (Modern Algebra)

Unit I

Definition of a group, examples and properties of a group, Subgroups, Counting principle

Unit II

Normal subgroup, Quotient group, Homomorphism, Permutation groups, Even and odd permutations.

Unit III

Ring Theory: Definition and examples of rings, Some special classes of ring, Subring, Homomorphism, Ideal and quotient rings.

Unit IV

Integral domain, Fields, Euclidean rings, polynomial rings

Text Books:

1. Topics in Algebra, I. N. Herstein, Wiley Eastern Ltd., New Delhi, 1975
2.Mathematics, B.Sc. Sem III,V.M.Soni, R.K.Agrawal, N.T.Katre, R.T.Katre, N. L. Khobragade, Himalaya Publishing House, Nagpur.
3. Lectures on Algebra, T. M. Karade: SonuNilu, Einstein Foundation International

Reference Books:

1. Higher Algebra, H. S. Hall and S. R. Knight, S.Chand& Co. Ltd.,New Delhi,2008.
2. Basic Abstract Algebra (2nd Edition), P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Cambridge University Press, India Edition, 1997.

List of Practicals:

1) Determination of order of an element and order of a group
2) Determination of index of a subgroup of a group

3)Determination of normal subgroup of a group
4) Determination of even and odd permutation
5) Determination of inverse of a permutation
6) Determination of zero divisor and integral domain
7) Determination of characteristic of a ring.
8) Determination of kernel of homomorphism of a ring.

VSEC (2 Credits)
(For Maths Major subject)
Course Title: Basic Mathematics for Physics

Vector Algebra: Vectors, addition of vectors, unit vector, position vector, product of two vectors, scalar or dot product, workdone, vector product or cross product, area of parallelogram, moment of a force, angular velocity, scalar triple product, vector product of three vectors.

List of Practicals:

1) Determination of modulus and unit vector of a given vector
2) Determination of position vector of centroid of a triangle
3) Determination of projection of a vector on another vector and angle between the vectors
4) Determination of workdone by the forces
5) Determination of vector product of two vectors
6) Determination of area of parallelogram
7) Determination of moment of force
8) Determination of angular velocity
9) Determination of scalar triple product and volume of parallelopiped
10) Determination of vector product of three vectors

Reference Book:

Advanced Engineering Mathematics, H.K Dass,S. Chand &Co.Ltd., New Delhi.

SEC (2 Credits)

(For Maths Minor subject)

Course Title: Introduction to Finite Differences and Interpolation

Calculus of finite differences: Introduction, basic properties,difference operators delta and E**,** relations between delta and E operators and their properties, higher order differences,

construction of difference table, Factorial polynomials, representation of polynomials in the factorial notation. Interpolation: Interpolation and extrapolation with equal and unequal intervals, Newton's interpolation formula.

References :

1. S. S. Sastri, Introductory methods of Numerical Analysis, EEE
2. B.S.Goel and S.K. Mittal, Numerical Analysis, Pragati Prakashan, Meerut.
3. Bhupendra Singh,Numerical Analysis, Pragati Prakashan, Meerut.

List of Practicals:

1) Determination of differences of functions.
2) Representations of any polynomial in factorial notation
3) Determination of missing terms.
4) Interpolation of function for equal interval
5) Interpolation of the function for unequal interval.
6) Extrapolating the function for equal interval of arguments.

B.Sc. Sem-IV

DSC-4

Paper-I (Real Analysis)

Unit I:

Bounded sets, completeness, Archimedean property of R, absolute value of real number, Neighborhood, Interior points, Open set, Limit points, closed sets, closure, Bolzano Weierstrass theorem.

Unit II

Sequences: Definition and examples, Bounded and Monotonic sequences, limit of a sequence, Convergent, divergent and oscillatory sequences, theorems and problems, Cauchy's sequence – examples and theorems on Cauchy sequences, limit superior and limit inferior of sequences.

Unit III

Infinite Series: Series of non-negative terms, Geometric series, p-test, Comparison test, D-Alembert's Ratio test, Cauchy's Root test, Cauchy's integral test, Alternating series, Leibnitz test. Absolute and Conditional convergence of series.

Unit IV

Riemann integration: Riemann integral, criterion for integrability, Properties of integrable functions, certain classes of integrable function. The Fundamental theorem of calculus. Mean value theorem.

Text Books:

1. An Introduction to Real Analysis, P.K. Jain & Kaushik, S. Chand &Co.Ltd., New Delhi,2000.
2.Mathematics, B.Sc. Sem IV, V.M.Soni, R.K.Agrawal, N.T.Katre, R.T.Katre, N. L. Khobragade, Himalaya Publishing House, Nagpur.
3. Lectures on Analysis, T. M. Karade: SonuNilu, Einstein Foundation International

Reference Books:

1. Mathematical Analysis, I.M. Apostol Narosa, Publishing House, New Delhi,1985.
2. A First Course in Mathematical Analysis, D. SomasundaranAnd B. Choudhary, Narosa Publishing House, New Delhi,1977.
3. Principles of Mathematical Analysis (Third Edition), Walter Rudin, McGraw-Hill International Edition,1976.

List of Practicals

1) Determination of supremum and infimum of a set
2) Determination of neighborhood of a point
3) Determination of interior point and interior of a set
4) Determination of limit point and closure of a set
5) Examination of convergence of sequence
6) Examination of convergence of series
7) Determination of absolute convergence of series
8) Determination of integrability of function

Paper-II (Mathematical Methods)

Unit I

Power series solution: Introduction, a review of power series, series solution of first order equations, second order linear equations, ordinary point, singular point, regular singular point, irregular singular point, Legendre's and Bessel's equations.

Unit II

Special functions: Legendre's and Bessel's functions with their properties, generating functions, recurrence relations, orthogonality of functions.

Unit III

Laplace transform: Definition of Laplace transform, Laplace transform of some elementary functions, properties of Laplace transform, Laplace transform of derivatives and integrals, Laplace transform of t.f(t), Laplace transform of f(t)/t, Inverse Laplace transform, properties of inverse Laplace transform, convolution theorem.

Solutions of ordinary differential equations with constant coefficients, solutions of simultaneous ordinary differential equations.

Unit IV

Fourier series: Definition and examples. Convergence of Fourier series, Fourier series of even & odd functions, Half Range Fourier Sine and Cosine series. Extension to arbitrary intervals.

Text Books:

1. Differential Equations with Applications & Historical Notes (Second Editions), G. F. Simmons: McGraw-Hill,1991.
2. Advanced Engineering Mathematics, H.K. Das, S. Chand & Co. 2009
3. Mathematics, B.Sc. Sem IV, V.M.Soni, R.K.Agrawal, N.T.Katre, R.T.Katre, N. L. Khobragade, Himalaya Publishing House, Nagpur.

Reference Books:

1. Laplace and Fourier Transforms, Goel & Gupta, Pragati Prakashan, Meerut, 2001.
2. Laplace transform, Murray R. Spiegel, Schaum series, Mc-Graw Hill.

List of Practicals:

1) Determination of power series solution of first order differential equations
2) Determination of ordinary point, singular point, regular singular point
3) Determination of Legendre's polynomial
4) Determination of Laplace transform of a function
5) Evaluation of integrals using LT method
6) Determination of inverse Laplace transform of a function
7) Finding the solution of ODE with constant coefficient using Laplace transform
8) Determination of Fourier series of a function.

VSEC (2 Credits)

(For Maths Major subject)

Course Title: Applied Mathematics for Physics

Applications of Differential Equations: Electrical circuits problems, Mechanical problems, Elastic string, Simple Harmonic motion, Simple pendulum, Oscillation of a string, Vibrating string, Wave equation, one dimensional heat flow.

List of Practicals

1) Determination of current flowing through the given circuit

2) Determination of displacement and velocity of body falling from rest
3) Determination of displacement of simple pendulum
4) Determination of time period of oscillation for simple pendulum
5) Determination of equation of vibrating string
6) Determination of displacement of vibrating string
7) Determination of temperature distribution in the rod

Reference Book:

1) Mathematical Physics, H.K Dass,Dr. Rama Verma, S. Chand &Co.Ltd., New Delhi.
2) Advanced Engineering Mathematics, H.K Dass,S. Chand &Co.Ltd., New Delhi.

SEC (2 Credits)

(For Maths Minor subject)

Course Title: Introduction to Numerical Methods

Solution of Algebraic and Transcendental equations: Newton-Raphson method, Regula- falsi method.

Solution of system of linear equations: Gauss-elimination method,Gauss-seidel method.

Solution of ordinary differential equations: Picard method, Eulers method, Runge-Kutta method.

References :

1. S. S. Sastri, Introductory methods of Numerical Analysis, EEE
2. H. K. Dass, Advanced Engineering Mathematics, S. Chand, New Delhi.
3. B.S.Goel and S.K. Mittal, Numerical Analysis, Pragati Prakashan, Meerut.
4. Bhupendra Singh,Numerical Analysis, Pragati Prakashan, Meerut.

List of Practicals:

1) Determination of solution of algebraic and transcendental equation using Newton-Raphson method
2) Determination of solution of algebraic and transcendental equation using Regula- falsi method
3) Determination of solution of system of linear equations using Gauss-elimination method
4) Determination of solution of system of linear equations using Gauss-seidel method
5) Determination of solution of ordinary differential equations using Picard method
6) Determination of solution of ordinary differential equations using Eulers method
7) Determination of solution of ordinary differential equations using Runge-Kutta method.