M.Sc. Sem-III

DSC 9 (Functional Analysis)

Unit I:

Normed spaces, Banach spaces, Further properties of normed spaces, Finite dimensional normed spaces and subspaces, Compactness and finite dimension, Bounded and continuous linear operators.

Unit II:

Linear functional, Normed spaces of operators, Dual spaces. Inner product space, Hilbert space, Further properties of inner product spaces, Orthogonal complements and direct sums, Orthonormal sets and sequences, Total orthonormal sets and sequences.

Unit III:

Representation of functionals on Hilbert spaces. Hilbert adjoint operators, self-adjoint, unitary and normal operators. Hahn-Banach Theorem, Hahn-Banach Theorem for complex vector spaces and normed spaces. Reflexive spaces.

Unit IV:

Category theorem, Uniform boundedness theorem, strong and weak convergence,Convergence of sequences of operators and functional, Open mapping theorem, closed linear operators and closed graph theorem.

Text Book:

Introductory Functional Analysis with Applications by E. Kreyszig, John Wiley and Sons.

Reference Books:

1. Introduction to Functional Analysis by A.E. Taylor and D.C. Lay, John Wiley and Sons.
2. Introduction to Topology and Modern Analysis: G.F. Simmons, Mc Graw Hill

DSC 10 (Complex Analysis)

Unit I:

Impossibility of ordering Complex numbers. Extended complex plane andstereographic projection. Elementary properties and examples of analytic Functions: Power series, analytic functions.

Unit II:

Analytic functions as mappings, Mobius transformations. Power series representation of analytic functions, zeros of an analytic function, index of aclosed curve.

Unit III:

Cauchy's theorem and integral formula, the homotopic version of cauchy's theorem and simple connectivity, counting zeros; the open mapping theorem, Goursat's theorem, Classification of singularities, residues, the argument principle.

Unit IV:

The maximum principle, Schwarz's lemma, convex functions and Hadamards three circles theorem, Phragmen-Lindel of theorem.

Text Book:

Functions of one complex variable: John B. Conway, Second edition, Springerinternational Student Edition.

Reference Book:

Complex Analysis, L.V. Ahlfors. Mc-Graw Hill, 1966.

DSC 11 (Advanced Mathematical Methods)

Unit I:

Fourier integral theorem. Fourier transform. Fourier cosine and sine transform. The convolution integral. Multiple Fourier transform. Solution of partial differential equation by means of Fourier transform.

Unit II:

Calculations of the Laplace transform of some elementary functions. Laplace transforms of derivatives. The convolution of two functions. Inverse formula for the Laplace transform. Solutions of ordinary differential equations by Laplace transform.

Unit III:

Finite Fourier transform. Finite Sturm-Liouville transforms. Generalized finite Fourier transform.

Unit IV:

Finite Hankel transform. Finite Legendre transform. Finite Mellin transform.

Text Book:

The use of integral transforms: I N. Sneddon, Tata Mc Graw Hill PublishingCompany Ltd.

ReferenceBooks:

Modern Mathematics For Engineers: Edwin F Beckenbach, Second series, Mc Graw Hill Book Company.

DSC 12 –Practical

(Functional Analysis, Complex Analysis and Advanced Mathematical Methods)

List of Practical

1) Determination of Radius of Convergence of Power Series.
2) Examination of Harmonic Functions.
3) Evaluation of Integrals using Cauchy Integral Formula.
4) Determination of Singularities and Residues of Complex valued functions.
5) Finding the solution of PDE using Fourier transform.
6) Finding the solution of ODE using Laplace transform.
7) Determination of finite sine, cosine transform of functions.
8) Finding the solution of PDE using finite sine, cosine transform.

9) Determination of Optimum Solution of LPP using Simplex Method and Big-M Method.
10) Transportation and Assignment Problems.
11) Determination of Optimum Solution of LPP using Revised Simplex Method.
12) Determination of Optimum Solution by Integer Programming.

DSE 3 (Operations Research-I)

Unit I:

Operations Research: Origin, definition and scope. Linear Programming: Formulation and solution of linear programming problems by graphical and simplex methods, Big - M and two-phase methods, Degeneracy, Duality in linear programming.

Unit II:

Transportation Problems: Basic feasible solutions, Optimum solution by stepping stone andmodified distribution methods, Unbalanced and degenerate problems, Transhipment problem.Assignment problems: Hungarian method, Unbalanced problem, Case of maximization, Travelling salesman and crew assignment problems.

Unit III:

Revisedsimplexmethod(withandwithoutartificialvariables).PostOptimalityAnalysis:changesin (i) objective function, (ii) requirement vector, (iii) coefficient matrix; Addition and deletion of variables, Addition of constraints.

Unit IV:

IntegerProgramming:Gomory'scuttingplanealgorithm(Allintegerandmixedintegeralgorithms),Branchand Boundmethod.

Text book:
Operations Research: Kanti Swarup P.K. Gupta and Man Mohan: Sultan Chand and Sons New Delhi.

Reference Books:

1. H. A. Taha, Operations Research – An Introduction, Prentice-Hall, 1997.
2. J. K. Sharma, Operations Research: Theory and Applications, Macmillan, 1997
3. S. D. Sharma, H. Sharma, Operations Research: Theory, Methods and Applications, Kedar Nath Ram Nath, 1972
4. S. S. Rao, Optimization-Theory and Applications, Wiley Eastern Ltd., 1977.
5. F. S. Hillier, G. J. Lieberman, Introduction to Operations Research, McGraw-Hill, 2001
6. M. S. Bazaraa, H. D. Sherali, C. M. Shetty, Nonlinear Programming-Theory and Algorithms, Wiley-Interscience, 2006

7. A. K. Bhunia and L. Sahoo, Advanced Operations Research, Asian Books Private Limited, New Delhi, 2011.
8. M. Aokie, Introduction to Optimization Techniques: Fundamentals and Applications of Nonlinear Programming, The Macmillan Company, 1971.

M.Sc. Sem-IV

DSC 13 (Partial Differential Equations)

Unit I: Introduction of first order linear and non-linear Partial Differential Equations, Pfaffian differential equations, Criteria of Integrability of a Pfaffian differential equation. Compatible systems of first order partial differential equations. Second order Partial Differential Equations, Classification of second order partial differential equation, Reduction of equation to canonical (Normal) form.

Unit II: One dimensional wave equation: Vibration of an infinite string (both ends are not fixed), Physical Meaning of the solution of the wave equation. Vibration of a semi-infinite string, Vibration of a string of finite length (Method of separation of variables), Uniqueness of solution of wave equation.

Unit III: Laplace's equation, Boundary Value Problems, Maximum and minimum principles, The Cauchy problem, Dirichlet's problem and Neumann problem for a upper half plane, Dirichlet's problem and Neumann problem for a circle, Dirichlet Problem for a rectangle, Harnack's theorem.

Unit IV: Heat conduction Problem: Heat conduction with finite and infinite rod, Duhamel's Principle, Wave equation, Heat conduction equation, Classification in the case of n –variables, Families of equipotential surfaces, Kelvin's inversion theorem.

Text Book:

1. T. Amarnath: An elementary course in Partial differential equations, 2nd edition, Narosa publishing House (2012).

Reference Books:

1. Mark Pinsky: Partial differential equations and boundary-value problems with applications, AMS,3rd edition (2011).
2. I. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Int.
3. Fritz John: Partial Differential Equations, Springer(1952).

DSC 14 (Advanced Numerical Methods)

Unit I:

Simple enclosure methods, Secant method, Newton's method, general theory for one point iteration methods. Aitken extrapolation for linearly convergent sequences, Error tests, Numerical evaluation of multiple roots, roots of polynomials, Mullers method, Non-linear systems of equations, Newton's method for non- linear systems.

Unit II:

Polynomial interpolation theory, Newton's divided differences, finite difference and table-oriented interpolation formulas. Forward-differences. Hermite interpolation.

Unit III:

The Weierstrass theorem and Taylor's theorem. The minimax approximation problem, the least square approximation problem, orthogonal polynomial, economisation of Taylor series, minimax approximation.

Unit IV:

The trapezoidal rule and Simpson's rule, Newton- Cotes integration formulas.

Text book:

An Introduction to Numerical Analysis by K. E. Atkinson, Johan Wiley and sons, Inc.

DSC 15 (Fluid Dynamics)

Unit I:

Real fluids and ideal fluids. Velocity of a fluid at a point. Stream lines and path lines. Steady and unsteady flows. Velocity potential. Velocity vector. Local and particle rate of change. Equation of continuity. Acceleration of a fluid. Condition at a rigid boundary. General analysis of fluid motion. Euler's equation of motion. Bernoulli's equation. Worked examples. Discussion of the case of steady motion under conservative body forces. Some further aspects of vortex motion.

Unit II:

Sources, sinks and doublets. Images in a rigid infinite plane. Images in solid spheres. Axisymmetric flows. Stokes' stream function. The complex potential for two dimensional irrotational, incompressible flow. Complex velocity potential for standard two-dimensional flow. Uniform stream. Line source and line sink. Line doublets. Line vortices. Two-dimensional image systems. The Milne-Thomson circle theorem. Circle Theorem. Some applications of circle theorem. Extension of circle theorem. The theorem of Blasius.

Unit III:

The equations of state of a substance, the first law of thermodynamics, internal energy of a gas, functions of state, entropy, Maxwell's thermodynamic relation, Isothermal Adiabatic and Isentropic processes. Compressibility effects in real fluids, the elements of wave motion. One

dimensional wave equation, wave equation in two and three dimensions, spherical waves, progressive and stationary waves.

Unit IV:

The speed of sound in a gas, equation of motion of a gas. Sonic, subsonic, supersonic flows; isentropic gas flow. Reservoir discharge through a channel of varying section, investigation of maximum mass flow through a nozzle, shock waves, formation of shock waves, elementary analysis of normal shock waves.

Text Book:

F. Chorlton, Text book of Fluid Dynamics, CBS Publishers, Delhi 1985.

Reference Books:

1. G.K. Batchelor, An Introduction to fluid Mechanics, Foundation Books, New Delhi 1994.
2. M.D. Raisinghania, fluid Mechanics, S. Chand and Company, Delhi

DSE 4 (Operations Research-II)

Unit I:

Concepts of stochastic processes, Poisson process, Birth-death process, Queuing models: Basic components ofa queuingsystem,Steady-statesolutionofMarkovianqueuingmodelswithsingleand multiple servers (M/M/1. M/M/C, M/M/1/k, M/MC/k).

Unit II:

Inventorycontrolmodels:Economicorderquantity(EOQ)modelwithuniformdemand,EOQwhenshortages are allowed, EOQ with uniform replenishment, Inventory control with price breaks.

Unit III:

CPM and PERT: Network Representation, Critical Path (CPM) computations, Construction of Time Schedule, Linear Programming Formulation of CPM, PERT calculations.

Unit IV:

GameTheory:Two–personzerosumgame,GamewithSaddlePoints,RuleofDominance,Algebraic, Graphical and linear programming methods for solving mixed strategy games.

Text book:

Operations Research: Kanti Swarup P.K. Gupta and Man Mohan: Sultan Chand and Sons New Delhi.

Reference Books:

1. H. A. Taha, Operations Research – An Introduction, Prentice-Hall, 1997.
2. J. K. Sharma, Operations Research: Theory and Applications, Macmillan, 1997
3. S. D. Sharma, H. Sharma, Operations Research: Theory, Methods and Applications, Kedar Nath Ram Nath, 1972

4. S. S. Rao, Optimization-Theory and Applications, Wiley Eastern Ltd., 1977.
5. F. S. Hillier, G. J. Lieberman, Introduction to Operations Research, McGraw-Hill, 2001
6. M. S. Bazaraa, H. D. Sherali, C. M. Shetty, Nonlinear Programming-Theory and Algorithms, Wiley-Interscience, 2006
7. A. K. Bhunia and L. Sahoo, Advanced Operations Research, Asian Books Private Limited, New Delhi, 2011.
8. M. Aokie, Introduction to Optimization Techniques: Fundamentals and Applications of Nonlinear Programming, The Macmillan Company, 1971.