

PARTIAL DIFFERENTIAL EQUATIONS

**Unit-I**

Introduction, Classification of second order Partial Differential Equations (PDE), Canonical Forms, Boundary Value Problems (BVPS), Properties of Harmonic Functions, Separation of variables

**Unit- II**

Elliptic Differential Equations, Laplace Equations, Poisson Equations, Dirichlet Problem for a Rectangle. The Neumann Problem for a Rectangle, Interior Dirichlet Problem for a Circle, Exterior Dirichlet Problem for a Circle, Interior Neumann problem for a circle. Solution of Laplace Equation in Cylindrical Coordinates, solution of Laplace Equation in Spherical Coordinates.

**Unit-III**

Parabolic Differential Equations Diffusion Equations Heat Equations Occurrence of Diffusion Equation, Boundary Conditions, Elementary Solutions of the Diffusion Equation, Dirac Delta Function, Separation of Variables Method Solution of Diffusion Equation in Cylindrical Coordinates, Solution of Diffusion Equation in Spherical Coordinates.

**Unit- IV**

Hyperbolic Differential Equations Wave Equations, Occurrence of the Wave Equation, Solution of one Dimensional Wave Equation by Canonical Reduction, the initial value problems: D'Alembert Solution, Vibrating String Variables Separable Solution, Forced Vibrations- Solution of Non homogenous Equations.

**Unit-V**

Duhamel's Principle, Green's Function, Green's Function For Laplace Equation, The method of Images, Green's Function for the Wave Equation-Helmholtz Theorem, Green's Function for the Diffusion Equation.

**Books Recommended:**

1. Introduction to Partial Differential Equations by K. Sankara Rao, PHI.

**Reference Books:**

1. Elements of Partial Differential Functions by I.N. Sneddon Mc Graw Hill

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M. Sc. IV Semester

~~Nov-Dec 2015~~

Subject Mathematics

Paper II

Marks- (85, 15)

ADVANCED GRAPH THEORY

**Unit- I**

Revision of graph theoretic preliminaries, Operations on graphs, Graph Isomorphism disconnected graph and their Components. Traveling salesman problem, round table problem, Konisberg Bridge problem, Eulerian and Hamiltonian Paths and circuits.

**Unit- II**

Properties of trees, Distance, centre, radius, diameter eccentricity and related theorems, Graph as a metric space, Rooted and binary trees, Labeled graph and trees spanning tree, weighted spanning tree, Shortest path, Fundamental circuits. Rank and nullity, cut sets and cut vertices, Fundamental cut sets.

**Unit- III**

Connectivity and separability in graphs, Abstract graphs, geometric graphs, planar graphs, Kurtowski two graphs, Embedding and regions of a planar graphs, Detection of Planarity, Geometric dual and combinational dual.

**Unit- IV**

Coloring and covering of graphs, Chromatic Polynomial, chromatic partitioning, Dimmer problem, Domminating sets, Independent sets, Four colour conjecture.

**Unit- V**

Digraph and types of digraphs, Digraph and binary relation, Equivalence relation in a graph, Directed path, walk, circuit, and connectedness. Eulerian digraph, arborescence matrices A, B and C of digraph, Adjacency metric of a digraph, Algorithms, Kruskal algorithm, Prism algorithm, Dihkastra algorithm.

**Text Book:**

1. Graph Theory with Applications to Engineering and Computer Science by Narsingh. Deo.

**Reference Book:**

1. Graph Theory by Harary.

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DISCRETE MATHEMATICAL STRUCTURES

**Unit-I**

Relation, Equivalence relation, Partitioning, Fundamental theorem on equivalence relation, ordered sets, First and last elements, maximal and minimal elements, upper and lower bounds, similar sets, Totally ordered sets, well ordered sets, Axioms of choice, Zorn's lemma, Well ordering theorem (statements only), Inclusion exclusion principle & Pigeon Hole principle.

**Unit-II**

Mathematical logic: Propositions and logical operators, Contradictions and Tautologies, Equivalence & Implication, Duality NAND and NOR connections, Functionally complete sets, Two-state devices and statements logic, Normal forms, Predicate calculus, Free and bound variables.

**Unit-III**

Lattice-Definition & examples, Distributive lattice, modular lattice, Bounded lattice, complemented lattice, Boolean lattice, Sublattice.

**Unit-IV**

Boolean algebra-Definition & examples, Basic Boolean algebra laws Principle of duality, Applications of Boolean algebra, Boolean functions, Disjunctive & Conjunctive normal forms, Switching circuits, Minimization of switches.

**Unit-V**

Mathematical Induction, Recursion, Recursion and iteration, closed form expression, sequence of integers, Recurrence relation, linear recurrence relation, and Homogeneous recurrence, Recurrence relations obtained from solutions, Solving linear homogenous recurrence relation, solving linear non-homogeneous recurrence relations, Generating functions, solution of recurrence relation using generating functions.

**Text Books:**

1. Discrete Mathematics by N.Ch. S.N. Iyengar, V.M. Chandra Sekharan, K.A. Venkatesh, P.S. Arunachalam- Vikas Publishing House Pvt. Ltd.
2. Set Theory-Schaum outline series.

**Reference Books:**

1. Discrete Mathematics and its applications by Keneth H. Rosen Tata Mc Graw Hill Pub, Ltd.
2. Discrete Mathematics for Computer Scientists by J.K. Truss, Pearson Education Asia Ltd.
3. Discrete Mathematical Structures with Applications by J.P. Tremblay, R. Manohar DataMc Graw Hill Pub. Company Ltd.

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Unit-I

Gamma and Beta Functions

Gamma Function, A series for  $\Gamma'(z)/\Gamma(z)$ , Difference equation  $F(z+1) = zF(z)$ , Euler's integral for  $\Gamma(z)$ , Beta function, value of  $F(z)\Gamma(z)$ , Factorial Function, Legendre's duplication formula, Gauss multiplication theorem, The behavior of  $\log \Gamma(z)$  for large  $|z|$ .

Unit-II

Hypergeometric and Generalized Hypergeometric functions:

Gauss Hypergeometric Function  ${}_2F_1$  and its convergence a simple integral form evaluation of  ${}_2F_1(a, b; c; 1)$  Contiguous function relations, Hypergeometric differential equation, Elementary series manipulations, simple transformation, generalized equation elementary series manipulations, simple transformation, Generalized hypergeometric function  $pF_q$  and its convergence, Whipple's theorem, Thom's theorem.

Unit-III

Bessel function and Legendre polynomials

Definition of  $J_n(z)$ , Bessel's differential equation, Generating function, Recurrence relations, Generating function for Legendre polynomials, Rodrigue's formula, Besselman's relations. Generating function, Additional functions, Hyper geometric forms of  $P_n(x)$ , special properties of  $P_n$ , Some more functions, Laplace's first integral form, orthogonality.

Unit-IV

Hermite and Laguerre polynomials

Definition of Hermite and Laguerre polynomials, Pure recurrence relations, Differential recurrence relations, Rodrigue's formula, Other generating functions, Orthogonality for Laguerre and Hermite polynomials.

Unit-V

Mascrobert's E-function and Meijer's G-Function

Definition of Mascrobert's E-function and its expansion in series of  $pF_q$ , simple integrals involving E-function Meijer's G-function, Definition and Simple Properties, Simple multiplications theorems Differential equation for G-function

Books Recommended:

1. Rainville, E.D; Special Functions, The Macmillan co. New York 1971.
2. Mathai and Saxena: Generalized Hypergeometric function with Application in statistics and physical sciences, springer verlag, Heidelberg and New York Lecture Notes no 348, 1973
3. Sarin, N, Sharma S.D. and Trivedi. Special Functions with application, Pragati prakashan, 1986.

Reference Books:

1. Leitch, N.N. Special Functions and their Applications, Prentice Hall, Englewood Chiffs, New jersey, USA 1995.
2. Whittaker, E.T. and Watson, G.N. course of Mc Graw Hill.

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