MATHEMATICS

(Choose any two subjects)

S.No	Subject Name	Subject Code
1	Advanced Topics In Differential Equations	10MH 01
2	Boundary Value Problems	10MH 02
3	Mathematical Methods	10MH 03
4	Operation Research	10MH 04
5	Partial Differential Equations	10MH 05

ADVANCED TOPICS IN DIFFERENTIAL EQUATIONS

UNIT - I

Uniqueness and Lipschitz and conditions for Ordinary Differential Equations - Boudary Value Problems - Linear Ordinary differential systems some general properties, constant coefficients oscillations and damping in application variation of Parameters, matrix norms, Matrix exponential, existence of solutions.

UNIT - II

Introduction to delay differential equations examples and the method of steps, Lipschitz conditions and Uniqueness.

UNIT - III

Existence theory : Ordinary differential systems, systems with bouded delays, notation and Uniqueness, existence linear delay differential systems, Superposition, constant coefficients, variation of parameters.

UNIT - IV

Stability : Definition and examples Liapunov method for uniform stability, Asymptotic stability linear and quasilinear ordinary differential systems, Autonomous Ordinary differential systems, trajectories and critical points, linear systems of second order critical points of quasilinear systems of second order.

REFERENCES :

1. Theory of Ordinary and delay differential equations by R.D. Driver Kingston R.I., Nov, 1976(Springs Verlag)

2. Theory of ordinary differential equations by E.A. coddington and N. Levinson.

NOTE :

i) Question Paper setter is advised to set 8 questions from each unit.

ii) Students are to answer 5 questions out of 8. Each question carries 20 marks.

BOUNDARY VALUE PROBLEMS

General theory for linear first order system of differential equations, Existence of solutions, Solution space. The first order non-homogeneous equation, variation of parameters. The adjoint vector equation. The adjoint n^{th} order equation. Relation between scalar and vector adjoints.

The two point boundary value problems, Homogeneous two -point boundary value problems, the adjoint boundary problem, the non-homogeneous boundary problem, and Green's matrix and self - adjoint boundary value problem. Introduction to Eigen value problems, the vibrating string problem, Heat conduction problem, properties of the operator G. Existence of Eigen values and Eigen functions. Expansion theory and spectral decomposition (Chapters 3, 6, 7 abd 8 of Ref. 1.)

Non - linear boundary value problems, kinds of boundary value problems, the Generalized Lipschitz condition, failure of existence and uniqueness to Linear boundary value problem-standard results on initial value problems and relation between first and second boundary value problems, picards iteration, Contraction mapping principal boundary value problems, A more general Lipschitz condition, An improved error boundary for the picards iterates, Generalization to contraction mapping principal and application to boundary value problems (Chapters 1,2, and 3 of Ref. 2).

Reference :

1) R.H. Cole, Theory of ordinary differential equations appleon century - crofts, New York, 1968.

2) P.B. Bailey, L.F. Shampine and P.E. Waltman, Non-Linear two point boundary value problems, Academic press, New York and Lindon (1968)

METHEMATICAL METHODS

UNI T - I :

Laplace Transforms - Introduction - Definition - Linearity property - existence of Laplace Transforms - Laplace transforms of elementary functions - Shifting theorems - Laplace transform of derivative of f(t) - Initial value problems - Final value theorem in Laplace transform of integrals - Multiplication by t- Division by t - Evaluation of integral - periodic functions - Inverse Laplace Transforms - Shifting theorems - Inverse Laplace Transforms of derivative and integrals - Convolution theorem - Application of Laplace transform to solutions of differential equations, integral equations and boundary value problems.

UNIT : II

Fourier Series - Expansion in an arbitrary period - Half range expansions. Wave lets - The Haar wavelets - A wavelets expansion - Multiresolution analysis with Haar Wavelets - General construction of wavelets and multiresolution analysis - Shannon wavelets. Flourier integral formula - Fourier transform - Inversion theorem for complex Fourier transform - Fourier Sine and Consine transforms - Inversion formulae - convolution theorem for Fourier transforms - Parseval's Identity - Finite Fourier sine and Cosine Transform - Inversion formulae - Applications to integral equations and boundary value problems.

UNIT - III :

Beta, Gamma functions - Applications to definite Integral and multiple integrals, Legendre equations, Legendre polynomials, Properties, Bessel Equation, Bessel functions, Properties.

UNIT - IV :

Boundary Value Problems, Sturm - Liouville Problems, Green's function, Application to BVP.

Scope as in :

1. Advanced Engineering Mathematic by Erwin Kreyszig

2. Advanced Engineering Peter V.O'Neil Thomson Brooks /Cole

3. Ordinary Differential Equations by Deo and Raghavendra

4. Fourier analysis with Applications of boundary value problems schaum series.

5. Integaral Transforms by Goyal and Gupta.

OPERATION RESEARCH

UNIT - I :

Linear Programming problem Formation, Graphical solution of Linear Programming problems, General formation of Linear Programming problem, convex set, Extreme points of a Convex set, convex Hull.

Linear Programming : Simplex Method, computational procedure of simplex method, Artificial variables Technique, Two phase Method, simple way for two phase simplex method. Big M - Method.

UNIT - II :

Method of resolve degeneracy special cases unbounded solutions, Non existing feasible solutions summary of computational procedure of Simplex Method.

Revised Simplex Method, Duality in linear programming, Fundamental duality theorem, Existence theorem, The Dual simplex method : Computational procedure of Dual simplex method.

UNIT - III :

Transportation modals : Matrix form of transportation problem, feasible solution existence of feasible solution existence of optimal solution, loops in transportation table and their properties, The initial basic in transportation table and their properties, The initial basic feasible solution to Transportation problem, methods for initial Basis feasible solution, Moving towards optimum solution, To examine the initial basic feasible solution for Non- degeneracy, Determination of Net evaluations, the Optimality test, Degeneracy in Transportation problem, Unbalanced transportation problem.

UNIT - IV :

Assignment problem : Mathematical formulation of Assignment problem, Fundamental theorems, Hungarian Method for Assignment problem, Assignment Algorithm unbalanced assignment problem. The Maximal Assignment problem, Restrictions on Assignment.

Replacement Models : The Replacement problem, Failure Mechanism of items, Replacement policy for items whose maintenance cost increases with time and money value is constant.

Scope as in Operations Research by S.D. Sharma

Reference :

1. HOROWITZ AND SAHNI : Data Structures in Pascal, Galgotia Pub.

2. Linear Programming by M K. Venkata Raman

PARTIAL DIFFERENTIAL EQUATIONS

UNIT - I :

Ordinary Differential Equations in more than two variables : Simultaneous Differential equations of the first order and the first degree in three variables - Method of solutions of dx/P=dy/Q = dz/R - Orthogonal trajectories of a system of curves on a surface - Pfafian Differential Forms and Equations.

UNIT - II :

Partial Differential Equations of the First Order : Origins of First Order Partial Differential Equations - Cauchy's problem for first order equations - Linear equations of the first order - Nonlinear Partial differential equations of the first order - Cauchy's method of Characteristics - Charpit's method - Jacobi's method.

UNIT - III

Partial Differential Equations of the Second Order : Linear Partial Differential Equations with constants coefficients - Characteristic curves of second order equations in there variables - The solution of linear hyperbolic equation - Separation of variables.

UNIT - IV :

Laplace Equations : The occurrence of Laplace's equations in physics Elementary solutions of Laplace equation - Boundary Value Problems Separation of variables - The two dimensional Laplace equation.

The Wave equation : The occurrence of the Wave equation in Physic - Elementary solutions of the One - dimensional wave equation. Green's function for the wave equation.

Scope as in Elements of Partial Differential Equations by I N. Sneddon, McGraw Hill, Hogashuka Ltd.

Reference :

1. Partial Differential Equations by I. G. Petrovski

2. Partial Differential Equations an Introduction by Bernard Epstein. Tata Mc Graw Hill, Pub,. Company Ltd. New Delhi.

3. Partial Differential Equations - Methods and Applications, Second Edition, by Robert C. McOwen, Pearson Education Asia.