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Recognized as per u/s 2(f) of University Grants Commission Act, 1956
NH-52, Namsai, Arunachal Pradesh -792103

MASTER OF SCIENCE (MATHEMATICS) - THIRD SEMESTER

Third Semester			
S. No.	**Name of Subject**	**Credits**	**Total Marks**
1	Numerical Methods and Computer Programming	5	100
2	General Topology	5	100
3	Mathematical Methods	4	100
	Any Two	5	100
4 5	1. Fluid Dynamics 2. Probability Theory and Statistics 3. Fuzzy Mathematics 4. Optimization Theory	5 5	100 100
	Total	**24**	

Subject Name: NUMERICAL METHODS AND COMPUTER PROGRAMMING

Section A: Numerical Methods

Unit 1 : Solution of system of equations :

Doolittle and Crout‟s Decomposition , Successive approximation by Gauss Jacobi and Gauss Seidal Methods, Newton‟s method, Convergence of successive approximations.

Unit 2 : Solution of Ordinary Differential Equations : (Single Step Methods)

Stability and Convergence of numerical methods, Runge-Kutta method of second, third and fourth order.

Unit 3: Predictor-Corrector Methods :

General explicit method, Adam‟s-Bashforth method, Nystrom method, general implicit methods, Adam‟s Moultan and Milne-Simpson predictor-corrector methods

Section B: C-Programming

Unit 1 : Programme solving technique and C-Programming preliminaries

Algorithm, flow charts, top down and bottom up approach, data types, operators, input-data statements in C, simple C programmes.

Unit 2 : Array, Pointer and Data Files

Arrays to functions, pointers, operations on pointers, array using pointers, opening and closing data files, creation of a data file, processing of data file.

Section C : Practical

Based on Section A and Section B

REFERENCE BOOKS :

1. M.K. Jain, *Numerical Solutions of Differential Equations*, Wiley Eastern.
2. E.V. Krishnamurthy and S.K. Sen, *Numerical Algorithms,* Prentice Hall of India.
3. 4. E. Balaguruswamy, *Programming in C*, Tata Mc.Grew Hilsl.
5. E.V. Krishnamurthy, S.K. Sen, *Numerical Algorithms*, Prentice Hall of India.

Subject Name: GENERAL TOPOLOGY

Unit 1: Basis

Open Sets, Closed Sets, Neighbourhood, Limit Point, Interior, Closure, Basis, Sub-basis, finer and coarser topology, Subspace.

Unit 2: Continuity

Continuous Functions, Open Functions, Closed Functions, Homoemorphism, Composition of Continuous Functions, Pasting Lemma, Product Topology, Quotient Topology.

Unit 3: Compactness and Connectedness

Compact Space, Countable Compact Spaces, Linderloff Space, Local Compactness, Connectedness, Path Connectedness , Local Connectedness,.

Unit 4: Separation Axiom and Countability :

Ti (i = 1, 2, 3, 4, 5) spaces, Regular and Complete Regular Spaces, Normal Spaces, First and Second Countable Spaces, Separable Space.

REFERENCE BOOKS :

1. Topology – A first course by J.R. Munkres, Prentice- Hall. New Delhi.
2. *Introduction to Topology and Modern Analysis* by G.F. Simmons, Tata McGraw Hill, New Delhi.
3. *Schaum's Outlines General Topology* by S. Lipschutz, Tata McGraw Hill, New Delhi

Subject Name: MATHEMATICAL METHODS

Unit 1 : Fredholm Integral Equations

Definition of Integral Equation, Eigen values and Eigen functions : Reduction to a system of algebraic equations, Reduction of ordinary differential equations into integral equations. Fredholm integral equations with separable kernals, Method of successive approximations, Iterative scheme for Fredholm Integral equations of second kind, Conditions of Uniform convergence and uniqueness of series solution.

Unit 2 : Voltera Integral Equations :

Voltera Integral Equations of second kind, Resolvant kernel of Voltera equation and its results, Application of iterative scheme to Voltera integral equation of the second kind. Convolution type kernals.

Unit 3 : Fourier Transform :

Fourier Integral Transform, Properties of Fourier Transform, Fourier sine and cosine transform, Application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems. Evaluation of definite integrals.

Unit 4 : Calculus of Variation with one independent variable :

Basic ideas of calculus of variation, Euler‟s equation with fixed boundary of the functional $I [y (x)] = \int_a^b f (x, y, y') \, d x$

containing only the first order derivative of the only dependent variable with respect to one independent variable. Variational problems with functional having higher order derivatives of the only dependent variable, applications.

Unit 5 : Calculus of Variation with several independent variables :

Variational problems with functional dependent on functions of several independent variables having first order derivatives, Variational problems in parametric form, variational problems with subsidiary condition (simple case only), Isoperimetric problems, Applications.

REFERENCE BOOKS :

1. R.P. Kanwal : *Linear Integral Equations, Theory and Techniques*, Academic Press, New York 1971.
2. M.R. Spiegel : *Theory and Problems of Laplace Transform.*
3. A.S. Gupta : *Calculus of Variation with Applications* : Prentice Hall of India (1999).

Subject Name: FLUID DYNAMICS

UNIT-1 : MOTION OF INVISCID FLUID IN TWO DIMENSIONS

Meaning of two dimensional motion, complex potential, velocity potential and stream function, sources, sinks and doublets, two dimensional image system, Milne-Thomson circle theorem, Blasius theorem, Magnus effect.

Unit-2 : MOTION OF SPHERE IN AXI-SYMMETRIC MOTION

Axi-symmetric flow, Stokes‟s stream function, stationary sphere in a uniform stream, pressure on the surface of a sphere, thrust on a hemisphere, D‟ Alembert‟s Paradox, kinetic energy of liquid.

Unit-3 : EQUATION OF MOTION FOR VISCOUS FLOW

Viscous fluid, co-efficient of viscosity, exact solution of Navier Stokes equation (Couette flow, Generalized Couette flow, Poiseuille flow, Hagen-Poiseuille flow through a pipe, flow between two concentric rotating cylinders, Stokes first problem), rate of change of circulation, diffusion of vorticity, energy dissipation due to viscosity.

Unit-4 THEORY OF SLOW MOTION

Stokes‟ equations, Oseen‟ equations, Reynolds number, lubrication theory.

Unit-5 BOUNDARY LAYER THEORY:

Laminar boundary layer, two-dimensional boundary layer equations for flow over a plane wall, Blasius equation, characteristic boundary layer parameters, similar solutions of boundary layer equations, separation of boundary layer, momentum and energy integral equation.

REFERENCE BOOKS :

1. *Textbook of Fluid Dynamics* by F. Chorlton, CBS Publishers & Distributors, New Delhi
2. *Viscous Fluid Dynamics* by J. L. Bansal, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
3. *Fluid Dynamics* by M. D. Raisinghania, S. Chand & Company Ltd., New Delhi.
4. *Boundary layer theory* by H. Schlichting, Paragamon press, London, 1995.

Subject Name: PROBABILITY THEORY AND STATISTICS

Unit I : Probability :

Axiomatic definition, Properties. Conditional probability, Bays rule and independence of events. Random variables, Distribution function, probability mass and density functions, Expectation, Moments, Moment generating function, Probability inequalities (Chebyshev, Markov, Jensen).

Unit II: Special distributions :

Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson, Uniform, Exponential, Gamma, Normal, covariance, correlation, Normal and Poisson approximations to Binomial.

Unit III:

Standard multivariate distributions, functions of random variables, modes of convergence, sequence of random variables, Joint distributions, Marginal and conditional distribution, Moments, Independence of random variables, weak and strong laws of large numbers, central limit theorem (i.i.d. case)

Unit IV:

Introduction to Stochastic processes, definitions and examples, discrete-time Markov chain renewal and regenerative processes, continuous-time Markov chains, martingales, Brownian motion.

Unit V:

Methods of Estimation, Properties of Estimators, Confidence intervals. Errors (Type I & II), Test of Hypothesis, Analysis of discretedata and Chi-square test of goodness of fit, sample test.

REFERENCE BOOKS :

1.S. Ross, *A First Course in Probability*, 6th Edn., Pearson, 2002.
2.V. K. Rohatgi and A. K. Md. E. Saleh, *An Introduction to Probability and Statistics*, 2nd Edn., Wiley, 2001.
3.S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, S. Chand, 2000.

4. S. M. Ross, *Stochastic Processes*, 2nd Edn, Wiley, 1995.

Subject Name: FUZZY MATHEMATICS AND ITS APPLICATIONS

Unit 1: Fundamentals of Fuzzy Sets:

Level Subsets, Representation of Fuzzy Sets, Extension Principle for Fuzzy sets, Operations on Fuzzy Sets.

Unit 2: Fuzzy Arithmetic and Fuzzy Relations:

Fuzzy Numbers, Arithmetic operations on intervals, Fuzzy Number, Arithmetic operations on Fuzzy Numbers, Projectins and extensions of Fuzzy Relations, Binary Fuzzy Relations, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations, Fuzzy Ordering Relations.

Unit 3: Construction of Fuzzy Membership Functions

Unit 4: Uncertainty Measurement and Applications of Fuzzy Sets:
Information and Uncertainty, Non-specificity of Crisp Sets, Non-specificity of Fuzzy Sets, Fuzzyness of Fuzzy Sets, Application of Fuzzy sets in decision making and in Medical Diagnosis.

REFERENCE BOOKS :

1. George J. Klir and Bo Yuan, *Fuzzy sets and Fuzzy Logic - Theory and applications*, Prentice Hal of India Ltd. , New Delhi, 2001
2. H.J.Zimmerman, *Fuzzy set theory and its applications*, Allied publishers, Chennai, 1996.
3. Witold Pedrycz and Fernando Gomide, *An Introduction to Fuzzy Sets- Analysis and Design*, Prentice Hall of India Pvt Ltd. New Delhi, 2004

Subject Name: OPTIMIZATION THEORY

Unit 1 : Background :

Organization of Optimization Problems, System Models, Black Box Approach.

Unit 2 : Optimization Techniques :

Functions, Regions and Optimizations, Functions of a single variable : Analytical & Numerical Methods.

Unit 3 : Multivariable Search :

Analytical Methods. Lagrange Multipliers, Kuhn-Tucker Theorem, Simplex Theorem.

Unit 4 : Multivariable Functions :

Numerical Methods : Local and Global Optima, General Principle of Sequential Numerical Search, Gradient Methods.

REFERENCE BOOKS :

1. Gordon S.G. Beveridge and Robert S. Schechter; *Optimization: Theory and Practice*, Mc-Graw Hill Book Co.
2. Erwin Kreyszig, *Introductory Functional Analysis with Applications*, Wiley Classic Library.
3. D.G. Luenberger, Optimization by Vector space methods, Wiley Pub. co