

Math 401

PARTIAL DIFFERENTIAL EQUATIONS

Unit-1

Methods of solution of $dx/P=dy/Q=dz/R$

Where P, Q, R, are given functions of x, y, and z, Pfaffian Differential Equations and solution of Pfaffian differential equation in three variables.

Partial Differential Equations of the First order, Linear Equations of the First-Order, Integral Surfaces passing through a given curve, Surfaces Orthogonal to a given system of Surfaces, Lagrange's equation, nonlinear partial Differential Equations of the first order, cauchy's Method of characteristics, compatible systems of first-order Equations, Charpit's Method, Special Types of first-order Equations.

Unit-2

Introduction, Classification of Second Order Partial Differential Equations (PDE), Canonical Forms, Boundary Value Problems (BVPs), Properties of Harmonic functions, Separation of Variables method.

Unit-3

Elliptic Differential Equations, Laplace Equation, Poisson Equation, Dirichlet Problem for a Rectangle, 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-4

Parabolic Differential Equations, Diffusion Equations, Heat Equation, Occurrence of Diffusion Equation, Boundary Conditions, Elementary Solution 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-5

Hyperbolic Differential Equations, Wave Equation, Occurrence of the Wave Equation, Solution of One-Dimensional Wave Equation by Canonical Reduction, The Initial Value Problem, D'Alembert's Solution, Vibrating String-Variables Separable Solution, Forced Vibrations-Solution of Nonhomogeneous Equation.

Books Recommended:

1. Introduction to Partial Differential Equations by K.Sankara Rao, PHI
2. Elements of Partial Differential Equations by IAN N. SNEDDON Mc GRAW-HILL Book Company.

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Math 402

ADVANCED FUNCTIONAL ANALYSIS

Unit-I

Differentiation in normed spaces, Gateaux derivative, Frechet Derivative, sub-differential, Fixed-point theorems and their applications, Banach contraction principle and its generalization, Applications of Banach contraction principle.

Unit-II

Definition and examples of topological vector spaces, Convex, Balanced and absorbing sets and their properties, Minkowski's functional, Subspace, Product space and quotient space of a topological vector space.

Unit-III

Finite dimensional topological vector spaces, Locally convex topological vector spaces, Normable and metrizable topological vector spaces, complete topological vector spaces.

Unit-IV

Frechet space, Uniform-boundedness principle, Open mapping theorem and closed graph theorem for Frechet spaces, Banach-Alaoglu theorem.

Unit-V

Variational Inequalities, Lions-Stampacchia theory, Physical phenomena represented by variational inequalities, Extreme points and Extremal sets, Krein-Milman's theorem.

Text Books:

1. Functional Analysis With Applications by A.H.Siddiqi, Tata McGraw Hill Publishing Company.
2. Linear Topological Spaces by Kelley J.L., Van Nostrand East West Press, New Delhi.

Reference Books:

1. Topological vector spaces and Distributions by John Horvath, Addison-Wesley Publishing Company, 1966.
2. Modern methods in Topological vector spaces by Albert Wilansky, McGraw-Hill, 1978.
3. Functional Analysis by K.Chandra Sekhar Rao, Narosa 2002.

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Math 403

WAVE LETS

Unit-I

Haar's simple wavelets, Haar wavelet transforms, Inverse Haar wavelet transforms, Multi dimensional wavelets, Two-dimensional Haar wavelets.

Unit-II

Application of wavelets, Noise reduction data compression, Edge detection, Daubechies wavelet (DW), approximation of samples with D' wavelets, Fast DW transform and its inverse.

Unit-III

Inner products and orthogonal projection, Applications of orthogonal projection computer graphics, Computation of functions and wavelets, Discrete and fast Fourier transform with inverse and applications.

Unit-IV

Fourier series for periodic functions, its convergence and inversion, uniform convergence of Fourier series, Bessel's inequality, Parsevals inequality.

Unit-V


The Fourier Transform, Convolution and inversion of Fourier transform, weight function, approximate identities.

Text Books:

1. Wavelets Made Easy by Y. Nievergelt.
2. A first Course on Wavelets by E. Hernandez and G. Weiss.

Reference Book:

1. An Introduction to Wavelets by Chui, Academic Press.

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Math 404

MATHEMATICS OF FINANCE AND INSURANCE

Unit-I

Elements of Theory of Interest, Cash Flow Valuation, Annuities, Amortization and Sinking Funds, Brief Review of Probability Theory.

Unit-II

Survival Distributions, Life Tables, Valuing Contingent Payments, Life Insurance, Life annuities, Net Premiums, Insurance Models including Expenses.

Unit-III

A Brief Introduction to Financial Markets, Basics of Securities, Stocks, Bonds and Financial Derivatives, Viz Forwards, Futures, Options and Swaps.

Unit-IV

An Introduction to Stochastic Calculus, Stochastic Process, Geometric Brownian motion, Stochastic Integration and Ito's Lemma.

Unit-V

Option Pricing Models -Binomial Model and Black Scholes Option Pricing Model for European Options, Black Scholes Formula and Computation of Greeks.

Text Books:

1. Options, Futures and other Derivatives by John C. Hull, Prentice-Hall of India Pvt.Ltd.
1. An introduction to Mathematical Finance by Sheldon M. Ross, Cambridge University Press.

Reference Books:

1. An Introduction to Mathematics of Financial Derivatives by Salih N. Neftci, Academic Press, Inc.
2. Mathematics of Financial Markets by Robert J. Elliot & P. E. Kopp Springer-Verlag, New York Inc.

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Math 406

FUZZY SETS AND THEIR APPLICATIONS**Unit- I**

Fuzzy Sets-Basic definitions, α -level sets, convex fuzzy sets, Basic operations on fuzzy sets Types of fuzzy sets, Cartesian products, Algebraic products, Bounded sum and difference, t-Norms and t-co norms.

Unit-II

The Extension Principle – The Zadeh's extension principle, Image and inverse image of fuzzy sets, Fuzzy numbers, Elements of fuzzy arithmetic.

Unit-III

Fuzzy Relation and Fuzzy Graphs-Fuzzy relation on fuzzy sets, Composition of fuzzy relations, Min-Max composition and its properties, Fuzzy equivalence relation, Fuzzy compatibility relations, Fuzzy relation equations, Fuzzy graphs, Similarity relation.

Unit-IV

Possibility Theory-Fuzzy measures, Evidence theory, Necessity measure, Possibility measure, Possibility distribution, Possibility theory and fuzzy sets, Possibility theory versus probability theory.

Unit-V

Fuzzy Logic-An overview of classical logic, Multivalued logics, Fuzzy propositions, Fuzzy quantifiers, Linguistic variables and hedges, Inference from conditional fuzzy propositions, the compositional rule of inference.

Text Books:

1. Fuzzy set theory and its Applications by H.J. Zimmermann, Allied Publishers Ltd., New Delhi, 1991.
2. Fuzzy sets and Fuzzy logic by G.J. Klir and B. Yuan Prentice-Hall of India, New Delhi, 1995.

Reference Book:

1. Fuzzy Sets, Uncertainty and Information by G.J.Klir, Tina A. Folger Prentice-Hall of India.

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