MA 701

ALGEBRA

3-0-0-6

Abstract Algebra:
Elementary set theory. Groups, subgroups, normal subgroups, homomorphisms, quotient groups, automorphisms, groups acting on sets, Sylow theorems and applications, finitely generated abelian groups. Examples: permutation groups, cyclic groups, dihedral groups, matrix groups. Basic properties of rings, units, ideals, homomorphisms, quotient rings, prime and maximal ideals, fields of fractions, Euclidean domains, principal ideal domains and unique factorization domains, polynomial rings. Elementary properties of finite field extensions and roots of polynomials, finite fields.

Linear Algebra:

Text Books:

Reference Books:
Topology:
Topological spaces, Basis for a topology, Limit points and closure of a set, Continuous and open maps, Homeomorphisms, Subspace topology, Product and quotient topology, Connected and locally connected spaces, Path connectedness, Components and path components, Compact and locally compact spaces, One point compactification, Countability axioms, Separation axioms, Urysohn’s Lemma, Urysohn’s metrization theorem, Tietze extension theorem, Tychonoff’s theorem, Completely Regular Spaces, Stone-Cech Compactification.

Functional Analysis:

Text Books:

Reference Books:
Ordinary Differential Equations:
First Order ODE \( y'=f(x,y) \)-geometrical Interpretation of solution, Equations reducible to separable form, Exact Equations, Integrating factor, Linear Equations, Orthogonal trajectories, Picard’s Theorem for IVP and Picard’s iteration method, Euler’ Method, Improved Euler’s Method, Elementary types of equations. \( F(x,y,y')=0 \); not solved for derivative, Second Order Linear differential equations: fundamental system of solutions and general solution of homogeneous equation. Use of Known solution to find another, Existence and uniqueness of solution of IVP, Wronskian and general solution of non-homogeneous equations. Euler-Cauchy Equation, extensions of the results to higher order linear equations, Power Series Method application to Legendre Eqn., Legendre Polynomials, Frobenious Method, Bessel equation, Properties of Bessel functions, Sturm-Liouville BVPs, Orthogonal functions, Sturm comparison Theorem. Systems of Linear ODEs, Reduction of higher order linear ODEs to first order linear systems, Stability of linear systems.

Transforms:

Partial Differential Equations:
Introduction to PDE, basic concepts, Linear and quasilinear first order PDE, Cauchy-Kowalewski theorem, second order PDE and classification of second order semilinear PDE (Canonical form), D’Alemberts formula and Duhamel’s principle for one dimensional wave equation, Laplace’s and Poisson’s equations, Maximum principle with application, Fourier Method for IBV problem for wave and heat equation, rectangular region, Fourier method for Laplace’s equation in three dimensions.

Text Books:

Reference Books:
MA 712  ANALYSIS-II  3-0-0-6

Complex Analysis:

Measure Theory:
Algebras and sigma algebras, measures, outer measures, measurable sets, Lebesgue measure and its properties, non-measurable sets, measurable functions and their properties, Egoroff’s theorem, Lusin’s theorem; Lebesgue Integration: simple functions, integral of bounded functions over a set of finite measure, bounded convergence theorem, integral of nonnegative functions, Fatou’s lemma, monotone convergence theorem, the general Lebesgue integral, Lebesgue convergence theorem, change of variable formula; Differentiation and integration: functions of bounded variation, differentiation of an integral, absolute continuity; Signed and complex measures, Radon-Nikodym theorem. Product measures, constructions, Fubini’s theorem and its applications.

Text Books:

Reference Books:
Nonlinear programming: Convex sets and convex functions, their properties, convex programming problem, generalized convexity, Pseudo and Quasi convex functions, Invex functions and their properties, KKT conditions.

Goal Programming: Concept of Goal Programming, Model Formulation, Graphical solution method.

Separable programming.

Geometric programming: Problems with positive coefficients up to one degree of difficulty, Generalized method for the positive and negative coefficients.

Search Techniques: Direct search and gradient methods, Unimodal functions, Fibonacci method, Golden Section method, Method of steepest descent, Newton-Raphson method, Conjugate gradient methods.


Multiobjective Programming: Efficient solutions, Domination cones.

Text Book:


Reference Books:

MA 713 TOPOLOGY 3-0-0-6

Quotient topology, Topological groups, Group Actions, Orbit spaces.

Homotopic maps, Construction of the fundamental group, Fundamental group of circle, Homotopy type, Covering spaces, Borsuk-Ulam and Ham-sandwich theorems, A lifting criterion, Seifert-van kampen theorem, Brouwer fixed point theorem and other applications


Orientation of complexes, Chains, Cycles and boundaries, Homology groups, Euler-Poincare formula, Barycentric subdivision, Simplicial approximation, Induced homomorphism, Degree and Lefschetz number fixed-point theorem.

Text Books:

Reference Books:
Probabilty Theory: Algebra of sets, Measure and probability measure, Random variables, Standard discrete and continuous distributions, Conditional distributions and their independence, Distribution of functions of random variables, Expectation, Variance, Correlation, Moment generating functions and their properties, Convergence of random variables, Characteristic functions and properties, Laws of large numbers, Limit theorems.

Statistical Inference: Parametric and nonparametric models, Exponential families, Sufficiency, Completeness, Basu's Theorem, Invariance and maximal invariant statistic.

Point Estimation: Unbiased estimation, maximum likelihood estimation, method of moments, Loss functions, Risk Functions, Bayesian methods, Minimax and admissible estimators, Interval estimation, Equivariance Principle

Hypothesis Testing: Neyman-Pearson theory, Most Powerful (MP) Test, UMP Test, Unbiased Test, Monotone likelihood ratio property, Likelihood ratio tests, Wald's Sequential Probability ratio Test (SPRT), Invariant tests.

Text Books:

Reference Books:

Reference Books: