PROSPECTUS
OF
MASTER OF SCIENCE IN
MATHEMATICS
Semester-I , Winter 2012
Semester-II, Summer-2013
Semester -III , Winter 2013
Semester-IV, Summer-2014

2012
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   - IV(104) Topology-I | 6

8. **Optional Papers : Choose Any One.**
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   - V(106) Advanced Discrete Mathematics-I | 8
   - V(107) Differential and Integral Equations-I | 9
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   - XII(302) Classical Mechanics- | 20
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M.Sc. Part-I-Semester I :

Compulsory Papers
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Paper-II : (102) Advanced Abstract Algebra-I
Paper-III: (103) Complex Analysis-I
Paper-IV : (104) Topology-I

Optional Papers : Choose Any One.
Paper-V : (105) Differential Geometry-I
Paper-V : (106) Advanced Discrete Mathematics-I
Paper-V : (107) Differential and Integral Equations-I

M.Sc. Part-I-Semester II :

Compulsory Papers
Paper-VI   : (201) Measure and Integration Theory
Paper-VII : (202) Advanced Abstract Algebra-II
Paper-VIII : (203) Complex Analysis-II
Paper-IX   : (204) Topology-II

Optional Papers: Choose Any One.
Paper-X : (205) Riemannian Geometry
Paper-X : (206) Advanced Discrete Mathematics-II
Paper-X : (207) Differential and Integral Equations-II

Text Book :

References :
(5) Jain P. K. and Gupta V. P., Lebesque Measure and Integration, New Age International (P) Ltd., Published, New Delhi, 1986. (Reprint 2000)
Paper - II (102): Advanced Abstract Algebra-I

Unit-I : Automorphisms, conjugacy, Class Equation of Finite Groups and G-Sets. Normal series, solvable groups, Nilpotent groups.

Unit-II : Direct products, fundamental theorem of finitely generated Abelian group, Invariants of a finite Abelian group, Sylow’s theorems, group of order $p^2$, $p,q$.

Unit-III : Ideals, Nil Potent and Nil Ideals, Euclidean Ring.

Unit-IV : Polynomial Ring, Integral Domain, Principal Ideal Domain, Unique Factorization Domain, Euclidian Domain, Polynomial Rings over unique factorization domain.

Unit-V : Cyclic modules, simple modules, Shur’s lemma, free module, Noetherian and Artiniam Module and rings, Hilbert basics theorem.


References :
16) J.A. Gallian, Contemporary Abstract Algebra, Narosa publication.
17) A.R. Vashistha, Modern Algebra, Krishanaprasian media (P) Ltd.
19) John B. Fraleigh, A first course in Abstract Algebra (Seventh Edition)
PAPER-III (103) : COMPLEX ANALYSIS - I

Unit-I : Complex Integration : Power Series representation of analytic functions, Cauchy’s integral formula, higher order derivatives, Cauchy’s inequality, Zeros of Analytic function, Liouville’s theorem, Fundamental theorem of algebra.

Unit-II : Taylor’s theorem, Maximum Modulus theorem, Morera’s theorem, Counting of zeros, Open Mapping theorem, Cauchy-Goursat theorem, Schwarz’s lemma.


Unit-IV : Residue, Cauchy’s residue theorem, Evaluation of integration by using residue theorem, Branches of many valued function (Specially arg z, log z, z), Bilinear transformation, Hadamard’s three circle theorem.

Unit-V : Spaces of continuous functions, spaces of analytic functions, Hurwitz theorem, Riemann mapping theorem, Wierstrass factorization theorem.


Reference :
7) E.Hille, Analytic Function Theory (2 Vols), Gonn & co. 1959.

PAPER-IV 104 : TOPOLOGY – I

Unit-I : Cardinal and Ordinal Numbers : Equipolent sets, cardinalnumbers, order types, ordinal numbers, Axiom of choice.

Unit-II : Topological Spaces : Definition and examples of topological spaces. Open sets and Limit points. Closed sets and closure. operators and neighbourhoods. Bases and Relative Topologies.

Unit-IV : Separation and Countability Axioms: T0, T1 & T2 spaces. T spaces and sequences. First and Second axiom spaces, separability.


Text Books:

Scope: Unit-I: Chapter 2, Unit-II: Chapter 3, Unit-III: Chapter 4, Unit-IV: Chapter 5: From Pg. No. 69 to 87. Unit-V: Chapter 5: From Pg. No. 87 to 98.

References Books:
(3) K.D. Joshi, Introduction to General Topology. Publisher: Wiley Eastern Ltd.
(4) By R.S. Aggarwal A Text Book on Topology. Publisher: S.Chand & Company.
(5) J.N. Sharma, General and Algebraic Topology, Krishna prakashan Pvt. Ltd.

PAPER-V (105): DIFFERENTIAL GEOMETRY-I

(OPTIONAL)

Unit-I : Local Intrinsic properties of a surface, Definition of surface, curves on a surface, surfaces of Revolution, Helicoids, Metric, Direction Coefficients.

Unit-II : Families of curves, Isometric correspondence, Intrinsic properties, Geodesics, Canonical Geodesic Equation, Normal Properties, Geodesic Existence theorems, Geodesic parallels.

Unit-III : Geodesic curvature, Gauss-Bonnet Theorem, Gaussian Curvature, Surface of constant curvature, conformal mapping, Geodesic mapping.

Unit-IV : Review of tensor calculus, Vector spaces, the dual space, Tensor product of vector spaces, Transformation formulae, contraction special tensors, Inner product. Associated tensors Exterior Algebra.

Unit-V : Differential manifolds, Tangent vectors, Affine Tensors and Tensorial forms, Connexions, covariant differentiation, Absolute derivation of Tensorial forms, Tensor connexions.


References:
(1) W. Klingenberg (Springer), A course in Differential Geometry
(2) Weatherburn, C. Riemannian Geometry and Tensor Calculus
(3) T. M. Karade, G.S. Khadekar, Maya S. Bendre, Lectures on General relativity, Sonu-Nilu publication.

PAPER-V (106): ADVANCED DISCRETE MATHEMATICS-I

(OPTIONAL)


Unit-II : Semigroups and Monoids: Definitions and examples of semigroups and monoids (including those pertaining to concatenation operation). Homomorphism of semigroups and monoids. Congruence relation and Quotient semigroups. Sub-semigroups and submonoids. Direct products. Basic Homomorphism theorem.

Unit-III : Lattice Theory: Lattices are partial ordered sets. Their properties. Lattices as algebraic systems. Sublattices. Direct products and Homomorphisms. Some special lattices, e.g. complete, complemented and distributive lattices.


References:

PAPER-V (107) : DIFFERENTIAL AND INTEGRAL EQUATIONS-I (OPTIONAL)

Unit-I : Existence theorems, Linear equations of arbitrary order, solutions of linear equations, linear system with constant coefficients, operational calculus and solutions of linear differential equations, infinite series solutions.

Unit-II : Solutions of differential equations by definite integrals, Boundary value problems, Green’s functions, expansion theorems, non-linear differential equations.

Unit-III : Fourier Transform: Definition, properties, evaluation of Fourier and inverse Fourier transform of functions, Convolution theorem for Fourier transform, Sine and Cosine Fourier transforms, solving differential and integral equation using Fourier transform.

Unit-IV : Mellin Transform: Definition, properties and evaluation of transforms, Convolution theorem for Mellin transform, application to integral equation.

Unit-V : Hankel Transform: Definition, properties and evaluation of Hankel transform, application to integral equation, Finite Hankel transform.


References:

SYLLABUS PRESCRIBED FOR M.Sc.-II SEMESTER-II

PAPER-VI (201) : MEASURE AND INTEGRATION THEORY

Unit-I : Lebesgue outer measure, measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability.

Unit-II : Integration of Non-negative function, the general integral, integration of series, Riemann and Lebesgue integrals.

Unit-III : The Four derivatives, continuous non-differentiable functions, functions of bounded variation, Lebesgue differentiation theorem, differentiation and integration.

Unit-IV : Measures and outer measures, Extension of a measure.


References:
Unit-I: Field, Extension fields, Algebraic and transcendental extensions, separable and inseparable extensions, normal extensions.

Unit-II: Perfect Fields, Finite fields, primitive elements, algebraically closed fields, automorphism of extensions, Galois extensions, Fundamental theorem of Galois theory, Fundamental theorem of algebra.

Unit-III: Roots of Unity and cyclotomic polynomials, cyclic extensions, solution of polynomial equations by radicals, Ruler and Compass construction.

Unit-IV: Smith Normal Form over a PID and Rank: Preliminaries, row module, column module and rank, Smith normal form.

Unit-V: Fundamental Structure theorem for finitely generated modules over a PID and its applications to finitely generated abelian groups.


Reference Books:

PAPER-VIII (203): COMPLEX ANALYSIS-II

Unit-I: The Gamma function and its properties, the Riemann Zeta Function, Remann’s Functional Equation, Euler’s theorem, Mittag-Leffler’s Theorem.

Unit-II: Analytic Continuation, uniqueness of direct analytic continuation, uniqueness of analytic continuation along a curve, power series method of analytic continuation.

Unit-III: Schwartz Reflection Principle, monodromy theorem and its consequences, Harmonic functions on a disk, Harnack’s inequality, Dirichlet’s problem, Green’s function.
Unit-IV: Canonical products, Jensen’s formula, Poisson-Jensen formula, The genus and order of an entire function, exponent of convergence, Hadamard’s factorization theorem.

Unit-V: The range of an analytic function, Bloch theorem, Little theorem

Text Book:

References:
7) E. Hille, Analytic Function Theory (2 Vols), Ginn & co. 1959.
17) Dennis G. Zill, Patrick D. Shanahan Jones and Burtlett, A first course in Complex analysis with application (Second edition) publisher (2010).
19) J.N. Sharma, Complex variables, Pragati publication.
20) A.R. Vasishta, Complex variables, Krishna publication.
21) John Mathew and Howell, Complex analysis for mathematician and Engineers.

PAPER-IX (204) : TOPOLOGY-II

Unit-I: Metric Spaces: Metric Spaces as topological spaces. Topological properties. Hilbert (e2) space. Frechet space. Space of continuous functions.

Unit-II: Complete Metric Spaces: Cauchy sequences, completions, Equivalent conditions, Baire Theorem.


Unit-V: Metrization and Paracompactness: Urysohn’s metrization theorem, paracompact spaces, Nagata-Smirnov metrization theorem.


Reference Books:
1) S.R. Munkres, Topology: A First Course, Publisher: Prentice Hall of India.
PAPER-X (205): RIEMANNIAN GEOMETRY
(Optional)

Unit-I: Riemannian metric, metric tensor, Christoffel symbol, Christoffel symbol of first kind, second kind, properties of Christoffel symbols. Computations of Christoffel's symbols for static and non-static spherically symmetric and R-W space-times, transformation of Christoffel symbols, derivatives of tensor, absolute derivative. Covariant derivatives, divergence, gradient, Laplacian.

Unit-II: Parallel Vector Fields: Parallel vector field of constant magnitude, parallel displacement of covariant vector field, parallelism of a vector field of variable magnitude. Geodesic: Differential equations of a geodesic, special co-ordinate system: Local cartesians, Riemannian co-ordinates, Normal co-ordinates, Geodesic normal co-ordinates.

Unit-III: Curvature Tensor: Covariant curvature tensor of Riemann tensor, curvature tensor in Riemannian co-ordinates, properties of curvature tensors, on a cyclic property, number of independent components of R.

Unit-IV: Ricci tensor, curvature invariant, Einstein tensor, Computations of Einstein's tensor for static and non-static spherically symmetric and R-W space-times, the Bianchi identity. Geodesic deviation: Equations of Geodesic deviation.

Unit-V: Riemannian curvature, space of constant curvature, flat space, cartesian tensor.

Reference Books:
(1) T. M. Karade, G. S. Khadekar and Maya S. Bendre, Lectures on General Relativity Sonu Nilu Publication.
(2) T. J. Willmore, An Introduction in Differential Geometry
(3) J. L. Synge, Tensor Calculus – Schild.
(5) L. P. Eisenhard, Riemannian geometry, University press Princeton (1926)
(6) J. A. Schouten, Ricci Calculus, Springer Verlag, Berlin
(7) T. Y. Thomas, Concepts from tensor analysis and differential geometry, Academic press, New York
(8) W. Boothby, Introduction to differentiable manifold and Riemannian geometry, Academic press, 1975

PAPER-X (206): ADVANCED DISCRETE MATHEMATICS-II
(Optional)

Unit-I: Graph Theory: Definition of (undirected) graphs, paths, circuits, cycles and subgraphs. Induced subgraphs. Degree of a vertex. Connectivity planar graphs and their properties. Trees, Euler formula for connected planar graphs. Complete and complete bipartite graphs. Kuratowski’s theorem (statement only) and its use.


Unit-V: Turing machine and partial recursive functions, notation.
References:
Notions of syntax analysis, polish notations. Conversion of infix expressions to polish notations. The reverse polish

(1) N.Deo, Graph Theory with Applications to Engineering and Computer Sciences, Prentice Hall of India.
(6) K.R.Parthasarthy, Basic Graph Theory (TMH)

PAPER-X (207) : DIFFERENTIAL AND INTEGRAL EQUATIONS-II
(OPTIONAL)

Unit-I : Fredholm Equations : Some Problems which give rise to integral equations, conversion of ordinary differential equations into integral equations, integro-differential equations.

Unit-II : Degenerated Kernels, Hermitian and symmetric Kernel, the Hilbert-Schmidt theorem, Hermitization and Symmetrization of Kernels, Solutions of integral equations with Green’s function type Kernels.

Unit-III : Volterra Integral Equation : Types of Volterra equations, Resolvent Kernel of volterra equations, convolution type Kernel, some miscellaneous type of volterra equations.

Unit-IV : Non-linear Volterra equations, approximate methods, application to Volterra equations with convolution type Kernels.

Unit-V : Existence and uniqueness of solution using fixed point theorem in case of linear and non-linear Volterra and Fredholm integral equations.

References:
SEMESTER-III
PAPER-XI (301): FUNCTIONAL ANALYSIS-I


Unit-II : Basic Properties of finite dimensional normed linear spaces and compactness. Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, Dual spaces with example.

Unit-III : Boundedness theorem and some of its consequences, open mapping, Hahn Banach theorem for real linear spaces, complex linear spaces and normed linear spaces.

Unit-IV : Reflexive Spaces, Weak sequential compactness, compact operators, solvability of linear equations in Banach spaces, the closed graph theorem.

Unit-V : Inner product spaces, Hilbert spaces, orthogonal sets, Bessel’s inequality, complete orthogonal sets, Parseval’s identity, structure of Hilbert spaces, Projection theorem.


References :
12) B. V. Limaye, Functional Analysis, Wiley Eastern Ltd.

PAPER-XII (302): CLASSICAL MECHANICS


Unit-II : Generalised coordinates, Halonomic & Non-holonomic systems, Scleronomic and Rheonomic systems, Generalized potential, Lagranges Equations of first kind and second kind, uniqueness of solution, Energy equations for conservative fields.
Unit-III : Legendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorems, Routh’s equations, Derivation of Hamilton’s equations from a variational principle, the principle of least action.

Unit-IV : Canonical transformations: The equations of Canonical transformation, examples of canonical transformations. Poisson’s bracket & other canonical invariants (Lagrange Bracket), Poisson’s identity

Unit-V : The Hamilton-Jacobi Equation for Hamilton’s principle function, The harmonic Oscillator problem as an example of the Hamilton-Jacobi method. The Hamilton-Jacobi Equation for Hamilton’s characteristic function, Separation of variables in the Hamilton-Jacobi equation.

Text Book :
(2) N.C.Rana & P .S.Joag ,Classical Mechanics ,Tata Mc Graw Hill,

References:
(1) A.S.Ramsey Dynamics Part-II, the English Language Book Society and Cambridge University Press.
(2) Gupta, Kumar and Sharma, Classical Mechanics
(3) T.M. Karade, G.S.Khadekar, Lectures on Advanced Mechanics, Sona-Nilu publication

303 : GENERAL RELATIVITY AND COSMOLOGY - I (OPTIONAL)

Unit-I : Newtonian Relativity, Introduction of special theory of relativity and principles of special theory of relativity, space time structure, Minkowskian space time, Relativistic mechanics, mass energy equivalence energy momentum tensors.

Unit-II : Einstein’s relativity: SR to GR, Principle of equivalence, Principle of covariance and Mach’s Principles, Einstein’s field equations, Derivation of Einstein’s field equations from action principle, Newtonian approximation: Relation between $g_{aa}$ and $V$, Einstein equations compared with poisson equation.

Unit-III : Schwarzschild exterior solution and its isotropic form, planetary orbits, General relativistic Kepler problem, Advance of Perihelion of a planet, Bending of light ray in a gravitational field, gravitational red shift in spectral lines

Unit-IV : Schawrschild interior solutions, the boundary conditions, covariant conservation law, Gravitational wave equations, Birkhoff’s theorem.

Unit-V : Eddington’s form of the Schwarzschild solution, Linearisation of filed equations, time independent and spherically symmetric field. Weyl’s solutions to the linearized field equations

References :
(4) Relativity , Thermodynamics and Cosmology - R.C. Tolman (Oxford Press)
(7) Dr. S. R. Roy, Dr. Raj Bali, Theory of relativity, Jaipur publishing house
(8) T.M. Karade, K.S. Adhav, M.S. Bendre, Lectures on Special relativity
(9) R. Resnicik, Introduction to special relativity, Wiley Eastern Ltd.

304: FLUID DYNAMICS-I (OPTIONAL)

Unit-I : Kinematics of fluid in Motion : Real fluids and ideal fluids. Velocity of a fluid at a point stream lines and path lines. Steady and unsteady flows. Velocity potential, vorticity vector , local and particles rates of change. Equation of continuity , worked examples. Acceleration of a fluid. Conditions at a rigid boundary , general analysis of fluid motion.
Unit-II: Pressure of motion of a fluid: Pressure at a point in a fluid at rest. Pressure at a point in a moving fluid, conditions at a boundary of two inviscid immiscible fluids, Euler’s Equation of motion, Bernoulli’s equation, worked examples. Discussion of the case of steady motion under conservative body forces, some potential theorem, some special two-dimensional flow. Some further aspects of vortex motion.

Unit-III: Sources, sinks and Doublets, images in a rigid infinite plane. Images in a solid sphere. Asymmetric flow, Stokes stream function. Some two-dimensional flows, meaning of two-dimensional flow, use of cylindrical polar coordinate, the stream function, the complex potential for two-dimensional, irrotational incompressible flow. Complex velocity potentials for standard two-dimensional flows, uniform stream, line source and line sinks, link system.

Unit-IV: The Milne-Thomson circle theorem, some application of the circle theorem, extension of the circle theorem, the theorem of W a sins, the use of conformal transformation. Vortex rows, single infinite row of line vortices. The Karnar vortex street.

Unit-V: Elements of Thermodynamics: The equation of state of substance, the first law of Thermodynamics, internal energy of a gas. Specific heat of a gas. Function of state, Entropy, Maxwell’s Thermodynamics relation. Iso-thermal Adiabatic and Isentropic Process.

Text Book:
(1) F. Chorlton, Text Book of Fluid Dynamics, CBS Publishers, Delhi.

References:

(305): OPERATION RESEARCH-I (OPTIONAL)

Unit-I: Operation Research & its scope, linear programming, Mathematical formulation, Graphical solution, General linear programming, Simplex method, Use of Artificial variable, (Big-M method), Duality in LP, Economic Interpretation, dual simplex method.

Unit-II: Integer Programming, Branch and Bound technique, Fractional cut plane method, Goal programming, Advanced techniques in LP (upper bound technique).

Unit-III: Parametric linear programming, Transportation problem and assignment problems.

Unit-IV: Network analysis, minimal spanning tree problem, shortest route problem, network scheduling, critical path analysis.

Unit-V: Dynamic programming, The recursive equation approach, characteristics of dynamic programming, Dynamic programming algorithm, Discrete DPP, solution of LPP by dynamic programming.

Text Book:

Reference Books:
(2) G.Hadle, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
306: DIFFERENCE EQUATIONS-I

Unit-I: Introduction: Difference calculus. The difference operator. Generating function and approximate summation.


Unit-III: The Z-transform: Properties, initial and final value theorems, partial sum theorem, convolution theorem. Inverse Z-transforms, solution of difference equation with constant coefficients by Z-transforms.


Reference Books:

307: FUZZY SETS AND APPLICATIONS-I (OPTIONAL)

Unit-I: Fuzzy sets - basic definitions, a-level sets. Convex fuzzy sets, basic operations on fuzzy sets, cartesian products. Algebraic products, bounded sum and difference t-norms and t-conorms ([1] Cha.1).

Unit-II: The Extension Principle - The Zade’s extension principle, image and inverse image of fuzzy sets, Fuzzy numbers and elements of fuzzy arithmetic ([1] Cha.2).

Unit-III: Fuzzy relations and fuzzy graphs - Fuzzy relations fuzzy sets, composition of fuzzy relations. Min-Max composition and its properties, fuzzy equivalence relations, fuzzy computability relations, fuzzy relations equations, fuzzy graphs, similarity relations ([1] Cha.3).

Unit-IV: Possibility theory - fuzzy measures, evidence theory, possibility theory and fuzzy sets ([1] Cha.4).


Text Books:

Reference Books:

308: WAVELET ANALYSIS (OPTIONAL)

Unit-I: Preliminaries - Linear algebra, Hilbert spaces, Fourier series, Fourier integral and signal processing. [Cha.1 (1.1-1.4)]

Unit-II: Windowed Fourier transform - Motivation and definition, time frequency localization, the reconstruction formula. [Cha.2 (2.1-2.3)] 2324
Unit-III: Continuous Wavelet Transforms - Motivation and definition of Wavelet Transforms, the constructions formula, frequency localization. [Cha.3 (3.1-3.3)]

Unit-IV: Generalized Frames - From resolution of unity to frames, reconstruction formula and consistancy condition, Recursive construction. [Cha.4 (4.1, 4.2, 4.4)]

Unit-V: Discrete Time - Frequency analysis, Shannon sampling theorem, sampling in the time frequency domain, time sampling verses frequency sampling. [Cha.5 (5.1-5.3)]

Text Book:

Reference Books:

309: BANACH ALGEBRAS-I (OPTIONAL)

Unit-I: Definition of Banach Algebra and Examples. Singular and non-singular elements. The abstract index. The spectrum of an element.


Unit-IV: C* - algebras: Definition and examples, self-adjoint, unitary, normal, positive and projection elements in C* - algebras.

Unit-V: Commutative C* algebras. C* - homomorphisms. Representation of commutative C*-algebras.

Text Book:

Reference Books:

310: NON COMMUTATIVE RINGS-I (OPTIONAL)

Unit-I: Basic Terminology and examples. Semi simplicity (x 1, x 2 of [1]).

Unit-II: Structure of Semi simple rings. (x 3 of [1]).

Unit-III: The Jacobson Radical (x 4 of [1]).

Unit-IV: The prime radical; prime and semi prime rings. Structure of primitive rings; the Density Theorem (x10, x 11 of [1]).

Unit-V: Sub-direct products and commutativity theorems. (x 12 of [1]).

Text Book:

Reference Books:
(1) I.N. Herstein, Non commutative Rings, Carus Monographs of AMS, 1968.
(2) N. Jacobson, Basic Algebra II, WH Freeman, 1989.

SYLLABUS PRESCRIBED FOR M.Sc. II SEMESTER-IV

PAPER-XVI 401: FUNCTIONAL ANALYSIS-II

Unit-I: Riesz Representation theorem, adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces, self adjoint operators, normal and unitary operators.

Unit-II: Spectral properties of bounded linear operators, basic concepts, further properties of resolvent and spectrum, use of complex analysis in spectral theory.
Unit-III : Compact linear operators on normed spaces, further properties of compact linear operators, spectral properties of compact linear operators on normed spaces.

Unit-IV : Spectral properties of bounded self-adjoint linear operators, further spectral properties of bounded self-adjoint linear operators.

Unit-V : Positive operator, square root of positive operator, projection operators, spectral family.

Text Book:

References:
(12) B.V. Limaye, Functional Analysis, Wiley Eastern Ltd.

PAPER-XVII 402: PARTIAL DIFFERENTIAL EQUATIONS

Unit-I : Curves and Surfaces, Genesis of first order P.D.E., Classification of integrals, Linear Equations of the first order, Pfaffian differential Equations, Compatible systems, Charpit's Method, Jacobi's Method, Integral Surfaces through a given curve.

Unit-II : Quasi-Linear equations, Non-linear first order P.D.E., genesis of second order P.D.E., Classification of second order P.D.E.

Unit-III : One dimensional Wave equation, Vibrations of an infinite string, Vibrations of a Semi-infinite string, Riemann's Method, Vibrations of a string of finite Length.


403: GENERAL RELATIVITY AND COSMOLOGY-II
(OPTIONAL)

Unit-I: Einstein Field Equations with Cosmological term, static cosmological models of Einstein and De-sitter, their derivations, properties and comparison with the actual Universe.

Unit-II: Cosmological principle, Hubble’s law, Weyl’s Postulate, Steady State Cosmological models, Derivation of Roberson-Walker Metric, Further Properties.

Unit-III: Motion of particles and light rays in R-W model: Material particles, Radial motion of a particle, General motion, light rays. The red shift in R-W model, Hubble’s and Deceleration Parameters.

Unit-IV: Fundamental equation of dynamical cosmology: Density and pressure of present universe, the matter dominated era of the present universe, Friedmann models: closed model, Flat model, Open model.

Unit-V: Relativistic stellar structure, simple stellar models- The interior Schwarzschild solution, The field of a charged mass point

References:

(2) Introduction to General Relativity - Ronald Ader, Maurice Bazin, Menahem, Schiffer.

404: FLUID DYNAMICS-II (OPTIONAL)

Unit-I: Gas Dynamics: Compressibility effects in real fluids, the elements of wave motion, one dimensional wave equation, wave equation in two and in three dimensions, spherical waves, progressive and stationary waves, the speed of sound in gas equation of motion of a gas, subsonic, sonic and supersonic flows, isentropic gas flow, Reservoir discharge through a channel of varying section. Investigation of maximum mass flow through a nozzle. Shockwaves, formation of shockwaves, elementary analysis of normal shock waves.

Unit-II: Viscous Flow: Stress components in a real fluid, relation between cartesian components of stress, translation motion of fluid element, the rate of strain quadric and principal stresses. Some further properties of the rate of strain quadric and principal stresses, stress analysis in fluid motion, relation between stress and rate of strain, the coefficient of viscosity and Laminar flow.

Unit-III: The Navier stokes equations of motion of a viscous fluid, some solvable problem in viscous flow, steady motion between parallel planes, steady flow through tube of uniform circular cross section, steady flow between co-centric rotating cylinders, diffusion of vorticity energy dissipation due to viscosity steady flow past a fixed sphere.

Unit-IV: Magnetohydrodynamics: Nature of Magnetohydrodynamics, Maxwell’s electromagnetic field equation, medium at rest, medium in motion, the equation of motion of a conducting fluid rate of flow of charge, simplification of the electromagnetic field equations, the magnetic Renolds number, Alfven’s theorem, the magnetic body force, Ferraro’s law of isorotation.

Unit-V: Dynamical similarity, Buckingham p-theorem, Reynolds number, Prandt’s boundary layer, Boundary layer equations.
in two dimensions, Blasing solutions, boundary layer thickness, displacement thickness, Karmar integral conditions, seperation of boundary layer flow.

Text Book :
(1) Chorlton, Text Book of Fluid Dynamics, CBS Publishers, Delhi,

References:
(2) G.K.Batchelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi, 1994

405: OPERATION RESEARCH-II (OPTIONAL)

Unit-I: Queing system, Basic characteristic of queuing system, Element of Queing system, Poisson and Non Poisson Queing system.

Unit-II: Games and strategies, Two Person zero sum games, The maximum -minimum principle, games without saddle point, mixed strategies, Graphics solution of 2xn and mx2games, Dominance properties, general solution of mnxn rectangular games.

Unit-III: Non-Linear Programming, Formulation, general NLLP, constrained optimization with equality constraints, with inequality constraints, saddle point problems.

Unit-IV: Non-Linear Programming method, Graphical solution, Kuhn-Tucker condition with non-negative constraints, Quadratic Programming, wolfe’s modified simplex method, Beals method.

Unit-V: Separable convex programming, geometric programming, Geometric -Arithmetic mean inequality, unconstrained and constrained geometric programming problems, complementation geometric programming.

Text Book :

Reference Books :
(2) G.Hadle, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
(7) N.S.Kambo, Mathematical Programming Techniques. Affiliated East-West Press Pvt.Ltd., New Delhi, Madras

406: DIFFERENCE EQUATIONS-II


References:

407: FUZZY SETS AND APPLICATIONS-II (OPTIONAL)


Unit-II: Linguistic Variables and hedges. Inference from conditional fuzzy propositions. The compositional rule for inference.


Unit-IV: An Introduction to fuzzy control - fuzzy controllers. Fuzzy rule base. Fuzzy inference engine fuzzification. Defuzzification and the various defuzzification methods (the centre of area, the centre of maxima, and the mean of maxima methods)


Reference Books:

408: LIE GROUPS


Unit-I: Topological Groups. The family of nuclei of a topological group. Subgroups and homomorphic images. Connected topological groups.

Unit-II: Local Groups: Lie groups. Local lie groups. Analytic subgroups of a lie group. One dimensional lie groups.

Unit-III: The Commutator of two infinitesimal transformations. The algebra of infinitesimal right translations. Lie groups of transformations.

Unit-IV: The lie algebra of sub-group. One parameter subgroup. Taylor’s theorem for Lie groups. The Exponential mapping.


Text Books:

Reference Books:
1. Lie Groups and Compact Groups by John F. Price (Cambridge University Press)
409 : BANACH ALGEBRAS-II (OPTIONAL)


Unit-III : The Commutant. The double commutant theorem. The Kaplansky Density theorem. L as V on Newmann Algebra, Maximal Abelian Algebras.


Text Book : M.A.Naimark, Normed Algebras, Noordhof f, Groningen, Netherlands, 1972..

Reference Books:

410 : NON-COMMUTATIVE RINGS-II (OPTIONAL)

Unit-I : Division rings, tensor products and maximal subfields [x13,x 15 of [1]].

Unit-II : Polynomials over division rings. [ x 16 of [1]].

Unit-III : Local rings, Semi local rings [x 19, x 20 of [1]].

Unit-IV : The theory of idempotents. Central idempotents and block decompositions. [x21, x22 of [1]].


Reference Books:
(4) Louis H. Rowen, Ring Theory (Student Edition), Academic Press,