SEMESTER SYLLABUS
M.Sc. MATHEMATICS

SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER - I

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Advanced Abstract Algebra (I)	20	80		100
2.	Real Analysis (I)	20	80		100
3.	Topology (I)	20	80		100
4.	Complex Analysis (I)	20	80		100
5.	Advanced Discrete Mathematics (I)	20	80		100

SEMESTER - II

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Advanced Abstract Algebra (II)	20	80		100
2.	Real Analysis (II)	20	80		100
3.	Topology (II)	20	80		100
4.	Complex Analysis (II)	20	80		100
5.	Advanced Discrete Mathematics (II)	20	80		100

SEMESTER - III

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Integration Theory and Functional Analysis -I	20	80		100
2.	Partial Differential Equations, Mechanics and Gravitation - I	20	80		100
OPTIONAL PAPER (ANY THREE)					
3.	Program. in C with ANSI Features I	20	50	30	100
4.	Fuzzy Sets and their Applications-I	20	80		100
5.	Operations Research-I	20	80		100
6.	Fluid Mechanics-I	20	80		100
7.	Information Theory-I	20	80		100
8.	Fundamentals of Computer Science –I	20	80		100

SEMESTER - IV

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Practical	Total Marks
1.	Integration Theory and Functional Analysis -II	20	80		100
2.	Partial Differential Equations, Mechanics and Gravitation - II	20	80		100
OPTIONAL PAPER (ANY THREE)					
3.	Programming in C with ANSI Features- II	20	50	30	100
4.	Fuzzy Sets and their Applications-II	20	80		100
5.	Operations Research-II	20	80		100
6.	Fluid Mechanics-II	20	80		100
7.	Information Theory-II	20	80		100
8.	Fundamentals of Computer Science II	20	80		100

SEMESTER-I
PAPER- I
ADVANCED ABSTRACT ALGEBRA

Group- Permutation group, Normal subgroup, Three Isomorphism Theorems,Correspondence Theorem, Maximum Normal subgroup, Automorphism and Inner Automorphism, Centre of groups.

Normal Series- Normal and Subnormal series, Composition Series, Jordan-Holder theorem, Solvable groups, Nilpotent groups.

Rings & Modules- Definitions, Maximal and prime ideals, Nilpotent and Nill Ideals, Zorn's Lemma (statements only), its application to obtain maximal ideals.

REFERENCES:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra (2nd Ed.), Cambridge University Press, Indian Edition, 1997
2. I.S. Luther and I.B.S. Passi, Algebra: Vol. I - Groups, Narosa Publishing House, 1996.
3. Surjeet Singh and Quazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
4. N. Jacobson: Basic Algebra: Vols. I & II, Hindustan Publishing Company, 1980.
5. S. Lang: Algebra, 3rd Edition, Addison-Wesley, 1993.

SEMESTER-I
PAPER-II
REAL ANALYSIS-I

The Riemann–Stieltjes Integral- Definition and existence of Riemann–Stieltjes integral, Properties of the Integral,Integration and differentiation, the Fundamental Theorem or Calculus, integration of vector-valued function Rectifiable curves.

Functions of Several Variables- Linear transformation, derivatives in an open subset of R^n,Contraction principle, Inverse function theorem, Implicit function theorem, Derivatives of higher orders,Differentiation of integrals.

Sequences and series of Functions- Point wise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, Uniform convergence and continuity uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weiertrass approximation theorem.

Power Series- Uniquencess theorem for power series, Abel's and Tauber's theorem.

REFERENCES:

[1] Walter Rudin:Principles of Mathematical Analysis' (3re edition) McGraw Hill, Kogakusha, 1976, International student edition.

[2] P.K. Jain and V.P. Gupta: Lebesgue Measure and Integration, New age International (P) Limited published, New Delhi 1986 (Reprint 2000).

SEMESTER-I
PAPER-III
TOPOLOGY – I

Definition and examples of topological spaces,closed sets, Closure, Dense subsets Neighborhoods, Interiors, exteriors and boundary points.

Accumulation point and derived set, Bases and sub-base, subspaces and relative topology, Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighborhoods systems.

Continuous functions and Homeomorphism.

Separation axioms, T_0, T_1, T_2, T_3, $T_{31/2}$, T_4 spaces, their characterization and basic properties.

First and second countable countable spaces, Lindelof's theorems, Separable Spaces, Second Countability and Separability, Uryshohn's lemma and Tietz Extension Theorem.

REFERENCES:

1. G.F. Simmons: Introduction to Topology and Modern Analysis, McGraw -Hill
2. J.N .Sharma: Topology, Krishna PrakashanMandir, Meerut
3. M.J.Mansfield: Introduction to Topology. **Van Nostrand. Princeton, New Jersey, I963**
4. Jame R. Munkres: Topology, A First Couse. **Prentice Hall, Incorporated, 1974**
5. K.D.Joshi: Introduction to General Topology , New Age International(P) Ltd. New Delhi.
6. JDugundji. Topology. Boston: Allyn and Bacon, 1966. [OP]
7. B.Mendelson: Introduction to Topology,**Dover Publications, 1990**.

SEMESTER-I
PAPER- IV
COMPLEX ANALYSIS– I

Complex Integration, Cauchy-Goursat Theorem, Cauchy's integral Formula, Higher order derivatives.

Morera's theorem, Cauchy inequality and Liouville theorem,the fundamental theorem of Algebra, Taylor's theorem, Maximum modulus principle.

Laurent's series isolated singularities.

Meromorphic functions,Scwartz lemma,the Argument principle,Rouche's theorem Inverse function theorem.

Residues, Cauchy's residue theorem, Evaluation of integrals, Branches of many values functions with special references to argz,logz. And z^8.

Bilinear transformations, their properties and classification, Definitions and examples of conformal mappings.

REFERENCES:-

1. J.B. Convay : Functions of one complex variable. Springer-Verlag international student Edition.Narosa.publishing House. 1980.
2. D. Sarason : Complex Function theory. Hindustan Book Agency. Delhi 1994.
3. S.Ponnusamy : Foundation of complex Analysis. Narosa publishing house 1997.
4. J.N. Sharma.: Functions of a complex variable , Krishna PrakashanMandir, Meerut
5. B.S.Tyagi: Functions of a Complex Variable, KedarNath Ram NathPrakashan, Meerut ,1981.

SEMESTER-I
PAPER-V
ADVANCED DISCRETE MATHEMATICS- I

Formal logic- Statement and Notation, Connectives– Negation, Conjunction, Disjunction, Truth Table, Conditional and Biconditional statement, well-formed formula, Tautology, Equivalent formula, Duality and functionally complete set of connectives, two state devices and statement logic, Normal form, Principle conjunctive and Principle Disjunctive Normal forms, The theory of interface for the statement calculus, Rules of Interface, Automatic Theorem proving, the predicate calculus, Quantifiers, Rules of Interface, Free and Bound variables, Interface theory of predicate calculus, valid formulas over finite universe, valid formulas involving quantifiers, formulas involving more than one quantifiers.

Algebraic Structure - Algrebraic system, Semigroups and Monoids (including those pertaining to concatenation operation), Homomorphism of semigroup and SubMonoids. Direct products, Basic Homomorphism theorem.

Lattices - Lattices as partially ordered sets and their properties. Lattices as Algebraic systems, Sub lattices, directproducts and homomorphism, Complete, Complemented and Distributive Lattice

Boolean Algebra- Boolean Algebras as lattices, Various Boolean Identities, The switching Algebra, example, Subalgebras, Direct products and Homomorphism, Join-irrecducible elements, Atoms and min-terms, Boolean forms and their Equivalence,Minterm Boolean forms, Sum of products, canonical forms, Minimization of Boolean functions Application of Boolean Algebra to Switching theory (Using AND, OR, NOT gates) The Karnaugh Map Method.

REFERENCES:

1. J.P. Tremblay & R. Manohar:.Discrete Mathematical structure with application to computer sciences.McGraw Hill Book Co. 1997.
2. Seymour Lepschutz.: Finite Mathematics (International edition 1993) McGraw Hill Book Co. New York.
3. N. Deo: Graph Theory with applications to Engineering and Computer Sciences. Prentice Hall of India.
4. S. Wiitala: Discrete Mathematics - A unified approach McGraw Hill Book Co. New York.
5. C.L. Liu: Elements of Discrete mathematics. McGraw Hill Book Col.
6. M.K.Gupta: Discrete Mathematics, Krishna Prakashan Mandir (P) Ltd., Meerut.

SEMESTER-II
PAPER-I
ADVANCED ABSTRACT ALGEBRA-II

Modules and Vector Space - Definition and examples of sub-modules, Quotient modules, Direct sum, Modules generated by a set R, Homomorphism of modules, Isomorphism Theorem, exact sequence of modules, short exact sequence Cyclic Modules, Semi Simple Modules, Simple Modules, Schure's Lemma, Free Modules, Representation of Linear mapping, Rank of Linear mapping, Rank Nullity Theorem.

Field Theory - Extension field, Algebraic and transcendental extensions, Separable and inseparable extensions, Normal extension, Perfect fields, Finite fields, Primitive element, algebraically closed fields, Automorphisms of extensions, Galois extensions, fundamental theorem of Galois Theory.

Noetherian and Artinian modules and rings, Hilbert basis theorem, Wedderburn – Artin theorem.

REFERENCES:

1.P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra (2nd Ed.), Cambridge University Press, Indian Edition, 1997

2. I.S. Luther and I.B.S. Passi, Algebra: Vol. I - Groups, Narosa Publishing House, 1996.

3. Surjeet Singh and QuaziZameeruddin: Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.

4. N. Jacobson: Basic Algebra: Vols. I & II, Hindustan Publishing Company, 1980.

5. S. Lang: Algebra, 3rd Edition, Addison-Wesley, 1993.

SEMESTER-II
PAPER-II
REAL ANALYSIS-II

Measurablesets-Lebesgue outer measure, Lebesgue measure, Properties of measurable sets,Borel sets and their measurability characterization of measurable sets, Non measurable set

Measurable functions- Definition and properties, Simple, Step and characteristics function, Continuous function, sets of measure Zero, Sequence of functions, Egoroff's Convergence in measure, Riesz theorem.

Lebesgue Integral- Lebesgue integral of a bounded function, Comparison of Riemann integral and Lebesgue integral, Bounded Convergence Theorem, Integral of non-negative measureable function, Fatou's Lemma, Monotone convergence theorem, General Lebesgue integral, Lebesgue dominated convergence theorem.

Differentation and integration- Dini derivatives, Differentation of monotone functions, Lebesgue theorem, Function of bounded variation, Differentation of an integral, Lebesgue integral, Lebesgue sets, Absolutely Continuous Functions, Integral of the derivatives.

LebesgueL^p spaces- The classes L^p, Holder and Minikowski inequalities, L^pBanach Spaces, Convergences in the mean.

REFERENCES:

[1] Walter Rudin:Principles of Mathematical Analysis' (3re edition) McGraw Hill, Kogakusha, 1976, International student edition.

[2] P.K. Jain and V.P. Gupta: Lebesgue Measure and Integration, New age International (P) Limited published, New Delhi 1986 (Reprint 2000).

SEMESTER-II
PAPER-III
TOPOLOGY-II

Compactness - Basic properties of compactness.
Continuous functions and compact sets, compactness and Finite Intersection Property, Sequentially and Countably compact sets, Local compactness in Metric space Equivalence of compactness, countable compactness and sequential compactness in metric space.
Connected spaces, connectedness on the real line, Components, Locally connected spaces, totally disconnected spaces.
Nets – Topology and convergence of Nets, Hausdorffness and nets ,Filters and their convergence, ultra filters.
Tychonoff product topology in terms of standard sub-base and its characterization, Projection Maps.
Connectedness and product space, Compactness and product space (Tychonoff"s theorem)

REFERENCES:

1. G.F. Simmons :Introduction to Topology and Modern Analysis, McGraw -Hill
2. J.N .Sharma: Topology, Krishna PrakashanMandir, Meerut
3. M.J.Mansfield: Introduction to Topology. **Van Nostrand. Princeton, New Jersey, I963**
4. Jame R. Munkres: Topology, A First Couse. **Prentice Hall, Incorporated, 1974**
5. K.D.Joshi: Introduction to General Topology , New Age International(P) Ltd. New Delhi.
6. JDugundji. Topology. Boston: Allyn and Bacon, 1966. [OP]
7. B.Mendelson: Introduction to Topology,**Dover Publications, 1990**.

SEMESTER-II
PAPER-IV
COMPLEX ANALYSIS-II

Entire Functions- Weierstress factorization theorem Gamma function and its properties, Riemann Zeta function, Riemann's functional equation,Runge's theorem,MittagLeffler's theorem.

Analytic continuation ,uniqueness of direct analytic continuation, Uniqueness of analytic continuation along curve, Power series method of analytic continuation, Schwartz's Reflection Principle.

Monodromy theorem and it consequences.

Canonical product, Jensen's formula, Poisson– Jenson Formula, Hadamard's three circles theorem, Order of and entire function.

Exponent of convergence,Borel's theorem,Hadamard's factorization theorem.

The range of and analytic function, Bloch's theorem,Thelittle Picard theorem.

Schottky's theorem, Montel Caratheodory and the Great Picard theorem.

Univarient functions, Bieberbach's conjecture (statement only) and the "1/4 – theorem".

REFERENCES:-

1. J.B. Convay : Functions of one complex variable. Springer-Verlag international student Edition.Narosa.publishing House. 1980.
2. D. Sarason : Complex Function theory. Hindustan Book Agency. Delhi 1994.
3. S.Ponnusamy : Foundation of complex Analysis. Narosa publishing house 1997.
4. J.N. Sharma.: Functions of a complex variable , Krishna PrakashanMandir, Meerut
5. B.S.Tyagi: Functions of a Complex Variable, KedarNath Ram NathPrakashan, Meerut ,1981.

SEMESTER-II
PAPER-V
ADVANCE DISCRETE MATHEMATICS-II

Grammar and Language- Phase structure grammar, Rewriting Rules, Derivation, sentential forms, context-sensitive context, Free and Regular grammars and language, Notion of syntax, Analysis, Polish Notation, Conversion of Infix experience to Polish Notation, The Rename Polish Notation.

Introductory Computability Theory- Finite state Machines and their Transition, Table diagrams, Equivalence of Finite state Machines, reduced machines, Homomorphism Finite automata, and equivalence of its power to that of Deterministic finite automata, Moore and Mealy Machines, Turing machines and partial recursive functions.

Graph Theory- Definition of (undirected) graph, paths, Circuits Cycles & Sub graphs, Induced Sub graphs, Degree of a vertex, Connectivity, Planar Graphs and their properties, Trees, Euler's Formula for connected planner Graphs. Complete and complete Bipartite graphs, Kuratowski's Theorem(statement only), and it's use, Spanning trees. Cut sets. Fundamental cut sets and cycles, Minimal spanning trees. Matrix representation of graphs, Euler's theorem on the Existence of Eulerian Paths, and circuit, Directed Graphs, In degree and out degree of a vertex, Weighted undirected Graphs.

REFERENCES:

1. J.P. Tremblay & R. Manohar:.Discrete Mathematical structure with application to computer sciences.McGraw Hill Book Co. 1997.
2. Seymour Lepschutz.: Finite Mathematics (International edition 1993) McGraw Hill Book Co. New York.
3. N. Deo: Graph Theory with applications to Engineering and Computer Sciences. Prentice Hall of India.
4. S. Wiitala: Discrete Mathematics - A unified approach McGraw Hill Book Co. New York.
5. C.L. Liu: Elements of Discrete mathematics. McGraw Hill Book Col.
6. M.K.Gupta: Discrete Mathematics , Krishna PrakashanMandir(P) Ltd., Meerut.

SEMESTER-III
PAPER-I (COMPULSORY)
INTEGRATION THEORY AND FUNCTIONAL ANALYSIS-I

Signed measure, Hahn decomposition theorem, mutually singular measures, Radon-Nikodym theorem,Lebesgue decomposition,Riesz representation theorem, Extension theorem (Caratheodory)

Lebesgue-Stieltjesintegeal, product measures, Fubini's theorem,Tunnelle's theorem, Integral operator, Inner measure, Extension by set of measure zero, Caratheodory outer measure. Hausdorff measure,Differentiation and Integration, Decomposition into absolutely continuous and singular parts.

Baire sets, Baire measure, continuous functions with compact support, Regularity of measures on locally compact spaces.

REFERENCES:

1. H.L. Royden: Real Analysis, Macmillan Publishing Co. Inc., New York, 4th Edition, 1993.
2. B.Choudhary and Sudarsan Nanda: Functional Analysis with Applications Wiley EasternLtd., 1989
3. J.H. Williamson: Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962
4. P.R. Halmos: Measure Theory, Van Nostrand, Princeton, 1950.
5. T.G. Hawkins: Lebesgue's Theory of Integration: Its Origins and Development, Chelsea, New York,1979.
6. B.V.Limaye: Functional Analysis, Wiley Eastern Ltd.
7. G.de. Barra: Measure Theory & Integration, Wiley Eastern Ltd, 1981.
8. Walter Rudin: Real & Complex Analysis, Tata McGraw Hill Publishing. Company, New Delhi.
9. P.K.Jain ,O.P.Ahuja& Khalid Ahmad: Functional Analysis, New Age International (P)Ltd., New Delhi.
10.A.Siddiqui: Functional Analysis with Applications: Tata McGraw Hill Publishing Company, New Delhi.

SEMESTER-III
PAPER- II (Compulsory)
Partial Differential Equations, Mechanics & Gravitation-I

Partial Differential Equations

Laplace's Equation–Fundamental solution, Mean value formulae, Properties of Harmonic function, Green function, Energy method.

Heat Equation - Fundamental solution, Mean value formulae, Properties of solution, Energy method.

Wave Equation - Solutions by spherical means, Homogeneous equations, Energy method.

Non-linear first order PDE, complete integrals, Envelopes characteristics, Hamilton Jacobi equations (calculus of variations, Hamilton's ODE), Conservation Laws, Representation of solutions, Separation of variables.

Laplace and Fourier Transforms and their applications, Legendre Transform.

Attraction - Attraction of rod, disc, spherical shell and sphere, spherical shell of finite thickness.

Surface integral of normal attraction (Application &Guass's theorem) Laplace and Poisson equations, work done by self-attracting system.

REFERENCES:

1. D.Raisinghania: Ordinary and Partial Differential Equation, S.Chand , New Delhi.
2. Gupta, Kumar & Sharma: Classical - Mechanics**,** Pragati Prakashan,
3. S.L. Loney :An Elementary Treatise On Statics,University Press.
4. I.N. Sneddon: Partial Differential Equation , McGraw Hill Book Co.Ltd.
5. H.Goldstem: Classical Mechanics, Addition Wesley.
6. Narayan Chandra Rana&PramodSharad, Chandra Joag: Classical Mechanics. Tata McGraw-Hill Publishing Company, 1991.
7. B.D. Gupta &SatyaPrakash: Mechanics Relativity .PragatiPrakshan, Meerut.

SEMESTER-III
PAPER-III (OPTIONAL)
PROGRAMMING IN C (WITH ANSI FEATURES)-I

An overview of programming, Programming language, Classification- C Essentials Program Development Functions, Anatomy of a C Function, Variables and Constants, Expressions, Assignment Statements, Formatting Source Files, Continuation Character, The Pre-processor.

Scalar Data Types– Declarations, Different Types of Integers, Different kinds of Integer Constants, Floating- Point Types, Initialization, Mixing Types, Explicit Conversions-Casts, Enumeration Types, The Void Data Type,Typedefs, Finding the Address of an object Pointers.

Control Flow– Conditional Branching, The Switch Statement, Looping, Nested Loops, The break and continue Statements, The go to statement. Infinite Loops.

Operators and Expressions–Precedence and Associativity, Unary Plus and Minus operators, Binary arithmetic operators,Arithmetic assignment operators, Increment and Decrement Operators, Comma Operator, Relational Operators, Logical Operators, Bit-Manipulation Operators, Bitwise Assignment Operators, Cast Operator, Size of Operators, Conditional Operator, Memory Operators.

REFERENCES:

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Brian W. Kernighan & Dennis M. Ritohie: The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.
3. YashwantKanetkar: Let Us C, 8th Edison, B P B Publications 2007.
4. E. Balagurusamy: Programming in C (ANSI), 4th Edison, Tata Mac Graw Hill.

PRACTICAL

The break-up of marks for third Semester's Practical will be as under:			
Sr. No.	Argument	Maximum Marks	Minimum Passing Marks
1.	Lab Record (Internal Assessment)	6	
2.	Viva-voce (External Assessment)	9	
3.	Program Development and Execution (External Assessment)	15	
	Total Marks	**30**	**11**

SEMESTER-III
PAPER-IV (OPTIONAL)
FUZZY SETS AND THEIR APPLICATIONS-I

Fuzzy sets- Basic definitions α – cuts, Convex fuzzy sets, Basic operations on fuzzy sets, Types of fuzzy sets, properties of α – cuts, representation of fuzzy sets, First and Second decomposition theorem, Extension Principle for fuzzy sets, fuzzy complements, the two characterization theorems on fuzzy complementst-norms and t-conorms, Algebraic product and sum, bounded difference and sum, statements of characterization for t-norms and t-conorms, combination of operators.

Fuzzy Arithmetic- Fuzzy numbers, Arithmetic operations on fuzzy numbers, Lattices of fuzzy numbers, fuzzy equations.

Fuzzy Relations- Fuzzy relations on fuzzy sets, fuzzy binary relations and fuzzy equivalence relations, Fuzzy morphism, standard composition, sup i composition, inf-wi composition of fuzzy relations.

Fuzzy Relations Equations- Problem partitioning, solution methods, fuzzy relation equations based upon sup i composition and inf-wi composition, approximate solution.

REFERENCES:

1. G.J. Klir and B. Yuan: Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi
2. H.J. Zimmermann: Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi

SEMESTER-III
PAPER-V (OPTIONAL)
OPERATIONS RESEARCH-I

Operations Research and its Scope, Necessity of Operations Research in Industry ,Linear Programming-graphical method of solutions, Simplex Method, Theory of the Simplex Method, Two phase method, Big M method of solution to LPP, Duality in linear programming, Duality theorems, Dual Simplex method, Other Algorithms for Linear Programming-Dual Simplex Method.

Parametric Linear Programming, Upper Bound Technique, Interior Point Algorithm, Linear Goal Programming, Assignment Problems, Its mathematical formulation, Solution of assignment problems, Optimality test. Transportation Problems, Formulation of transportation problems, Solutions of Transportation problems, North-West corner method, least cost method, Vogel's approximation method, Test for optimality U-V method.

Network Analysis–shortest Path Problem, Minimum Spannig Tree Problem, Maximum Flow I Problem, Minimum Cost Flow Problem, Network simplex Method. Project Planning and Control I with PERT CPM.

REFERENCES:

1. F.S. Hillier and G.J. Ueberman: Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995 Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
2. G. Hadley: Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network flows, John Wiley I ' & Sons, New York, 1990.
5. H.A. Taha: Operations Researc~-An introduction, Macmillan Publishing Co., Inc., New Yark.
6. K. Swarup, P.K. Gupta and M. Mohan: Operations Research, Sultan Chand & Sons, N.Delhi.
7. S.S. Rao: Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.
8. P. K..Gupla and D.S. Hira, : Operations Research ,S. Chand & Co. Ltd., New Delhi.
9. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
10. S.D.Sharma: Operations Research, KedarNath Ram Nath Publication, Meerut.

SEMESTER-III
PAPER-VI (OPTIONAL)
FLUID MECHANICS-I

Kinematics- Lagrangian and Eulerian Methods, Equation of continuity, Stream lines, path lines, streak lines, velocity potential, Irrotational and rotational motions, Boundary surfaces, Vortex lines.

Equations of motion-Euler's dynamical Equations, Bernoulli's Equation of motion by flux method, Equations of motion under Impulsive forces, Principle of Energy for Incompressible fluids, Lagrange's Equations.

Motion in Two dimensions-Lagrange's stream function,Irrotational motion in two dimensions, Complex velocity Potential, sources, sinks, doublets and their Images, Use of conformal Transformation. TheMilne–Thomson Circle Theorem of Blasius.

Motionof Cylinders- Motion of a general, circular and coaxial cylinders, Circulation about a moving cylinder, Streaming and circulation about a fixed circular cylinder.

REFERENCES:

1. A.S.Ramsey: Atreatise on Hydrodynamics Part II, CBS Publication , Delhi
2. F.Choriton: Text book of Fluid Mechanics, CBS Publication , Delhi
3. L.D.Landan&E.M.Lipschitz : Fluid Mechanics , Pergaman Press.
4. R.K.Rathy: An Introduction to Fluid Dynamics, Oxford and IBH Company, New Delhi, 1976.

SEMESTER-III
PAPER- VII (OPTIONAL)
INFORMATION THEORY- I

Measure of Information –Axioms for a measure of uncertainty, The Shannon entropy and its properties, Joint and conditional entropies, Transformation and its properties, Some Intuitive properties of a measure of entropy–Symmetry, normalization, expansibility, boundedness, recursivity, maximality, stability, additivity, subadditivity, nonnegativity, continuity, branching etc and interconnection among them, Axiomatic characterization of the Shannon entropy due to Tverberg and Leo.

Information functions, the fundamental equation of Information, information function continuous at the origin, nonnegative bounded information functions, measurable information functions and entropy, The fundamental theorem of Information Theory and its strong and weak converses.

REFERENCES:

1. R.ASH: Information Theory , Inter science Publishers, New York, 1965.
2. F.M.REZA: An Introduction to Information Theory, McGraw Hill Book Company, Inc.,1961
3. J,Aczel and Z.Daroczy: On Measures of Information and their characterization, Academic Press, New York.

SEMESTER-III
PAPER-VIII (OPTIONAL)
FUNDAMENTALS OF COMPUTER SCIENCE-I

Object Oriented Programming – Classes and Scope, Nested Classes, Pointer, Class Members, Class Initialization, Assignment and Destruction, Overload functions and Operators, Templates including class templates, Class inheritance and sub-typing, multiple and virtual Inheritance.

Data Structures -Analysis of Algorithms, q, W,o,w notations; Lists, Stacks, and Queus. Sequential and linked representations, Trees: Binary tree – Search Tree Implementation, B-tree (concept only)Hasing–open and closed; Sorting Insertion sort, shell sort, quick sort, beap sort and their analysis.

REFERENCE:

1. S.B.Lipman, J.Lajoi: C++ Primer, Addition Wesey.
2. B.Stroustrup: The C++ Programming Language, Addition Wesey.
3. C.J.Date: Introduction to Database System, Addition Wesley.

SEMESTER-IV
PAPER-I (COMPULSORY)
INTEGRATION THEORY AND FUNCTIONAL ANALYSIS-II

Normed linear spaces,Banach space and examples, Quotient space of normed linear spaces and its completeness, equivalent norms,Riesz Lemma, basic properties of finite dimensional normed linear spaces and compactness, Weak convergence and bounded linear transformations, normed linear spaces of bounded transformations, dual spaces with examples.

Uniform boundedness theorem and some of its consequences, Open mapping and closed graph theorems, Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces, Reflexive spaces, Weak Sequential Compactness, Compact Operators, Solvability of linear equations in Banach spaces (Fredholm alternatives) The closed Range Theorem.

Inner product spaces, Hilbert spaces, Ortho-normal Sets, Bessel's inequality, Complete Ortho-normal sets and Parseval's identity,structure of Hilbert spaces, Projection theorem. Riesz representation theorem, Adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces, Self adjoint operators, Positive, Projection, normal and unitary operators.

REFERENCES:

1. H.L. Royden: Real Analysis, Macmillan Publishing Co. Inc., New York, 4th Edition, 1993.
2. B.Choudhary and Sudarsan Nanda: Functional Analysis with Applications Wiley EasternLtd., 1989
3. J.H. Williamson: Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962
4. P.R. Halmos: Measure Theory, Van Nostrand, Princeton, 1950.
5. T.G. Hawkins: Lebesgue's Theory of Integration: Its Origins and Development, Chelsea, New York, 1979.
6. B.V.Limaye: Functional Analysis, Wiley Eastern Ltd.
7. G.de. Barra: Measure Theory & Integration, Wiley Eastern Ltd, 1981.
8. Walter Rudin: Real & Complex Analysis, Tata McGraw Hill Publishing. Company, New Delhi.
9. P.K.Jain ,O.P.Ahuja& Khalid Ahmad: Functional Analysis, New Age International (P)Ltd., New Delhi.
10. A.Siddiqui: Functional Analysis with Applications: Tata McGraw Hill Publishing Company, New Delhi.

SEMESTER-IV
PAPER-II (COMPULSORY)
PARTIAL DIFFERENTIAL EQUATIONS, MECHANICS & GRAVITATION-II

Generalised co-ordinates,Holonomicand non-holonomicsystems,Scleronomic and Rheonomicsystem,Generalised Potentials.

Lagrange's equations of first kind,Lagrange's equations of second kind, Uniqueness of solution,Energy equation for conservation fields

Hamilton'svariable, Hamilton canonical equations, cyclic coordinates,Routh's equations.

Poisson's Bracket, Poisson's Identity, Jacobi-Poisson Theorem, Lagrange's Bracket, Motivating problems of calculus of variations, Shortest distance, Minimum surface of revolution,Brachistochrone problem, Isoperimetric problem, Geodesic, Fundamental lemma of calculus of variations, Euler's equation for one dependent function and its generalization to (i) independent functions, (ii) higher order derivatives, Conditional extremum under geometric constraints and under integral constraints.

Potential of rod, disc, spherical shell and sphere, spherical shell of finite thickness, Distributions for a given potential, Equipotential surfaces, Surface and solid harmonics. Surface density in terms of surface harmonics.

REFERENCES :

1. D.Raisinghania :Ordinary and Partial Differential Equation, S.Chand , New Delhi.
2. Gupta ,Kumar & Sharma: Classical - Mechanics, **PragatiPrakashan,**
3. S.L. Loney :An Elementary Treatise On Statics,University Press.
4. I.N. Sneddon: Partial Differential Equation , McGraw Hill Book Co.Ltd.
5. H.Goldstem: Classical Mechanics, Addition Wesley.
6. Narayan Chandra Rana&PramodSharad, Chandra Joag: Classical Mechanics. **Tata McGraw-Hill Publishing Company, 1991.**
7. B.D. Gupta &SatyaPrakash: Mechanics Relativity .PragatiPrakshan, Meerut.

SEMESTER-IV
PAPER- III (OPTIONAL)
PROGRAMMING IN C (WITH ANSI FEATURES)-II

Arrays–Declaring an Array, Array and Memory, Initializing Arrays, Encryption and Decryption

Storage Classes– Fixed vs. Automatic Duration, Scope, Global variables, The Register Specifier, ANSI rules for the syntax and Semantics of the storage – class keywords.

Pointers– Pointer Arithmetic, Passing Pointer as Function Arguments, Accessing Array Elements through Pointers, Passing Arrays as Function Arguments, Sorting Algorithms, Strings, Multidimensional Arrays, Arrays of Pointers, Pointers to Pointers.

Functions–Passing Arguments, Declarations and Calls, Pointers to Functions, Recursion, The main Function, Complex Declarations, The C Preprocessor–Macro Substitution, Conditional Compilation, Include Facility, Line Control.

Structures and Unions– Structures, Dynamic Memory Allocation, Linked Lists,Unions ,enumDeclarations

Input and Output– Streams, Buffering, The<Stdio.h>Header File, Error Handling, Opening and Closing a File, Reading and Writing Data, Selecting an I/O Method, Un-bufferedI/O Random Access, The standard library for Input/ Output.

REFERENCES:

1. Peter A. Darnell and Philip E. Margolis, C: A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Brian W. Kernighan & Dennis M. Ritohie: The C Programme Language, 2nd Edition (ANSI Features), Prentice Hall 1989.
3. YashwantKanetkar: Let Us C, 8th Edison, B P B Publications 2007.
4. E. Balagurusamy: Programming in C (ANSI), 4th Edison, Tata Mac Graw Hill.

PRACTICAL

The break-up of marks for third Semester's Practical will be as under:			
Sr. No.	Argument	Maximum Marks	Minimum Passing Marks
1.	Lab Record (Internal Assessment)	6	
2.	Viva-voce (External Assessment)	9	
3.	Program Development and Execution (External Assessment)	15	
Total Marks		**30**	**11**

SEMESTER-IV
PAPER- IV (OPTIONAL)
FUZZY SETS AND THEIR APPLICATIONS–II

Possibility Theorem- Fuzzy measures, evidence theory, possibility theory versus probability theory

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

Approximate reasoning-An overview of fuzzy expert systems, Fuzzy implications and their selection, Multi conditional approximate reasoning, the role of fuzzy relation equations

An introduction to fuzzy control- Fuzzy controllers, Fuzzy rule base, Fuzzy inference engine, Fuzzification, Defuzzification and various Defuzzification methods (the centre of area, the centre of maxima, and the mean of maxima methods.)

Decision Making in Fuzzy Environment-Individual decision making, Multi person decision making, Multi criteria decision making, Multistage decision making, Fuzzy ranking methods, Fuzzy linear programming

REFERENCES:

1. G.J. Klir and B. Yuan : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi
2. H.J. Zimmermann : Fuzzy Sets and Fuzzy logic, Prentice Hall of India New Delhi

SEMESTER- IV
PAPER-V (OPTIONAL)
OPERATION RESEARCH- II

Dynamic Programming– Deterministic and Probabilistic Dynamic programming
Game Theory– Two–Person, Zero-Sum Games, Games with Mixed Strategies, Graphical Solution, Solution by Linear Programming.
Integer Programming– Branch and Bound Technique.
Queueing system- Deterministic Queueing system, probability distribution in Queueing, classification of Queueing models, Poission Queueing system ((M/M/I): (∞/FIFO), (M/M/I): (/SIRO) (M/M/I): (N/FIFO)), Inventory control : The concept of EOQ, Deterministic inventory problem with no shortages.
Nonlinear Programming– One/ Multi-Variable Unconstrained Optimization, Kuhn-Tucker Conditions for Constrained Optimization, Quadratic Programming, Separable Programming, Convex Programming, Non-convex Programming.

REFERENCES:

1. F.S. Hillier and G.J. Ueberman: Introduction to Operations ResBareft (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995 Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
2. G. Hadley: Linear Programming, Narosa Publishing House, 1995.
3. G. Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network flows, John Wiley I ‘ & Sons, New York, 1990.
5. H.A. Taha: Operations Researc~-An introduction, Macmillan Publishing Co., Inc., New Yark.
6. K. Swarup, P.K. Gupta and M. Mohan: Operations Research, Sultan Chand & Sons, N.Delhi.
7. S.S. Rao: Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.
8. P. K..Gupla and D.S. Hira, : Operations Research ,S. Chand & Co. Ltd., N.Delhi.
9. N.S. Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
10. S.D.Sharma: Operations Research, KedarNath Ram Nath Publication, Meerut.

SEMESTER-IV
PAPER- VI (OPTIONAL)
FLUID MECHANICS- II

Motion of Elliptic Cylinder- Streaming Past a fixed Elliptic cylinder, Rotating Elliptic cylinder, Kinetic Energy, Circulation.

Motion in Three Dimensions- Motion of a sphere in a liquid at rest at in infinity, Liquid streaming Past a Fixed sphere, Concentric spheres, Equation of motion of a sphere, Stoke's stream function.

Vortex Motion- Vortex motion and its elementary properties, Kelvin's proof, Conservation of Velocity, Strength of a Vortex Tube, Rectilinear vortices with circular and elliptice section, Pressure distribution, Rankine Combine Vortex, Vortex Pair, Image of a vortex filament in a plane, Karman street.

Wave motion of an Ideal Fluid- Wave motion of an Ideal Fluid and its properties, Progressive waves on the surface of a Canal and Deep Canal, Standing waves, Energy of Progressive Waves, Reduction of Progressive waves to a steady motion, Capillary waves, Waves at an Interface with surface free, Long gravity waves, Group velocity, Paths of Particles.

REFERENCES:

1. A.S.Ramsey: Atreatise on Hydrodynamics Part II, CBS Publication , Delhi
2. F.Choriton: Text book of Fluid Mechanics, CBS Publication , Delhi
3. L.D.Landan&E.M.Lipschitz : Fluid Mechanics , Pergaman Press.
4. R.K.Rathy: An Introduction to Fluid Dynamics, Oxford and IBH Company, New Delhi, 1976.

SEMESTER-IV
PAPER- VII (Optional)
INFORMATION THEORY- II

Information Functions- The general solution of the fundamental equation of information, Derivations and their role in the study of information functions.

Continuous Channels- The time-discrete Gaussian channel. Uncertainty of an absolutely continuous random variable, the converse to the coding theorem for time–discrete Gaussian channel. The time-discrete Gaussian channel, Band limited channels.

Noiseless Coding- In-gradients of noiseless coding problem, uniquely decipherable codes, Necessary and Sufficient condition for the existence of instantaneous codes, Construction of optimal codes.

Discrete Memory less Channel- Classification of channels, Information processed by a channel, Calculation of channel capacity, Decoding schemes, the ideal observer.

REFERENCES:

1. R.ASH: Information Theory , Inter science Publishers, New York, 1965.
2. F.M.REZA: An Introduction to Information Theory, McGraw Hill Book Company, Inc.,1961
3. J,Aczel and Z.Daroczy: On Measures of Information and their characterization, Academic Press, New York

SEMESTER-IV
PAPER- VIII (OPTIONAL)
FUNDAMENTALS OF COMPUTER SCIENCE –II

Database System-Role of Database system, Database system Architecture, Introduction to Relational Algebra and Relational Circuits. SQL–Basic features, including views, Integrity contains, Database design–Normalization up to BCNF.

Operating System– User Interface, Processor Management, I/O Management Memory Management, Concurrently and Security, Network and Distributed System.

REFERENCES:

1. S.B. Lipman, J.Lajoi: C++ Primer, Addition Wesey.
2. B.Stroustrup: The C++ Programming Language, Addition Wesey.
3. C.J.Date: Introduction to Database System, Addition Wesley.