MATHEMATICS

There shall be three compulsory papers. Each paper of 50 marks is divided into five units and each unit carry equal marks.

B.Sc. Part-I MATHEMATICS PAPER - I ALGEBRA AND TRIGONOMETRY

- **UNIT-I** Elementary operations on matrices, Inverse of a matrix. Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristic equations of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.
- **UNIT-II** Application of matrices to a system of linear (both homogeneous and nonhomogeneous) equations. Theorems on consistency of a system of linear equations. Relation between the roots and coefficients of general polynomial equations in one variable. Transformation of equations. Descarte's rule of signs. Solutions of cubic equations (Cardons method), Biquadratic equation.
- UNIT-III Mappings, Equivalence relations and partitions. Congruence modulo n. Definition of a group with examples and simple properties. Subgroups, generation of groups, cyclic groups, coset decomposition, Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Normal subgroups. Quotient group, Permutation groups. Even and odd permutations. The alternating groups An. Cayley's theorem.
- **UNIT-IV** Homomorphism and Isomorphism of groups. The fundamental theorems of homomorphism. Introduction, properties and examples of rings, Subrings, Integral domain and fields Characteristic of a ring and Field.

TRIGONOMETRY :

UNIT-V De-Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions. Logarithm of a complex quantity. Expansion of trigonometrical functions. Gregory's series. Summation of series.

TEXT BOOK :

- 1. I.N. Herstein, Topies in Algebra, Wiley Eastern Ltd., New Delhi, 1975
- 2. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd.New Delhi, 2000.
- 3. Chandrika Prasad, Text-Book on Algebra and Theory of equations, Pothishala Private Ltd., Allahabad.
- 4. S.L. Loney, Plane Trigonometry Part II, Macmillan and Company, London.

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- 1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, First Course in linear Algebra, Wiley Eastern, New Delhi, 1983.
- 2. P.B. Bhattacharya, S.K.Jain and S.R. Nagpaul, Basic Abstract Algebra (2 edition), Cambridge University Press, Indian Edition, 1997.
- 3. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.
- 4. H.S. Hall and S.R. Knight, Higher Algebra, H.M. Publications, 1994.
- 5. R.S. Verma and K.S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahabad.



B.Sc. Part-I MATHEMATICS PAPER - II CALCULUS

DIFFERENTIAL CALCULUS :

- **UNIT-I** $\varepsilon \delta$ definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuties. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.
- **UNIT-II** Asymptotes. Curvature. Tests for concavity and convexity. Points of inflexion. Multiple points. Tracing of curves in cartesian and polar coordinates.

INTEGRAL CALCULUS:

UNIT-III Integration of transcendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution.

ORDINARY DIFFERENTIAL EQUATIONS :

- UNIT-IV Degree and order of a differential equation. Equations reducible to the linear form.
 Exact differential equations. First order higher degree equations solvable for x, y,
 p. Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations.
- **UNIT-V** Linear differential equations of second order. Transformation of the equation by changing the dependent variable/the independent variable. Method of variation of parameters. Ordinary simultaneous differential equations.

TEXT BOOK :

- 1. Gorakh Prasad, Differential Calculaus, Pothishala Private Ltd. Allahabad.
- 2. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. Allahabad.
- 3. D.A. Murray Introductory Course in Differential Equations, Orient Longman (India), 1976.

- 1. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
- 2. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's outline series, Schaum Publishing Co. New York.
- 3. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
- 4. P.K. Jain and S.K. Kaushik, An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
- 5. G.F. Simmons, Differential Equations, Tata Mc Graw Hill, 1972.
- 6. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentics Hall of India, 1961.
- 7. H.T.H. Piaggio, Elementary Treatise on Differential Equations and their Applications, C.B.S. Publishe & Distributors, Dehli, 1985.
- 8. W.E. Boyce and P.O. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 1986.
- 12. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley and Sons, 1999.

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B.Sc. Part-I MATHEMATICS PAPER - III VECTOR ANALYSIS AND GEOMETRY

VECTOR ANALYSIS :

- **UNIT-I** Scalar and vector product of three vectors. Product of four vectors. Reciprocal Vectors. Vector differentiation. Gradient, divergence and curl.
- **UNIT-II** Vector integration. Theorems of Gauss, Green, Stokes and problems based on these.
- **UNIT-III** General equation of second degree. Tracing of conics. System of conics. Confocal conics. Polar equation of a conic.
- **UNIT-IV** Sphere. Cone. Cylinder.
- **UNIT-V** Central Conicoids. Paraboloids. Plane sections of conicoids. Generating lines. Confocal Conicoids. Reduction of second degree equations.

TEXT BOOKS :

- 1. N. Saran and S.N. Nigam, Introduction to vector Analysis, Pothishala Pvt. Ltd. Allahabad.
- 2. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.
- 3. R.J.T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Machmillan India Ltd. 1994.

- 1. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
- 2. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
- 3. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley & Sons, 1999.
- 4. Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Co., New Delhi.
- 5. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, london.
- 6. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of two Dimensions, Wiley Eastern Ltd., 1994.
- 7. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of three Dimensions, Wiley Eastern Ltd., 1999.
- 8. N. Saran and R.S. Gupta, Analytical Geometry of three Dimensions, Pothishala Pvt. Ltd. Allahabad.



MATHEMATICS

There shall be three compulsory papers. Each paper of 50 marks is divided into five units and each unit carry equal marks.

B.Sc. Part-II Paper-I ADVANCED CALCULUS

- UNIT-I Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests, Cauchy's integral test, Ratio tests, Raabe's, Logarithmic, De Morgan and Bertrand's tests. Alternating series, Leibnitz's theorem. Absolute and conditional convergence.
- UNIT-II Continuity, Sequential continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders.
- UNIT-III Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Jacobians.
- UNIT-IV Envelopes, evolutes. Maxima, minima and saddle points of functions of two variables. Lagrange's multiplier method.
- UNIT-V Beta and Gamma functions, Double and triple integrals, Dirichlet's integrals, Change of order of integration in double integrals.

- 1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
- 2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
- 3. R.R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
- 4. D. Soma Sundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
- 5. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
- 6. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- 7. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
- 8. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 9. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
- 10. O.E. Stanaitis, An Introduction to Sequences, Series and Improper Integrals, Holden-Dey, Inc., San Francisco, California.
- 11. Earl D. Rainville, Infinite Series, The Macmillan Company, New York.
- 12. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- 13. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
- 14. Shanti Narayan, A Course of Mathematical Analysis, S.Chand and Company, New Delhi.



B.Sc. Part-II Paper-II DIFFERENTIAL EQUATIONS

- UNIT-I Series solutions of differential equations- Power series method, Bessel and Legendre functions and their properties-convergence, recurrence and generating relations, Orthogonality of functions, Sturm-Liouville problem, Orthogonality of eigen-functions, Reality of eigen values, Orthogonality of Bessel functions and Legendre polynomials.
- UNIT-II Laplace Transformation- Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using the Laplace transformation.
- UNIT-III Partial differential equations of the first order. Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.
- UNIT-IV Partial differential equations of second and higher orders, Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.
- UNIT-V Calculus of Variations- Variational problems with fixed boundaries- Euler's equation for functionals containing first order derivative and one independent variable, Extemals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form, invariance of Euler's equation under coordinates transformation.

Variational Problems with Moving Boundaries- Functionals dependent on one and two functions, One sided variations.

Sufficient conditions for an Extremum- Jacobi and Legendre conditions, Second Variation. Variational principle of least action.

- 1. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
- 2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967.
- 3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London.
- 4. Lan N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
- 5. Francis B. Hilderbrand, Advanced Calculus for Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
- 6. Jane Cronin, Differential equations, Marcel Dekkar, 1994.
- 7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Company, 1972.
- 8. Richard Bronson, Theory and Problems of Differential Equations, McGraw-Hill, Inc., 1973.
- 9. A.S. Gupta, Calculus of variations with-Applications, Prentice-Hall of India, 1997.
- 10. R. Courant and D. Hilbert, Methods of Mathematical Physics, Vots. I & II, Wiley-Interscience, 1953.
- 11. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice-Hill, Englewood Cliffs (New Jersey), 1963.
- 12. A.M. Arthurs, Complementary Variational Principles, Clarendon Press, Oxford, 1970.
- 13. V. Kornkov, Variational Principles of Continuum Mechanics with Engineering Applications, Vol. I, Reidel Publ. : Dordrecht, Holland, 1985.
- 14. T. Oden and J.N. Reddy, Variational Methods in Theoretical Mechanics, Springer-Verlag, 1976.

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B.Sc. Part-II Paper-III MECHANICS

STATICS

- UNIT-I Analytical conditions of Equilibrium, Stable and unstable equilibrium. Virtual work, Catenary.
- UNIT-II Forces in three dimensions, Poinsot's central axis, Null lines and planes.

DYNAMICS

- UNIT-III Simple harmonic motion. Elastic strings. Velocities and accelerations along radial and transverse directions, Projectile, Central orbits.
- UNIT-IV Kepler's laws of motion, velocities and acceleration in tangential and normal directions, motion on smooth and rough plane curves.
- UNIT-V Motion in a resisting medium, motion of particles of varying mass, motion of a particle in three dimensions, acceleration in terms of different co-ordinate systems.

- 1. S.L. Loney, Statics, Macmillan and Company, London.
- 2. R.S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
- 3. S.L. Loney, An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.



MATHEMATIS

There shall be three theory papers. Two compulsory and one optional Each paper carrying 50 marks is divided into five units and each unit carry equal marks.

PAPER - I (Paper Code-0898) ANALYSIS

REAL ANALYSIS

- **UNIT-I** Series of arbitrary terms. Convergence, divergence and Oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions.
- **UNIT-II** Riemann integral. Intergrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Improper integrals and their convergence, Comparison tests. Abel's and Dirichlet's tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

COMPLEX ANALYSIS

UNIT-III Complex numbers as ordered pairs. Geometric representation of Complex numbers. Stereographic projection.Continuity and differentiability of Complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions. lementary functions. Mapping by elementary functions. Mobius transformations. Fixedpoints, Cross ratio. Inverse points and critical mappings. Conformal mappings.

METRIC SPACES

- **UNIT-IV** Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness, Cantor's intersection theorem. Contraction principle, Construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field.
- UNIT-V Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform Isometry homeomorphism. Equivalent continuity, and metrics. Compactness,Sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and compact sets. Connectedness, Components, Continuous functions and connected sets.

to Sit

- 1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
- 2. R.R. Goldberg, Real Analysis, Oxford & IBH publishing Co., New Delhi, 1970.
- 3. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
- 4. D. Somasundaram and B. Choudhary, A First Coarse in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
- 5. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co. New Delhi.
- 6. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
- R.v. Churchill & J.W. Brown, Complex Variables and Applications, 5*" Edition, McGraw-Hill, NewYork, 1990.
- 8. MarkJ. Ablowitz & A.S.Fokas, Complex Variables : Introduction and Applications, Cambridge University Press, South Asian Edition, 1998.
- 9. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.
- 10. E.t. Copson, Metric Spaces, Cambridge University Press, 1968.
- 11. P.K. Jain and K. Ahmad, Metric Spaces, Narosa Publishing House, New Delhi, 1996.
- 12. G.F. Simmons, Inroductin to Topology and Modern Analysis, McGraw-Hill, 1963.

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PART - II (Paper Code-0899) ABSTRACT ALGEBRA

- **UNIT-I**Group-Automorphisms, inner automorphism. Automorphism groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group. Center for Group of prime-order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups.
- **UNIT-II** Ring theory-Ring homomorphism. Ideals and Quotient Rings. Field of Quotients of an Integral Domain, Euclidean Rings, Polynomial Rings, Polynomials over the Rational Field. The Eisenstien Criterion, Polynomial Rings over Commutative Rings, Unique factorization domain. R unique factorisation domain implies so is R [x1, x2 xn] Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.
- **UNIT-III** Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces, Linear span. Linear dependence, independence and their basic properties.

Basis. Finite dimensional vector spaces. Existence theoremfor bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.

- **UNIT-IV** Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigenvalues and eigenvectors of a linear transformation. Diagonalisation. Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms.
- UNIT-V Inner Product Spaces-Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

to Sit

- 1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
- 2. N. Jacobson, Basic Algebra, Vols. I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
- 3. Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.
- 4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
- 5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2"" Edition) Cambridge University Press, Indian Edition, 1997.
- 6. K. Hoffman and R. Kunze, Linear Algebra, 2"" Editon, Prentice Hall. Englewood Cliffs, New Jersey, 1971.
- 7. S.K. Jain, A. Gunawardena & P.B. Bhattacharya, Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.
- 8. S. Kumaresan, Linear Algebra, A.Geometric Approach, Prentice-Hall of India, 2000.
- 9. Vivek Sahai and Vikas Bist, Algebra, Norosa Publishing House, 1997.
- I.S. Luther and I.B.S.Passi, Algebra, Vol. I-Groups, Vol. II-Rings. Narosa Publishing House (Vol. I-1996, Vol. II-1999)
- 11. D.S. Malik, J.N. Mordeson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill International Edition, 1997.

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PAPER - III - (OPTIONAL)

(I) PRINCIPLES OF COMPUTER SCIENCE (Paper Code-0900)

UNIT-IData Storage - Storage of bits. Main Memory. Mass Storage. Coding Information of Storage. The Binary System. Storing integers, storing fractions, communication errors. Data Manipulation - The Central Processing Unit. The Stored-Program Concept. Programme Execution. Other Architectures. Arithmetic/Logic Instructions. Computer-Peripheral Communication.

UNIT-II Operating System and Networks - The Evolution of Operating System. Operating System Architecture. Coordinating the Machine's Activities. Handling Competition Among Process. Networks. Networks Protocol.

Software Engineering - The Software Engineering Discipline. The Software Life Cycle. Modularity. Development Tools and Techniques. Documentation. Software Ownership and Liability.

UNIT-III Algorithms - The Concept of an Algorithm, Algorithm Representation. Algorithm

Discovery. Iterative Structures. Recursive Structures. Efficiency and Correctness.

(Algorithms to be implemented in C).

Programming Languages - Historical Perspective. Traditional

Programming Concepts, Program Units. Language Implementation. Parallel

Computing. Declarative Computing.

UNIT-IV Data Structures - Arrays. Lists. Stacks. Queues. Trees. Customised Data Types. Object Oriented Programming.

File Structure - Sequential Files. Text Files. Indexed Files. Hashed Files. The Role of The Operating System.

Database Structure - General Issues. The Layered Approach to Database Implementation. The Relational Model. Object-Oriented Database. Maintaining Database Integrity. E-R models.

UNIT-V Artifical Intelligence - Some Philosophical Issues. Image Analysis. Reasoning, Control System Activities. Using Heuristics. Artificial Neural Networks. Application of Artificial Intelligence.

Theory of Computation - Turning Machines. Computable functions. A Non computable Function. Complexity and its Measures. Problem Classification.

- 1. J. Glen Brookshear, Computer Science : An Overview, Addition Wesley.
- 2. Stanley B. Lippman, Josee Lojoie, C^{++} Primer (3rd Edition), Addison-Wesley.

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PAPER - III - (OPTIONAL) (II) DISCRETE MATHEMATICS (Paper Code-0901)

UNIT-ISets and Propositions - Cardinality. Mathematical Induction, Principle of Inclusion and exclusion.

Computability and Formal Languages - Ordered Sets. Languages. Phrase Structure Grammars. Types of Grammars and Languages. Permutations. Combinations and Discrete Probability.

- UNIT-II Relations and Functions Binary Relations, Equivalence Relations and Partitions. Partial Order Relations and Lattices. Chains and Antichains. Pigeon Hole Principle. Graphs and Planar Graphs Basic Terminology. Multigraphs. Weighted Graphs. Paths and Circuits. Shortest Paths. Eulerian Paths and Circuits. Travelling Salesman Problem. Planner Graphs. TREES.
- UNIT-III Finite State Machines Equivalent Machines. Finite State Machines as Language Recognizers. Analysis of Algorithms - Time Complexity. Complexity of Problems. Discrete Numeric Functions and Generating Functions.
- UNIT-IV1 Recurrence Relations and Recursive Algorithms Linear Recurrence Relations with Constant Coefficients. Homogeneous Solutions. Particular Solution. Total Solution. Solution by the Method of Generating Functions. Brief review of Groups and Rings.
- **UNIT-V Boolean Algebras -** Lattices and Algebraic Structures. Duality, Distributive and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions. Prepositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.

REFERENCES :

C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986.

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PAPER - III - (OPTIONAL)

(III) APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE (Paper Code-0902)

Application of Mathematics in Finance :

UNIT-I Financial Management - An overview. Nature and Scope of Financial Management.

Goals of Financial Management and main decisions of financial management. Difference between risk, speculation and gambling.

Time value of Money-Interest rate and discount rate. Present value and future valuediscrete case as well as continuous compounding case. Annuities and its kinds.

- UNIT-II Meaning of return. Return as Internal Rate of Return (IRR). Numerical Methods like Newton RaphsonMethod to calculate IRR. Measurement of returns under uncertainty situations. Meaning of risk. Difference between risk and uncertainty. Types of risks. Measurement of risk. Calculation of security and Portfolio Risk and Return-Markowitz Model. Sharpe's Single Index Model Systematic Risk and Unsystematic Risk.
- **UNIT-III** Taylor series and Bond Valuation. Calculation of Duration and Convexity of bonds. Financial Derivaties Futures. Forward. Swaps and Options. Call and Put Option. Call and Put Parity Theorem. Pricing of contingent claims through Arbitrage and Arbitrage Theorem.

Application of Mathematics in Insurance

- **UNIT-IV** Insurance Fundamentals Insurance defined. Meaning of loss. Chances of loss, peril, hazard, and proximate cause in insurance. Costs and benefits of insurance to the society and branches of insurance-life insurance and various types of general insurance. Insurable loss exposuresfeature of a loss that is ideal for insurance. Life Insurance Mathematics Construction of Mortality Tables. Computation of Premium of Life Insurance for a fixed duration and for the whole life.
- **UNIT-V** Determination of claims for General Insurance Using Poisson Distribution and Negative Binomial Distribution-the Polya Case.

Determination of the amount of Claims in General Insurance - Compound Aggregate claim model and its properties, and claims of reinsurance. Calculation of a compound claim density function. F-recursive and approximate formulae for F.

to Sit RJ

- 1. Aswath Damodaran, Corporate Finance Theory and Practice, John Wiley & Sons Inc.
- 2. John C. Hull, Options, Futures, and Other Derivatives, Prentice-Hall of Indian Private Limited.
- 3. Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.
- 4. Mark S. Dorfman, Introduction to Risk Management and Insurance, Prentice Hall, Englwood Cliffs, New Jersey.
- 5. C.D. Daykin, T. Pentikainen and M. Pesonen, Practical Risk Theoryfor Actuaries, Chapman & Hall.

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PAPER - III - (OPTIONAL)

Theory component will have maximum marks 30. Practical component will have maximum marks 20.

(IV) PROGRAMMING IN C AND NUMERICAL ANALYSIS (Thoury & Practical) (Paper Code-0903)

UNIT-IProgrammer's model of a computer. Algorithms. Flow Charts. Data Types. Arithmetic and input/output instructions. Decisions control structures. Decision statements. Logical and Conditional operators. Loop. Case control structures. Functions. Recursions. Preprocessors. Arrays. Puppetting of strings. Structures. Pointers. File formatting.

Numerical Analysis

- UNIT-II Solution of Equations : Bisection, Secant, Regula Falsi, Newton's Method, Roots of Polynomials : Interpolation : Lagrange and Hermite Interpolation, Divided Differences, Difference Schemes, Interpolation Formulasusing Differences. Numerical Differentiation. Numerical Quadrature : Newton-Cote's Formulas. Gauss Quadrature Formulas, Chebychev's Formulas.
- UNIT-III Linear Equations : Direct Methods for Solving. Systems of Linear Equations (Guass Elimination, LU Decomposition, Cholesky Decomposition), Iterative Methods (Jacobi, GaussSeidel, Relaxation Methods).

The Algebraic Eigenvalue problem : Jacobi's Method, Givens' Method, Householder's Method, Power Method, QR Method, Lanezos' Method.

- UNIT-IV Ordinary Differential Equations : Euler Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne-Simpson Method, Methods Based on Numerical Integration, Methods Based on Numerical Differentiation, Boundary Value Problems, Eigenvalue Problems.
 Approximation : Different Types of Approximation, Least Square Polynomial Approximation, Polynomial Approximation using Orthogonal Polynomials, Approximation with Trigonometric Functions, Exponential Functions, Chebychev Polynomials, Rational Functions.
- **Unit-V** Monte Carlo Methods Random number generation, congruential generators, statistical tests of pseudo-random numbers.

Random variate generation, inverse tranform method, composition method, acceptancerejection method, generation of exponential, normal variates, binomial and Poisson variates.

Monte Carlo integration, hit or miss Monte Carlo integration, Monte Carlo integration for improper integrals, error analysis for Monte Carlo integration.

to Sit By

- 1. Henry Mullish& Herbert L. Cooper, Spirit of C : An Introductionto Modern Programming, Jaico Publishers, Bombay.
- 2. B.W. Kernighan and D.M. Ritchie. The C Programming Language 2"d Edition, (ANSI features) Prentice Hall, 1989.
- 3. Peter A Darnel and Philip E. Margolis, C : A Software Engineering Approach, Narosa Publishing House, 1993.
- 4. Robert C. Hutehisonand Steven B. Just, Programming using C Language, McGraw Hill, 1988.
- 5. Les Hancock and Morris Krieger, The C Primer, McGraw Hill, 1988.
- 6. V. Rajaraman, Programming in C, Prentice Hall of India, 1994.
- 7. Byron S. Gottfried, Theory and Problems of Programming with C, tata McGraw-Hill Publishing Co. Ltd., 1998.
- 8. C.E. Froberg, Introduction to Numerical Analysis, (Second Edition), Addison-Wesley, 1979.
- 9. James B. Scarborough, Numerical Mathematical Anasysis, Oxford and IBHPublishing Co. Pvt. Ltd. 1966.
- 10. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan publishing Co., Inc. New York, 1982.
- 11. M.K. Jain, 'S.R.K. lyengar, R.K. Jain, Numerical Methods Problems and Solutions, New Age International (P) Ltd., 1996.
- 12. M.K. Jain, S.R.K. lyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
- 13. R.Y. Rubistein, Simulation and the Monte Carlo Methods, John Wiley, 1981.
- 14. D.J. Yakowitz Computational Probability and Simulation, Addison-Wesley, 1977.

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PAPER - III - (OPTIONAL) (IV) PRACTICAL

PROGRAMMING IN C AND NUMERICAL ANALYSIS LIST OF PRACTICAL TO BE CONDUCTED...

- 1. Write a program in C to find out the largest number of three integer numbers.
- 2. Write a program in C to accept monthly salary from the user, find and display income tax with the help of following rules :

Monthly Salary	Income Tax
9000 or more	40% of monthly salary
7500 or more	30% of monthly salary
7499 or less	20% of monthly salary

- 3. Write a program in C that reads a year and determine whether it is a leap year or not.
- 4. Write a program in C to calculate and print the first n terms of fibonacci series using looping statement.
- 5. Write a program in C that reads in a number and single digit. It determines whether the first number contains the digit or not.
- 6. Write a program in C to computes the roots of a quadratic equation using case statement.
- 7. Write a program in C to find out the largest number of four numbers using function.
- 8. Write a program in C to find the sum of all the digits of a given number using recursion.
- 9. Write a program in C to calculate the factorial of a given number using recursion.
- 10. Write a program in C to calculate and print the multiplication of given 2D matrices.
- 11. Write a program in C to check that whether given string palindrome or not.
- 12. Write a C function seriessum () to calculate the sum of series : $1+X+1/2! X^2+1/3! X^3+.... 1/n! X^n$
- 13. Write a program in C to determine the grade of all students in the class using Structure. Where structure having following members name, age, roll, sub 1, sub2, sub3, sub4 and total.
- 14. Write a program in C to copy one string to another using pointers. (Without using standard library functions).
- 15. Write a program in C to store the data of five students permanently in a data file using file handling.

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PAPER - III - (OPTIONAL) (V) MATHEMATICAL MODELLING (Paper Code-0904) The Process of Applied mathematics.

- **UNIT-I** Setting up first-order differential equations Qualitative solution sketching. Difference and differential equation growth models.
- **UNIT-II** Single-species population models. Population growth-An age structure model. The spread of Technological innovation.
- **UNIT-III** Higher-order linear models- A model for the detection of diabetes. Combat modes.

Traffic models - Car-following models. Equilibrium speed distributions.

- **UNIT-IV** Nonlinear population growth models. Prey-Predator models. Epidemic growth models. Models from political science Proportional representation-cumulative voting, comparison voting.
- **UNIT-V** Applications in Ecological and Environmental subject areas- Urban waste water management planning.

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- 1. Differential equation models, Eds. Martin Braun, C.S. Coleman, D.A. Drew.
- 2. Political and Related Models, Steven. J. Brams, W.F. Lucas, P.D. Straftin (Eds.)
- 3. Discrete and System models, W.F. Lucas, F.S. Roberts, R.M. Thrall.
- 4. Life Science Models, H.M. Roberts & M. Thompson.

All volumes published as modules in applied Mathematics, Springer-Verlag, 1982.

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