

प्रपत्र

विषय/संकाय/प्रश्नपत्र का नाम: **B.Sc. Part-I (Mathematics)**

Paper-I (Algebra and Trigonometry)

वर्तमान पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम का औचित्य
Unit-I Symmetric, Skew symmetric, Hermitian and skew hermitian, matrices. 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. Eigen values, Eigen vectors and the characteristic equations of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.	Unit-I Symmetric, Skew symmetric, Hermitian and skew hermitian, matrices. 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. Eigen values, Eigen vectors and the characteristic equations of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.	पाठ्यक्रम का वह भाग जो कक्षा-11 एवं 12 वी के पाठ्यक्रम में सम्मिलित हो चुका है, उसे हटाया गया है। इससे शेष भाग का विस्तार से अध्यापन कराया जा सकेगा।

प्रश्नपत्र का शेष भाग यथावत है।

Prof.H.K.Pathak

Prof.B.S.Thakur

Prof.M.A.Siddiqui

Dr.S.K.Bhatt

Dr.R.K.Mishra

Dr.A.K.Mishra

S.K.Gupta

Sangeeta Pandey

प्रपत्र

विषय/संकाय/प्रश्नपत्र का नाम: **B.Sc. Part-I (Mathematics)**

Paper-II (Calculus)

वर्तमान पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम का औचित्य
Unit-III Integration of irrational algebraic functions and transcendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution.	Unit-III Integration of irrational algebraic functions and transcendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution.	पाठ्यक्रम का वह भाग जो कक्षा-11 एवं 12 वी के पाठ्यक्रम में सम्मिलित हो चुका है, उसे हटाया गया है। इससे
Unit-IV Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations. Linear equations and 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-IV Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations. Linear equations and 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.	शेष भाग का विस्तार से अध्यापन कराया जा सकेगा।

प्रश्नपत्र का शेष भाग यथावत है।

प्रपत्र

विषय/संकाय/प्रश्नपत्र का नाम: **B.Sc. Part-I (Mathematics)**

Paper-III (VECTOR ANALYSIS AND GEOMETRY)

वर्तमान पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम का औचित्य
Unit-IV Plane the Straight line and the plane. Sphere. Cone. Cylinder.	Unit-IV Plane the Straight line and the plane. Sphere. Cone. Cylinder.	कक्षा-11 एवं 12 वी के पाठ्यक्रम में सम्मिलित हो चुका है, उसे हटाया गया है। इससे शेष भाग का विस्तार से अध्यापन कराया जा सकेगा।
प्रश्नपत्र का शेष भाग यथावत है।		

Prof.H.K.Pathak

Prof.B.S.Thakur

Prof.M.A.Siddiqui

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प्रपत्र

विषय/संकाय/प्रश्नपत्र का नाम: **B.Sc. Part-II (Mathematics)**

Paper-I (ADVANCED CALCULUS)

प्रश्नपत्र का पाठ्यक्रम यथावत है।

Paper-II (DIFFERENTIAL EQUATIONS)

प्रश्नपत्र का पाठ्यक्रम यथावत है।

Paper-III (MECHANICS)

प्रश्नपत्र का पाठ्यक्रम यथावत है।

Prof.H.K.Pathak

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विषय/संकाय/प्रश्नपत्र का नाम: **B.Sc. Part-III (Mathematics)**

Paper-III (Optional Papers)

वर्तमान पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम	नवीन संशोधित पाठ्यक्रम का औचित्य
(I) PRINCIPLES OF COMPUTER SCIENCE (II) DISCRETE MATHEMATICS (III) APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE (IV) PROGRAMMING IN C AND NUMERICAL ANALYSIS (V) MATHEMATICAL MODELLING	(I) PRINCIPLES OF COMPUTER SCIENCE (II) DISCRETE MATHEMATICS APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE (III) PROGRAMMING IN C AND NUMERICAL ANALYSIS MATHEMATICAL MODELLING	पूर्व में प्रचलित 5 वैकल्पिक प्रश्नपत्रों में से दो को अलोकप्रिय होने के कारण विलोपित किया गया है। विगत 10 वर्षों में किसी भी छात्र/छात्रा द्वारा उक्त प्रश्नपत्रों का चयन नहीं किया गया है।
प्रश्नपत्र का पाठ्यक्रम यथावत है।		

Prof.H.K.Pathak

Prof.B.S.Thakur

Prof.M.A.Siddiqui

Dr.S.K.Bhatt

Dr.R.K.Mishra

Dr.A.K.Mishra

S.K.Gupta

Sangeeta Pandey

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. Descartes's rule of signs. Solutions of cubic equations (Cardon's 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 A_n . 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, Topics 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.

REFERENCES :

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 $\epsilon - \delta$ definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. 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 Calculus, 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.

REFERENCES :

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. Dprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 1986.
12. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 1999.

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.

REFERENCES :

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 Kreyszig, 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.

REFERENCES :

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, Extremals, 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.

REFERENCES :

1. Erwin Kreyszig, 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, Vols. 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.

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.

REFERENCES :

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.

MATHEMATICS

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.

B.Sc. Part-III PAPER - I 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. Integrability 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' 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. Geometrical representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, 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 continuity, isometry and homeomorphism. Equivalent metrics. Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and Compact sets, Connectedness, Components, Continuous functions and Connected sets.

REFERENCES :

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 Course 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.
7. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw- Hill, New York, 1990.
8. Mark J. Ablowitz and 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, Introduction to Topology and Modern Analysis, McGraw-Hill, 1963.

B.Sc. Part-III
PART - II
ABSTRACT ALGEBRA

- UNIT-I** Group-Automorphisms, inner automorphism. Automorphism of 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 Eisenstein criterion, polynomial rings over commutative rings, Unique factorization domain. R unique factorisation domain implies so is $R[x_1, x_2, \dots, x_n]$. 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 theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary 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.

REFERENCES :

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 (2nd Edition) Cambridge University Press, Indian Edition, 1997.
6. K. Hoffman and R. Kunze, Linear Algebra, (2nd Edition), Prentice Hall. Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A. Gunawardena and 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, Narosa Publishing House, 1997.
10. 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.

B.Sc. Part-III
PAPER - III - (OPTIONAL)
(I) PRINCIPLES OF COMPUTER SCIENCE

- UNIT-I** **Data 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** **Artificial Intelligence** - Some Philosophical Issues. Image Analysis. Reasoning, Control System Activities. Using Heuristics. Artificial Neural Networks. Application of Artificial Intelligence.
Theory of Computation - Turing Machines. Computable functions. A Non computable Function. Complexity and its Measures. Problem Classification.

REFERENCES :

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

B.Sc. Part-III
PAPER - III - (OPTIONAL)
(II) DISCRETE MATHEMATICS

UNIT-I **Sets 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-IV **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. Propositional
Calculus. Design and Implementation of Digital Networks. Switching Circuits.

REFERENCES :

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

B.Sc. Part-III
PAPER - III - (OPTIONAL)
(III) PROGRAMMING IN C AND NUMERICAL ANALYSIS
(Theory & Practical)

Theory component will have maximum marks 30.

Practical component will have maximum marks 20.

UNIT-I Programmer'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. Puppeting 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 Formulas using 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 (Gauss 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, Lanczos' 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.

Monte Carlo Methods

Unit-V Random number generation, congruential generators, statistical tests of pseudo-random numbers. Random variate generation, inverse transform method, composition method, acceptance rejection 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.

REFERENCES :

1. Henry Mullish and Herbert L. Cooper, Spirit of C: An Introduction to Modern Programming, Jaico Publishers, Bombay.
2. B.W. Kernighan and D.M. Ritchie. The C Programming Language 2nd 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. Hutehison and 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 Analysis, 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. Iyengar, R.K. Jain, Numerical Methods Problems and Solutions, New Age International (P) Ltd., 1996.
12. M.K. Jain, S.R.K. Iyengar, 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.

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 Program in C to calculate the sum of series:

$$1 + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \dots + \frac{1}{n!}x^n$$

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, sub1, sub2, sub3, sub4 and total.
14. Write a program in C to copy one string to another using pointer. (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.