

POST GRADUATE PROGRAMME

1. At each of the Previous and Final Year Examination in a subject, a candidate must obtain for a pass (i) at least 36% marks of the aggregate marks in all the papers prescribed at the examination, and (ii) atleast 36% marks in practical, wherever prescribed, at the examination; provided that if a candidate fails to secure 25% marks in each individual paper of theory at any of the examination and also in the Dissertation; wherever prescribed, he/she shall be deemed to have failed at the examination, notwithstanding his/her having obtained the minimum percentage of marks required in the aggregate for the examination. Division will be awarded at the end of the Final Examination of the combined marks obtained at the Previous and the Final Examinations taken together as noted below. No Division will be awarded at the Previous Examination.

First Division : 60 Percent	} of the total aggregate marks of Previous and Final year taken together
Second Division: 48 Percent	
Third Division : 36 Percent	

Note : The candidate is required to pass separately in theory and practicals.

2. Dissertation may be offered by regular students only in lieu of one paper of Final Year Examination as prescribed in the syllabus of the subject concerned. Only such candidates will be permitted to offer dissertation who have secured atleast 50% marks in the aggregate at the previous examination.

Note: Dissertation shall be type-written and shall be submitted in triplicate, so as to reach the Controller of Examinations atleast two weeks before the commencement of Examination.

3. There shall be atleast eight theory in Post-Graduate Examination, 4 in Previous and 4 in Final year examinations of 100 marks each unless and otherwise prescribed. The non-credit papers wherever prescribed will remain as such. The marks of these non-credit papers will not be counted for division but passing in the same is compulsory.
4. Each theory paper will be of three hours duration.
5. Wherever practicals are prescribed the scheme will be included in the syllabus.
6. A candidate who has completed a regular course of study for one academic year and Passed M.A. / M.Sc./ M.Com. Previous Examination of the university shall be admitted to the Final Year

Examination for the degree of Master of Arts / Master Of Science / Master of Commerce provided that he / she has passed in atleast 50% of the papers at the previous examination by obtaining atleast 36% marks in each such paper.

- (a) For reckoning 50% of the papers at the previous examination, practical will be included and one practical will be counted as one paper.
 - (b) Where the number of papers prescribed at the previous examination is an odd number it shall be increased by one for the purpose of reckoning 50% of the paper.
 - (c) Where a candidate fails for want of securing minimum aggregate marks but secured 36% marks in atleast 50% of the papers, he/she will be exempted from re-appearing in those papers in which he/she has secured 36% marks.
 - (d) Where the candidate secures requisite minimum percentage in the aggregate of all the papers but fails for want of the requisite minimum percentage of marks prescribed for each individuals paper he/she shall be exempted from re-appearing in such paper (s) in which he / she has secured atleast 25% marks.
7. A candidate who has declared fail at the Final Year Examination for the degree of Master of Science / Arts, Commerce shall be exempted

from re-appearing in a subsequent year in the following papers :

- (a) Where a candidate fails for want of securing the minimum percentage in the aggregate marks, he/she shall be exempted from re-appearing in such paper (s) Practical (s). Dissertation in which he/she has secured atleast 36% marks; provided he/she is passing in atleast 55% of the papers. (Here passing in each paper requires 36% marks).
- (b) Where a candidate secures the minimum requisite including dissertation wherever prescribed but fails for want of minimum percentage of marks prescribed for in each individual paper / dissertation, he / she shall be exempted from reappearing in such paper (s) dissertation in which he/she has secured atleast 25% marks provided he/she is passing in atleast 50% of the paper (here passing in each paper requires 25% marks)

M.A. /M.Sc. MATHEMATICS (PREVIOUS) 2004 - 2005

All papers are compulsory:

		Max. Marks	Exm.Hrs.	Teaching Hrs./Week
Paper-I	Abstract Algebra	100 Marks	3 Hours	6 Hours
Paper-II	Real & Complex Analysis	100 Marks	3 Hours	6 Hours
Paper-III	Special Functions	100Marks	3 Hours	6 Hours
Paper-IV	Geometry	100 Marks	3 Hours	6 Hours
Paper-V	Mechanics	100 Marks	3 Hours	6 Hours

FINAL 2005 - 2006

Paper-I	Topology & Functional Analysis	100 Marks	3 Hours	6 Hours
Paper-II	Mathematical Methods	100 Marks	3 Hours	6 Hours

Optional Papers:

Any three of the following papers with the permission of the Head of the Department of Mathematics & Statistics.

Paper-III	Relativity	100 Marks	3 Hours	6 Hours
Paper-IV	Viscous Fluid Dynamics	100 Marks	3 Hours	6 Hours
Paper-V	Number Theory	100 Marks	3 Hours	6 Hours

Paper-VI	Discrete Mathematics	100 Marks	3 Hours	6 Hours
Paper-VII	Continum Mechanics	100 Marks	3 Hours	6 Hours
Paper-VIII	Statistical Mathematics	100 Marks	3 Hours	6 Hours
Paper-IX	Optimization Techniques	100 Marks	3 Hours	6 Hours
Paper-X	Compressible Fluids And Magneto Hydro Dynamics	100 Marks	3 Hours	6 Hours
Paper-XI	Module Theory	100 Marks	3 Hours	6 Hours
Paper-XII	Computer Programming	100 Marks	3 Hours	6 Hours
Paper-XIII	Advanced Topology	100 Marks	3 Hours	6 Hours
Paper-XIV	Astronomy	100 Marks	3 Hours	6 Hours
Paper-XV	Fourier Transforms and Theory of Distributions	100 Marks	3 Hours	6 Hours
Paper-XVI	Theory of Functions	100 Marks	3 Hours	6 Hours

M.A./M.Sc. PREVIOUS MATHEMATICS 2004-2005

Note : There will be five papers in all and all papers are compulsory. Each paper will be assigned six hours per week.

PAPER-I ABSTRACT ALGEBRA

Duration : 3 Hours

Max. Marks: 100

Note : The question paper will be divided into three sections A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 10 marks. The candidate will required to attempt five questions in all, taking one question from each unit (aggregating 50 marks).

Section C : In this section, four questions will be, set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Groups: Properties of normal sub-groups and quotient groups; Three isomorphism theorems in groups;. Automorphism and inner-automorphism in groups.

UNIT-II

Commutator subgroup, Centre of a group; Conjugate elements and the relation of conjugacy, Normalizer and class equation; Cauchy's theorem for abelian and non abelian groups , Sylow's three theorem and their easy applications; Direct products.

UNIT-III

Composition and refinement of a normal series; Zassenhaus lemma and Jordan Holder theorem; Nilpotent and Solvable groups with their properties; Structure of finite groups up to order eight. Rings and Fields: Three isomorphism theorems in rings.

UNIT-IV

Three Embedding theorems in rings, Prime and maximal ideals in commutative rings; Polynomial rings, divisibility in integral domain; Unique factorization and Euclidean domains.

UNIT -V

Principal ideal domain, Prime fields and Characteristic in rings and integral domain; sum, direct sum and Product of ideals; Extension of fields; simple, Algebraic; Normal and Seperable extensions; Perfect field, Splitting field; Galois theory of fields.

References Books :

1. Surjeet Singh & : Modern Algebra
Quazi Zameeruddin
2. I.N.Herstein : Topics in algebra
3. R.S.Agrawal : Algebra
4. Gokhroo, Saini : Advanced Abstract Algebra.

PAPER-II REAL AND COMPLEX ANALYSIS

Duration : 3 Hours

Max.Marks: 100

Note : The question paper will be divided into three sections A,B and C as follows.

Section A : In this section, ten questions will be set I taking two questions from each unit-Each question will be of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 10 marks. The candidate will required' to attempt five questions in all, taking one question from each unit (aggregating 50 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions (aggregating 40 marks).

UNIT-I

COMPLEX ANALYSIS : Complex numbers : The extended plane and its spherical representation; Analytical functions; Cauchy-Riemann equations ,

Power series including differentiation and integration within the circle of convergence; Conformal transformation; Linear, Bilinear, Exponential, Trigonometric and Joukowski's transformations.

UNIT-II

Riemann definition of integration; index of a point with respect to a closed curve and general form of Cauchy's integral formula; Simple connectivity; Cauchy's fundamental theorem; Cauchy's integral formula; Liouville's theorem; Morera's theorem; Taylor's theorem; Laurent's theorem; Poisson's integral formula; Maximum Modulus theorem; Rouché's theorem.

UNIT-III

Singularities, residues, Cauchy's theorem of residues and Evaluation of definite integrals.

Metric spaces: Examples and properties of a metric space; Open sphere (ball or neighborhood) Open sets, closed sets and the related results; Cauchy sequence and convergence; complete metric space; closed subspace and complete-ness, Cantor's Intersection theorem, Baire's category theorem.

UNIT-IV

Measure Theory: Outer measure of a subset of \mathbb{R} ; Lebesgue outer measure of a subset of \mathbb{R} , Existence, non-negativity and monotonicity of Lebesgue outer

measure; Relation between Lebesgue outer measure and length of an interval; Countable subadditivity of Lebesgue outer measure; translation invariance Lebesgue outer measure-, (Lebesgue) measurable sets (Lebesgue) measure; Complement, union, intersection and difference of measurable sets; denumerable union and intersection of measurable sets; countable additivity of measure; the class of measurable sets as a algebra the measure of the intersection of a decreasing sequence of measurable sets; some special classes of measurable sets, intervals, open sets, closed sets, Borel sets, F_σ and G_δ sets.

Measurable functions; Different equivalent definition of a measurable function; Scalar multiple, sum, difference and product of measurable functions of measurable function. Measurability of a continuous function and measurability of a continuous image of measurable function.

UNIT-V

Supremum, infimum, limit superior, limit inferior and limit of a sequence of measurable functions. Convergence pointwise and convergence in measures of a sequence of measurable functions. Lebesgue Integral; Characteristic function of a set; simple function; Lebesgue integral of a simple function; Lebesgue integral of a bounded measurable function; Lebesgue integral and Riemann integral of a bounded function defined on a closed interval; Lebesgue integral of a non-negative function; Lebesgue integral

of a measurable function; Properties of Lebesgue integral. Convergence Theorems and Lebesgue integral; The bounded convergence theorem; Fatou's Lemma; Monotone convergence theorem; Lebesgue convergence theorem.

References :

1. George F-Simmons : Introduction to Topology and Modern Analysis, McGraw Hill Book Co.
2. S.I.Hu : Elements of Real Analysis
3. H.L.Royden : Real Analysis.
4. G.N.Purohit : Lebesgue Measure and Integration.
5. E.G.Phillips : Functions of a complex variable.
6. E.T.Copson : An introduction to the Theory of functions of a complex variable.

**PAPER-III
SPECIAL FUNCTIONS**

Duration 3 Hours

Max. Marks: 100

Note : The question paper will be divided into three sections A, B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question be of short answer type not exceeding 20 words and carry 1 mark. The candidate will be required to attend all the questions (aggregating 10marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 10 marks. The candidate will required, to attempt five questions in all, taking one question from each unit (aggregating 25 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions (aggregating 40 marks).

UNIT-I

Gamma functions: The definition of Gamma function; the analytic character of gamma function; Tannery's theorem; Euler's limit formula for $\Gamma(z)$; Legendre's

duplication formula; Eulerian integral of the first kind; Euler's constant; canonical product for $\Gamma(z)$; definition of asymptotic expansions; Watson's lemma ; The asymptotic expansion of $\Gamma(z)$, asymptotic behaviour of $\Gamma(x+iy)$ when y is large; Gauss' multiplication theorem.

UNIT-II

Hypergeometric functions: Definitions of hypergeometric series and function; elementary properties of hypergeometric function; Integral formula for hypergeometric series; Linear transformations; continuous function relation; Linear relation between the solutions of hypergeometric differential equation; confluent. hypergeometric function and its simple and basic properties.

UNIT-III

Generalized Hypergeometric Functions: Definition, Convergence of the series for ${}_pF_q$., Differential equation and its solution, the ${}_pF_q$ with unit argument. Saalschütz theorem, Whipple theorem, Dixon's theorem, Barne's contour integral, Euler type integrals involving the ${}_pF_q$.

UNIT-IV

Legendre's Functions: Legendre's differential equation and associated Legendre's differential equations; Simple properties of Legendre's functions of first and second kind and the associated Legendre's function of integral order.

UNIT-V

Bessel functions; Generating function, Integral formulae, Recurrence relations; Addition formula and other, properties of Bessel functions. Classical Orthogonal Polynomials; Generating functions and other properties, associated with the Jacobi; Laguerre, Legendre and Hermite Polynomials.

Books recommended:

1. E.T.Copson : Introduction to Complex Variables.
2. Rainville, E.D. : Special Functions.
3. Sneddon, I.N. : Special Functions.
4. Goyal : Integral Transforms.

PAPER - IV GEOMETRY

Duration: 3 hours

Max. Marks: 100

Note : The question paper will be divided into three sections A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry I mark. The candidate will be required to attempt all the questions (aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 10 marks. The candidate will required to attempt five questions in all, taking one question from each unit (aggregating 50 marks).

Section C : In this section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions (aggregating 40 marks).

UNIT-I

The Axes of Plane Sections : Circular sections; Axes of central sections of a central conicoid; Axes of any section of a central conicoid; Axes of section of a paraboloid; Circular sections; Umblics..

UNIT-II

Generating Lines; The section of a surface by a tangent plane; Systems of generators of a central hyperboloid; Locus of the points of intersection of perpendicular, generators; The projection of generators; Generators' of the hyperbolic paraboloid.

Confocal Conicoids: The three confocals through a point;- Elliptic coordinates; confocal touching a given plane; confocal touching a given line; The parameter of the confocals through a point on a central conicoid; The normals; The self polar tetrahedron; The axes of an enveloping cone; The equation to the conicoid.

UNIT-III

Tensors; Transformation of coordinates; Contravariant and covariant vectors, second order tensors; Higher order tensors. Addition, subtraction and multiplication of tensors; Contraction; Quotient Law; symmetric and skew symmetric tensors: Conjugate symmetric tensors of the second order, Fundamental tensor; Associated tensors; Christoffel symbols; Transformation law of Christoffel symbols; Covariant differentiation of vectors and tensors.

UNIT-IV

Conoids; Equation to a conoid; surface in general; The degree of a surface; tangents and tangent planes; The inflexional tangents; the equations $\zeta=f(\xi,\eta)$. The indicatrix and representation by parameters. Curves

in space; Equation to a curve; The tangent and its direction cosines; The normal plane-, contact of a curve and surface; Osculating plane; Principal normal and binormal curvature; torsion; spherical indicatrices, frenet's formulae; signs of the curvature and torsion; formula for direction cosines of the principal normal and binormal; radius of torsion the relation $\sigma = + \eta \tan \alpha$ Circle of curvature; The osculating sphere and coordinates in terms of the arc.

UNIT-V

Envelopes: Envelopes of a system of surfaces with one parameter and its relation with characteristic; The edge of regression and its relation with characteristic; Envelope of a system of surfaces with two parameters and its relation with characteristic; skew and developable surface; Tangent plane to a ruled surface; Generators of developable surface; envelope of a plane with one parameter: criterion for $\zeta = f(\xi, \eta)$ to represent a developable surface and properties of a generator of a skew surface.

Curvature of surfaces; Curvature of normal sections through elliptic and hyperbolic points; Umblics; Curvature of an oblique section; radius of curvature of a given section through any point of a surface; Principal radii at a point of an ellipsoid: Lines of curvature of an ellipsoid, Lines of curvature on a developable surface; Normals to a surface at points of a line of a curvature; Lines of curvature on a surface of revolution, Principal radii and lines of curvature

through a point of the surface, determination of umblics; Curvature at points of a generator of a skew surface; The measure of curvature at a point and expressions for the measure of curvature, Curvilinear coordinates, Linear element principal radii and lines of curvature.

Books recommended

1. Robert, J.T.Bell : Coordinate Geometry of the three dimensions.
2. Bansal & Sharma : Differential Geometry.
3. B.Spain : Tensor Calculus.
4. J.L.Bansal : Tensor Analysis.

**PAPER - V
MECHANICS**

Duration : 3 hours

Max.Marks:100

Note: The question paper will be divided into three section A,B and C as follows:

Section A: In this section ten questions will be set taking two questions from each unit. Each question will be of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (aggregating 10 marks).

Section B In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 250 words or two and a half page. Each question will be of 10 marks. The candidate will required to attempt five questions in all, (aggregating 50 marks).

Section C: In this section. four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks) .

UNIT-I

Hydrodynamics: Lagrange's and Euler's Methods; Acceleration; Equation of Continuity; Boundary

surface; Stream lines, velocity potential. Euler's dynamical Equations, Bernoulli's Theorem; Lagrange's Equations under conservative forces; the motion once irrotational is always irrotational; Impulsive action.

UNIT-II

Central Orbit, Kepler's Law of Planetary motion. Rigid Dynamics: Moments and products of inertia, Principal axes theorem, Parallel axes, Momental ellipsoid, D'Alembert's principle and the equation of motion.

UNIT-III

Motion in two dimensions under finite forces including sliding and rolling friction; Impulsive motion in two dimensions.

UNIT-IV

Principle of momentum and energy; Lagrange's equations in generalized coordinates.

UNIT-V

Michelson-Morley experiment, Lorentz-Fitzgerald contraction, postulates of special theory of Relativity, Lorentz transformations, Mass - Energy formula, transformation formulas for momentum and energy. Minkowski's 4-dimensional continuum space, Spaces like and time like intervals, Relativistic Hamiltonian and Lagrangian.

Books Recommended :

1. S.L.Loney : Dynamics
2. A.S.Ramsay : Dynamics
3. A.S.Ramsay : A Text book of Hydrodynamics
4. M.Ray : Hydrodynamics
5. Gaur, Mathur & Goyal : Hydrodynamics
6. Bansal, Sharma & Goyal : Dynamics of a Rigid Body
7. Ray & Sharma : A Text Book of dynamics of a Rigid Body
8. M.Ray : Dynamics of a particle
9. Roy & Bali : Theory of Relativity

M.A./M.Sc. FINAL MATHEMATICS, 2005-2006

Note : There will be five papers in all. Paper-I: Topology and Functional Analysis and Paper-II: Mathematical Methods Will be compulsory. Each paper will be assigned six hours per week.

PAPER-I TOPOLOGY & FUNCTIONAL ANALYSIS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Topological spaces: open sets, Closed sets, Closure of a set, Limit point of a set, Derived set, Boundary of a set. Kuratowski's theorem, Open bases, Open sub-bases, second countable space, separable space, Lindelöf theorem, continuous functions in topological spaces, continuity in Metric spaces.

UNIT-II

Compact Topological spaces: Continuity and compactness, compactness and base, Compactness and subbase, Product of compact spaces, Tychonoff theorem compactness, sequentially compactness and Bolzano-Weierstrass Property and their equivalences in Metric spaces.

Separation Axioms: T_0 - space, T_1 - space, Hausdorff space, Regular and completely regular and normal spaces separation Axioms and compactness.

UNIT-III

Connectedness: Connectedness and continuity, Product of connected topological spaces, Components, connectedness in metric spaces.

Approximation: Weierstrass approximation theorem, function algebra, $C(X, \mathbb{R})$ and $C(X, \mathbb{C})$ The real Stone-Weierstrass theorem, Complex Stone-Weierstrass theorem.

UNIT-IV

Normed linear spaces; Banach spaces; Continuous linear transformations, Hahn-Banach theorem; the natural embedding of a normed linear space into its second conjugate, the open mapping theorem; the closed graph theorem, the uniform boundedness theorem.

UNIT-V

Hilbert spaces; Schwartz's inequality: orthogonal complements, Orthonormal sets, conjugate space, Riesz representation theorem, Adjoint of an operator, self adjoint operator, Normal operator, Matrix representation of a linear operator.

Books recommended

1. George F. Simmons : Introduction to Topology and modern analysis, McGraw Hill Book Co.
2. S.I.Hu : Elements of Real Analysis.
3. H.L.Royden : Real analysis.
4. W.J.Thron : Topological structure.
5. J.Kelley : General Topology.

PAPER-II
MATHEMATICAL METHODS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Integral Equations: Type of integral equations, the equations of first and second kind, solution of Fredholm's and Volterra's equation by the method of

substitution and successive approximations, method of resolvent kernels. Statement of Hadamard and Fredholm's three theorems and their applications.

UNIT-II

Calculus of Variations: Linear functionals, Minimal functional theorem, general variation of a function. Euler-Lagrange's equation, variational methods of boundary value problems in ordinary and partial differential equations.

UNIT-III

Laplace transforms: Introduction to Laplace transforms, simple rules of Laplace transforms, evaluation of direct and inverse transforms and their application to the solution of linear differential equations.

UNIT-IV

Partial differential Equations: Existence and uniqueness of solutions, second order partial differential equation, Boundary value problems and Green's function and Cauchy problem.

UNIT-V

Numerical Analysis: Eigen value and eigen vector, Problems of power method for finding all eigen pairs of a matrix complex eigen values. Numerical solution of ordinary differential equations: Taylor's series method, Euler's and modified Euler's methods,

RungaKutta method upto fourth order, Multistep method (Predictor-corrector strategies).

Books recommended:

1. Sastry, S.S. : An introduction to Numerical Analysis.
2. Scarborough, J.B. : Numerical Mathematical Methods.
3. Goel & Gupta : Numerical Analysis.
4. Raniville, E.D. : Laplace and Fourier Transforms
5. M. D. Raisingbania : Ordinary and Partial differential Equations.
6. Lowit : Linear Integral Equations.
7. Mallick : Finite differences and Numerical analysis
8. Savener : Finite difference and Numerical analysis
9. S.C.Saxena : Finite differences
10. M. Ray : Differential Equation.
11. Bansal, J.L. & : Differential Equations Vol.II.
12. Jain M.K. : Numerical Solutions of differential equation, Willey Eastern.
13. Jain, 1yenger : Numerical Analysis, Willey Eastern India.

OPTIONAL PAPERS

Any three of the following papers with the permission of the Head of the Department of mathematics & statistics.

**PAPER-III
RELATIVITY**

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A.B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Geodesics, Null Geodesics, Geodesics Coordinates, Equation of Geodesics for the given metric. Riemann christoffel tensors and its significance, Curvature tensor, Ricci-tensor, Bianchi Identity.

UNIT-II

Energy momentum tensor and its expression for perfect fluid. Principle of covariance, principle of equivalence, condition for flat space time, Newtonian approximation of relativistic equation of motion. Einstein field equations and its Newtonian approximation. Schwarzschild exterior and interior relations for gravitational field.

UNIT-III

Planetary orbit, Three crucial tests, Advance of perihelion, Gravitational. deflection of light, shift in spectral lines, Weyl postulates, Franhauser lines, Radar echo delay. Hubble law. Machs principle.

UNIT-IV

Static cosmological models of Einstein and De-Sitter, their derivation, properties and comparison with the actual universe, derivation of Robertson-Walker Metric. Hubble and Deceleration parameters. Redshift.

UNIT-V

Maxwell's equations in empty space, Energy momentum tensor for electromagnetic field, Einstein-

Maxwell equation in General Relativity, Reissner Nordstrom solution.

Books Recommended:

1. P.G.Bergman : Introduction to Theory of Relativity
2. J.L.Synge : Relativity, The special Theory
3. J.L.Synge : Relativity , the General Theory
4. B.Spain : Tensor Calculus
5. J.L.Bansal : Tensor Analysis
6. J.V.Narlikar : Lecture on general Relativity.
7. Ray & Bali : Theory of Relativity
8. B.F.Shutz : A first course in General Relativity.

PAPER - IV
VISCOUS FLUID DYNAMICS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Viscosity, Analysis of stress, Relation between stress and rate of strain, Navier-stokes equations and equation of energy in cartesian system of coordinates, vorticity and circulation. Reynolds law of similarity,

Physical importance of non-dimensional parameters, Raynolds number Froude numbers, Mach number, Prandtl number, Eckert number.

UNIT-II

Some exact solutions of Navier-stokes equations- steady, motion between parallel plates, Hagen poiseuille flow a circular pipe, flow between coaxial circular pipes, flow between two concentric rotating cylinders, Pulsatile flow between parallel surfaces, flow in convergent and divergent channels (Jaffery-Hamel flow), flow in the vicinity of stagnation point, unsteady motion of a plate.

UNIT-III

Theory of very slow motion of a sphere in viscous fluid Osceen's improvement of stoke's theory.

Boundary layer Theory: Boundary layer equations for two dimensional flow over a plane wall. Boundary layer on a flat plate (Blasius. Topper solution). Characteristic boundary layer parameters. similar solutions of the boundary layer equations.Exact solutions of the steady state boundary layer equation in two dimensional motion; Boundary layer along a flat plate.

UNIT-IV

Flow past a wedge, Flow past a convergent channel. Boundary layer seperation. Blasius series solution, Gortler, new series method. Prandtl-mises transfor-

mation, Axial symmetrical and three dimensional boundary layer:- Boundary layer on a Yawed cylinder. Approximate methods for the solution of the boundary layer equations Karman momentum integral equation, Karman-Pohlhausen method. Energy integral equations. Walz-Thwaites method based on energy integral equation.

UNIT-V

Thermal Boundary Layer in Two Dimension Flow

Thermal boundary layer equation for a plane wall. Forced convection in a laminar boundary layer on a flat plate (i) Crocco's first integral (ii) Reynold's analogy (iii) Crocco's second integral for $Pr = 1$. Free convection from a heated vertical plate : Thermal energy integral equation. Approximate solution of the Pohlhausen's problem of free convection from a heated vertical plate

Book & Recommended

1. G.Schlichting : Boundary Layer Theory.
2. S.I.Pai : Viscous Flow Theory, Vol.I
Laminar flow.
3. J.L.Bansal : Viscous Fluid Dynamics.
4. M.D. Raisinghania : Fluid Dynamics.
5. Shanti Swarup : Fluid Dynamics.

PAPER-V NUMBER THEORY

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Divisibility: Gcd and Lcm of two or more integers, Euclidean, algorithm, the linear diophantine equation $ax + by = c$. Prime Numbers: Prime Numbers, composite

numbers, infinitude of primes, fundamental theorem of arithmetic.

UNIT-II

Congruences: Basic properties, divisibility tests, linear congruences. Application of Congruences: Fermat's Little theorem, Euler's generalization, Wilson's theorem Chinese remainder theorem.

UNIT-III

Number Theoretic functions: T.J, and, Multiplicative functions, Mobius inversion formula, the greatest integer function. Primitive Roots and Indices: Primitive roots, characterization of natural numbers having primitive roots, theory of indices, solution of certain congruences; through indices.

UNIT-IV

Quadratic Residues: Quadratic residues and quadratic non residues of an integer in general and of a prime in particular, Gauss Lemma and its applications, the quadratic reciprocity law.

Special Numbers: Fibonacci numbers, Fermat's numbers, Perfect numbers.

UNIT-V

Diophantine Equations: Representation of integers as sums of 2,3 and 4 squares.

Continued Fractions: Finite and infinite continued fraction convergent of a given continued fraction and their properties, Uniqueness of a continued fraction Periodic continued fraction, Pell's equation in general, characterization of solutions of $x^2 - dy^2 = 1$ in terms of its smallest positive solution.

Books Recommended:

1. Donald M.Burton : Elementary Number Theory, Allyn and Bacon Inc. (1980).
2. Niven & H.S. Zuckerman : An Introduction to the Theory of Numbers. Willey eastern India Ltd.

PAPER-VI
DISCRETE MATHEMATICS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Propositional logic: Propositions, Logical operators identities and implication truth tables.

Predicate Calculus: Predicates, binding of individual variables, Qualitifiers and logical operators, Rules of

Inference. Methods of proof of arguments involving predicates and propositions, applications to the formal verifications of computer programme.

UNIT-II

Algebraic structures: Semigraphs, partially ordered sets, Harse diagrams, Lattice, complete lattices. Boolean algebra: Boolean algebra; Boolean expressions canonical forms simplification of Boolean functions, application to logic gates and digital circuits.

UNIT-III

Graph Theory: Definitions and elementary properties of graphs, Walks, Paths and circuits; connected and disconnected graphs, Eulerian and Hamiltonian graphs.

UNIT-IV

Trees; fundamental properties of trees distance and centers in a tree, Binary trees and their applications. Spanning tree and fundamental circuits, Minimal spanning trees, trees traversal algorithms, expression trees and parenthesis tree expressions.

UNIT-V

Planar Graphs, Kurtowskis's two graphs, different representations of a planar graphs, detection of planarity, geometrical and combinatorial duals.

Coloring of graphs, Chromatic number, chromatic partitioning, chromatic polynomial matchings and coverings. The four color problem.

Books Recommended :

1. D.F.stant and : Discrete Mathematics in
D.F Mc Alister Computer Science.
2. J.P. Tremblay & : Discrete Mathematical
R. Manohar structure with applications to
computer science.
3. Narsingh Deo : Graph Theory with application
to Engineering and computer
Science.
4. K.D. Joshi : Foundations of Discrete
Mathematics.
5. D.C. Ince : An Introduction to Discrete
Mathematics & Formal System
Specification.
6. C.L.Liu : Elements of Discrete
Mathematics.
7. Kenneth P. : Discrete mathematics.
Begut

**PAPER-VII
CONTINUUM MECHANICS**

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Cartesian tensors, index notation and transformation, law of cartesian tensors, addition, subtraction and multiplication of cartesian tensor, gradient of a scalar

function, divergence of a vector function and curl of a vector function using the index notation. The identity, Stocks Gauss and Green's theorem. The continuum approach classification of continuous media. Body forces and surface forces, components of stress tensor, force and moment equation of equilibrium.

UNIT-II

The stress quadric, Principal stresses and Principal axes, stress invariants and the stress deviator tensor, Maximum shearing stress. Lagrangian and Eulerian description of deformation of flow. The comoving derivative. Velocity and acceleration. The continuity equation.

UNIT-III

Strain tensors, the linear rotation tensor and rotation vector. Analysis of rotation displacement, Geometrical meaning of the components of the linear strain tensor, Principal axis theory for the linear strain tensor, Properties of linear strain tensors. The linear cubical dilation. Compatibility equations for the linear strain components. The rate of strain tensor and the vorticity tensor. The rate of rotation vector and vorticity. Properties of the rate of strain tensor.

UNIT-IV

Law of conservation of mass and Eulerian continuity equation. The momentum integral theorem and the equation of motion, Kinetic equation of state. the first

and second laws of thermodynamics and the dissipation functions.

Application: (linear elasticity): Assumptions and basic, equations, generalising Hook's law for an isotropic Homogeneous solid. capatibility equations. classifi-
cation of types of problems in linear elasticity. the principle of super position.

UNIT-V

The strain energy function, the uniqueness theorem P-L relationship and the work kinetic energy equation. Irrotational flow and the velocity potential, Kinetic equations of state and the first law of thermodynamics.

The equation of continuity. The equation of motion, vorticity-stream surfaces for inviscid flow, Bernoullis equations, Irrotational flow and the velocity potential, similarity parameters and fluid flow.

Books for References :

1. Q.Fredenic & T.S.Chang : Continuum mechanics: Allyn and Bacon, Inc, Boston.
2. Mase G.E. : Continuum Mechanics (Schaum Series).
3. Sommer Field A : Mechanics of Deformable bodies.
4. Mortone E.Gurtin:An Introduction to Continuum Mechanics (Academic Press).

PAPER-VIII
STATISTICAL MATHEMATICS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Elements of theory of probability; sample space, various definitions of probability, addition and multiplication laws of probability, conditional

probability and statistical independence of events. Baye's theorem and its applications. Mathematical expectations, conditional expectations, Moments and cumulants. moments generating and characteristic functions.

UNIT-II

Binomial, Negative-binomial, Poisson and Hypergeometric distributions Rectangular, Normal, Cauchy, Gamma and Beta distributions Elementary idea of Exponential and Laplace distributions.

UNIT-III

Inversion theorem. Chebyshev's inequality, control limit theorem for i.i.d. random variables. Curve fitting and principle of least squares, Scatter diagram, Linear regression and correlation.

UNIT-IV

Chi-square, t and F sampling distributions with derivations, properties and applications, large sample theory.

UNIT-V

Elements of theory of estimation: Point estimation, criterion of good estimators for one parameter;

Consistency, Efficiency, sufficiency and unbiasedness. Method of maximum likelihood estimation properties of maximum likelihood estimators (without proof). M.L.E. for Binomial, Poisson and Normal populations.

Interval estimation for mean and variance in case of Normal population.

Elements of testing of hypothesis: Two kinds of error in testing of hypothesis. critical region, Neyman-Pearson Lemma and determination of BCR in Neyman sense for testing simple v/s simple hypothesis in uniform and normal populations.

Note : Candidates who have offered Mathematical Statistics / Statistics / Applied Statistics as an optional subject / paper in their B.A./B.Sc. examination will not be permitted to offer this course.

Books recommended:

1. Gupta and Kapoor : Fundamentals of Mathematical Statistics.
2. Kapoor and Saxena : Mathematical Statistics.
3. Goon and Others : Outline of Statistical Theory, Vol. I, II.

**PAPER-IX
OPTIMIZATION TECHNIQUES**

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Dual simplex algorithm, Bounded value algorithm, Parametric linear Programming, sensitivity analysis, changes in the coefficients of the objective function,

changes in the components of vector b , variation in the components (aid) of the matrix A . Addition of the new variable, deletion of a variable, Addition of a new constraint. Deletion of constraint.

UNIT-II

Integer programming problem. All integer and mixed integer programming problems, Gomory's cutting plane methods (Fractional cut and λ -cut), Branch and bound method; Traveling salesman problem.

UNIT-III

Project scheduling through PERT and CPM, cost time, trade off, Resource leveling.

UNIT-IV

Quadratic forms, convex functions, Global and relative optimum of a function $f(x)$, Unconstrained extreme of differentiable functions, method of Lagrange multipliers for constrained extreme with equality constraints, convex programming problem. Lagrangian function and saddle point, Kuhn-Tucker theorem, Kuhn-Tucker conditions, Quadratic programming problem Wolfe's algorithms, Beale's algorithm.

UNIT-V

Dynamic Programming: Bellman's principle of optimality, multiple stage decision problem, characteristics of DPP. Solution of finite number of stages problems by Dynamic programming. Network

flow problems. Maximal flow, minimal cut theorems, shortest route problem.

Books Recommended :

- 1 . Operation Research : Kanti swaroop, Mak-Mohan, P.K.Gupta.
2. Operation Research : Hamdy A Taha
3. Operation Research : S.D.Sharna
4. Linear-Programming : S.I.Gass
5. Optimization Methods in Operations Research and systems analysis : K.V.Mittal

PAPER-X
COMPRESSIBLE FLUIDS AND MAGNETO
HYDRODYNAMICS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Thermodynamic concepts, ideal gases, Polytrophic gases, Differential equations of motion, Conservation

of energy; Isentropic flow; Subsonic and supersonic flow, circulation, Bernoulli's law, Lini speed and critical speed.

UNIT-II

Steady and non-steady flows, Steady isentropic channel flow, solution of the equation of steady flow methods of small perturbation linearised flows, Prandtl-Glauert motion, hodograph method, limiting line.

UNIT-III

Basic equations of electrodynamics of continuous media-Maxwell's equations, Constitutive equations, Ohm's law for moving media. electromagnetic body force, Coupled equations of electrodynamics and hydrodynamics, Conservation of mass momentum and energy.

Boundary condition, MHD approximation Magnetic pressure, similarity parameters and their significance, Frosen in fields, Magneto Hydrostatics and force free fields.

UNIT-IV

Steady MHD channel-flow problems-General equations and boundary conditions, Harlmann's and Poisseiulle flows, simple heat transfer problems, MHD waves Effect of Compressibility, Viscosity and finite conductivity, MHD shockwaves Stability problems-Stuart's and Lock's conditions, Chandrashekhar's contributions.

UNIT-V

Motion of charged particles in electromagnetic fields, Adiabatic invariants, Magnetic mirror and bottle, Pinches and their stability problems, applications of MHD to flowmetry, Power generation, MHD theories of sunspots and solar cycle, dynamo theories, elementary ideas of MHD boundary layers and turbulence.

Books recommended:

1. Millue Themson : Aero Dynamic
2. Sheroliff : Magneto-hydrodynamics
3. Sutton and Sherman : Engineering MHD
4. Cowling : Magneto-Hydrodynamics.
5. Ferraro and Plumpton : Magnet of Fluid mechanics.
6. Chandrasekhar : Hydrodynamics and Hydro-magnetics stability.

PAPER-XI MODULE THEORY

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Definition of module and elementary properties submodule, factor module; Direct product and direct sum; Isomorphism theorems; Composition series.

UNIT-II

Zassenhaus Lemma and Jordan Holder theorem in modules; Noetherian and Artinian modules; fittings lemma; indecomposable modules; Free modules; Ascending and Descending chain-conditions.

UNIT-III

Fundamental theorem of finitely-generated module over Euclidean rings. Prime ideals in commutative rings, Prime radical, Radical of a module, semi-primitive; Semi prime.

UNIT-IV

Prime and primary rings, subdirect product (sum) of rings; Primitive rings and faithful module, Jacobson radical; Completely reducible module.

UNIT-V

Injective module; character module; Essential extension; Structure theorem for semi simple rings with minimum condition and uniqueness theorems.

Books recommended

1. Lambek. J. : Lecture on rings & Modules (Chapter I & 2 up to page 36. and Chapter 3-page 51 to 64, Chapter 4 page 80 to 92.)
2. Jams, J.P. : Rings and Homology (Chapter 1 & 2).

PAPER-XII COMPUTER PROGRAMMING

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Information and Data concepts: Definition of information, and data categories, Features and levels of information, Number system in computers, classification of computers, elementary idea about

components, devices in a computer system, specification of a modern computer system.

Concept of Software: System and application of software, computer interpreters and assembler, Operating system, overview of DOG commands Overview of GUI and concept of windows, computer network and its uses, concepts of Internet, www, http, Telnet, e-mail.

UNIT-II

Programming languages, classification of programming languages, Generation of languages, steps in programme development, Problem identification, algorithms, flow charting, Program coding, testing & debugging. Fundamentals of C Programming: Overview of C, data types, constants and variables, operations and expressions, control constituents; If then-else and while. Type modifiers, Type casting.

UNIT-III

Arrays, functions, Basic I/O, Do-while, switch, Break and continue, exit() functions, Program design examples: Summation of set of numbers, generation of positive prime numbers, Generation of fibonacci sequences, finding kith smallest element, sorting by insertion of alphabets & numeric information.

Scope rules, functions: Parameters, Passing, call by value and reference functions with arrays, Recursion, Pointers, in G. file handling in C, C standard and header files.

UNIT-IV

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating point numbers, consequences of normalized floating point representation, computing pitfalls, errors in numbers, Binary representation of numbers.

Iterative Methods: The method of successive bisection, false position, Newton-Rapson iterative method, secant method, successive approximation, comparison of iterative methods, solution of polynomial equations, solution of simultaneous non linear equations.

UNIT-V

Solution of simultaneous algebraic equations: Gauss elimination method, Pivoting, Ill-conditioned equations, Gauss-Seidel iterative method and Algorithm, comparison of direct and iterative methods. Differentiation & Integration: formulae for numerical differentiation, Numerical integration Simpson's rule, errors in integration formulae algorithms for integration of tabulated function, algorithms for integrating known function, Gaussian quadrature formulae.

Numerical Solutions of differential equations: Eulers method. Taylor's series method, Runge Kutta method, Runge Kutta fourth order formulae, Higher order differential equations, Predictor-corrector method and its comparison with Runge Kutta methods.

Books Recommended:

1. Introduction Information Technology-Satish Jain, BPB Publication, Cannought Place, New Delhi.

2. Fundamentals of computers-V.Rajaraman PHI Ltd.
3. The c-Programming Language B.W.Kernyarn & D.M. Ritche- PHI Ltd.
4. Computer Programming inc.-Kanetekar-B.P.B. Publication, New Delhi.
5. Computer oriented Numerical Methods-V. Rajraman PHI Ltd.

Note:

1. Candidates who have offered Computer Programming/ Computer Science/ Computer Applications in B.A./B.Sc./M.C.A courses will not be allowed to offer this subject/paper in their M.A./ M.Sc. examination.
2. Only ten students will be allowed to offer this course on the basis of merit of M.A./M.Sc. Previous Mathematics examination.
3. Four hours will be given to theory and two hours will be given for practical per week. Practical will be based on theory paper.
4. Questions from Unit IV and V will be based on programming.
5. Ten marks will be allotted for file work and oral examination.
6. This course will run only after the necessary infrastructure facilities have been provided to the department.

PAPER-XIII ADVANCED TOPOLOGY

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Nets and filters: directed set, Net, Limit and cluster point of a net subnet, Filter, Base and sub-base of a filter limit and cluster point of filter, subfilter

Characterization of open sets; continuous functions; Hausdorff spaces and compact spaces in terms of nets and filters. The limited equivalence of nets and filters,

UNIT-II

Ultra filter, the various sets of necessary and sufficient conditions for a filter to be an ultrafilter, important results on ultra-filter. Embedding and metrization: Evaluation map. Meaning of embedding, Embedding lemma; Embedding theorem, meaning of metrization, Urysohn's Metrization theorem, Nagata-Smirnow Metrization theorem Compactification: Meaning of compactification. Alexandroff one point compactification, Stone-coach compactification.

UNIT-III

Paracompactness: Refinement, Locally and discrete Classes of subjects, Locally finite and discrete classes, Properties of these systems. Definition of a paracompact space, properties of paracompact space, the various definitions of paracompactness for a regular topological space and their equivalence, deductions from these of some simple sufficient conditions for paracompactness; behaviour of paracompact spaces with respect to products.

UNIT-IV

Uniform spaces: Uniformity, uniform spaces, Uniform topology and properties of uniformities. Uniformity of a topological space, equivalence of uniformity

and complete regularity. Uniform continuity, relation between uniform continuity and continuity. Product uniformity and topology induced by it, Cauchy filters in a uniform space and their properties, complete uniform spaces, relations between the completeness and the closedness of a sub-space of a uniform space, equivalence of the compactness of uniform space with its compactness and totally boundedness.

UNIT-V

Function space: Meanings of a function space, topology of pointwise convergence or point open topology, topology of compact convergence or compact open topology, topology of uniform convergence on compact spaces, relation between these three properties of Y which a space of functions from a set X to a top space Y possesses.

Books recommended :

1. Thron, W.J. : Topological Structure.
2. Pervin, V.J. : Foundations of General Topology.
3. Kelley; J. : General Topology.

**PAPER-XVII
ASTRONOMY**

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section, ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Spherical Trigonometry- Great and small circular spherical triangles and their properties, various spherical trigonometrical formula-Cosine, sine,

supplemental cosine, sine cosine, contingent, half of an angle and side Napier's analogies, Delambe's analogies, their identities formulae for, right angled triangles and their solutions.

Celestial sphere, diurnal motion, Hour angle rising and setting of stars motion of sun, Zenith distance and Azimuth, Twilight.

UNIT-II

Refraction: Laws, effect of refraction on sun rise and sun set, Simpson's Hypothesis, effect of refraction in right ascension and declination etc.

Time: Equation of time, seasons and their lengths, precession and Nutation and their effects on right ascension and declination, Planetary precession double stars.

UNIT-III

Aberration and its effect of longitude, latitude, right ascension and declination, position of apex, diurnal aberration and its effect in declination, right ascension and hour angle.

Parallax: shape of each, geocentric parallax, distance of Moon, Parallax in declination and Hour angle and geocentric parallax in zenith dist. azimuth, right ascension and declination annual parallax in longitude, and latitude, Parallactic angle and stellar parallax in right ascension and declination.

UNIT-IV

The meridian circle: the three errors, Besell's formula, correction for level and collimation error, total correction to the observed time of transit Kepler's Laws and planetary motion: Various definitions and laws, relation in elliptic motion, anomaly V in terms of eccentric anomaly, true anomaly V in terms of mean anomaly M , Euler's theorem.

UNIT-V

Planetary phenomena: Sidereal period and synodic period and their relation, elongation phases of moon, brightness, maximum brightness. Eclipses: Eclipses of moon angular radius of earth's shadow, duration of eclipses, the ecliptic limits, eclipses of sun and their limits, frequency of eclipse, the metonic cycle. Proper motions of stars and their relation, tangential velocity and parallax, radial velocity at different epochs, the solar motion and parallactic motion, determination of solar apex from proper motions.

Books Recommended :

1. Astronomy by Gorakh Prasad.
2. Astronomy by Smart.

PAPER-XV

FOURIER TRANSFORMS AND THEORY OF DISTRIBUTIONS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Fourier Transforms in $L^1(-\infty, \infty)$: Definition and simple properties, Riemann-Lebesgue lemma,

inversion formula. Analogues of Dini's and Jordan's tests for convergence-Derivatives and their transforms, Uniqueness of a fourier transform, summability theorems, Convolution of two functions and its transform. Analytic functions of Fourier transforms, Closures of translate in L and Wiener's theorem, closed maximal ideals of L.

UNIT-II

Fourier Transforms In $L^2(-\infty, \infty)$: Fourier plancherel transform, plancherel's theorems, Parseval's theorem, convolution and its transform, Convergence and summability, theorems 58 to 62 and 64 to 67 form E.C. Titchmarch's Book: Theory of Fourier Integrals.

UNIT-III

Generalizations of Wiener's Theorems: Books: The scope of the syllabus is indicated by R.R. Goldberg; Fourier Transforms; chapters by 2 to 4 together with the theorems cited above from Titchmarch's Book.

UNIT-IV

Fundamental sequences, distributions, distributions as a generalization of the notion of functions, Operations on distribution. Derivative of distributions, Locally integrable functions as distributions by functions, compositions, Equality of distributions in intervals, Functions with poles.

UNIT-V

Derivative as the limit of a difference quotient, the value of a distribution at a point, existence theorems for value of distributions, the value of a distribution in infinity.

The integral of a distribution, periodic distributions, distributions of infinite order.

Books Recommended :

1. Relevant topics form the book : Theory of distributions, The sequential approach by P. Antosik, J. Mikusinaki and R. Sikorski.
2. Elsevier Scientific Publishing Company, Amsterdam, Pwn-Scientific Publishers Warszawa, 1973.

PAPER - XVI
THEORY OF FUNCTIONS

Duration : 3 hours

Max. Marks: 100

Note : The question paper will be divided into three section A,B and C as follows:

Section A : In this section , ten questions will be set taking two questions, from each unit. Each question will be, of short answer type not exceeding 20 words and will carry 1 mark. The candidate will be required to attempt all the questions (Aggregating 10 marks).

Section B : In this section, ten questions will be set taking two questions from each unit. The answer of each will not exceed 2 words or two and a half page. Each question will be of 10 marks. The Candidate will be required to attempt five questions in all, (aggregating 50 marks).

Section C : In this, section, four questions will be set covering all the five units and whose answers shall not exceed 500 words or five pages each.. Each question may have sub-parts in it and will carry 20 marks. The candidate will be required to attempt any two questions. (aggregating 40 marks).

UNIT-I

Entire functions: The formula of F and R . Nevanlinna and Green's formula, Poisson-Joason formula Carleman's Theorem; The local theory of Integral functions, The zeros of $f(z)$. The function $T(r,f)$. The real part of $f(z)$.

UNIT-II

The maximum absolute value and order of an integral function. Hadamard's The circle theorem. Integral functions of Finite Order: The number of Zeros and points of an entire functions, sums of reciprocals. The exponent of convergence.

UNIT-III

The canonical product. Weierstrass's Primary factors, Hadamard's factorisation theorem. Exceptional values. function of integral order. Functions of Zero order.

UNIT-IV

Meromorphic Functions: Characteristic function $T(r,f)$ formula of Nevanlinna. first fundamental theorem of Nevanlinna. Order and type of Meromorphic functions. second Fundamental theorem of Nevanlinna statement of only, its application to exceptional values and defect relations.

UNIT-V

Elliptic Functions of Weierstrass: Periodic functions, definition of elliptic function, Licyvillcs's theorems on elliptic functions-The irreducible poles and zeros of an elliptic function. Weierstrass's sigma function. Weierstrass's elliptic function $P(z)$. The pseudo periodicity of $P(z)$ and $p(z)$. The algebraic relation connecting two elliptic functions. the differential equation satisfied by $p(z)$ and its solution. The expression of a elliptic function in terms of sigma functions. A formula for $P(z)-p(z)$.

Books recommended:

1. M. L. Cartwright: Integral functions, Cambridge U. tract No.44
2. V. K. Hayman : Meromorphic functions, Oxford University Press.
3. E. T. Copson : An Introduction of the Theory of Functions of a complex variable.

**Mohanlal Sukhadia University
Udaipur (Raj.)**

Syllabus

Scheme of Examination and Courses of Study

(Common for the Faculties of Arts & Science)



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