DISCRETE MATHEMATICS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Sets and propositions, Cardinality, mathematical induction, principle of inclusion and exclusion. Computability and formal languages- ordered set, Languages, phrase, structure, grammars, Types of grammars and languages.

UNIT - II

Relations and functions; Binary relations, equivalence relations and partitions. Partial ordered relations and lattices chains and antichains. Pigeons hole principle.

UNIT - III

Finite state machine: equivalent machines. Finite state machines as language recognizers. Discrete numeric functions and generating functions. Recurrence relation and recursive algorithms, linear recurrence relations with constant coefficients.

Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating function.

UNIT - IV

Boolean algebras-lattices and algebra structure, duality, distributive compliment lattices. Boolean lattices, Boolean function and expressions.

DIFFERENTIAL CALCULUS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Series : Infinite series and convergent series, test for convergence of a series; comparison test, D' Alembert's test Cauchy's test, Raabe's test, De-Morgan and Bertrand's test, Cauchy's condensation test, gauss test, alternating series, absolute convergence (derivation of test is not required).

UNIT - II

Taylor' s theorem. Machlaurin's theorem, power series expansion of sin x, cos x, e^x, $\log_e$ (1+x), $(1 - x)^n$, derivative of the length of an arc, pedal equations.

UNIT - III

Curvature. Asymptotes,

UNIT - IV

Multiple points, curve tracing of standard curves (Cartesian and polar coordinates), Envelopes.

B.Sc Semester I Maths Paper III P C 1009

THREE DIMENSIONAL GEOMETRY

Scheme of examination: **MM: 22**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Sphere

UNIT - II

Cone, Cylinder.

UNIT - III

Central conicoids; ellipsoid, hyperboloid of one and two sheets condition of tangency for a plane, normals plane sections

UNIT - IV

Generating lines of hyperboloid of one sheet and its properties. Reduction of a general equations of second degree in three dimensions standard forms.

B.Sc Semester I Maths Paper III P C 12-1009

THREE DIMENSIONAL GEOMETRY

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Sphere

UNIT - II

Cone, Cylinder.

UNIT - III

Central conicoids; ellipsoid, hyperboloid of one and two sheets condition of tangency for a plane, normals plane sections

UNIT - IV

Generating lines of hyperboloid of one sheet and its properties. Reduction of a general equations of second degree in three dimensions standard forms.

GRAPH THEORY

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Groups, Rings, Fields (Definitions, simple examples and elementary properties only).

UNIT II

Graphs - Basic terminology, Multigraphs, Union, Join, Product and composition of graphs. Weighted Graphs.

UNIT III

Paths and circuits, shorted paths, Eularian paths and circuits. Travelling salesman problems, Planar graphs and Geometric dual graphs.

UNIT IV

Trees, Rooted tree. Digraphs - Simple digraph, Asymmetric digraphs, Symmetric digraphs and complete digraphs. Digraph and Binary relations. Matrix representation of graphs and digraphs.

INTEGRAL CALCULUS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Partial derivatives. Chain rules, Euler's theorem for homogeneous functions. Differentiation of implicit functions. Maxima and Minima of functions of two variables. Lagrange's multipliers.

UNIT II

Double integrals, Change of order of integration.

UNIT III

Triple integrals, Dirichlet's integral, Areas.

UNIT IV

Lengths, Volumes and Surfaces.

OPTIMIZATION THEORY

Scheme of examination: **MM: 22**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

The linear programming problem Formulation. L.P.P. matric notation. Graphical solution of linear programming problems. Basic solution. Some basic properties of convex sets, Theorems based on convex sets.

UNIT II

Fundamental theorem of L.P.P. Application of the Simplex method for solution of a L.P.P. to simple problems.

UNIT III

Duality. Fundamental theorem of duality, Properties and Simple problems of duality.

UNIT IV

Assignment problems, Transportation problems.

REAL ANALYSIS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Real number as complete ordered field, properties of continuous functions on closed intervals

UNIT - II

Limit point, Bolzano-weierstrass theorem, Closed and Open sets, Union and Intersection of such sets. Concept of compactness. Heine-Borel theorem. Connected sets. Properties of derivable functions, Darboux's and Rolle's theorem.

UNIT - III

Real sequences- Limit and Convergence of a sequence, Monotonic sequences.

UNIT - IV

Cauchy's sequence, Subsequence, cauchy's general principle of convergence. Notion of limit and continuity for functions of two variables

DIFFERENTIAL EQUATIONS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations and equations reducible to homogeneous form.

UNIT - II

Linear equations and equations reducible to linear form. Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for x, y and p.

UNIT - III

Clairaut's form and singular solutions with extraneous Loci. Linear differential equations with constant coefficients. Complimentary function and particular integral.

UNIT - IV

Homogenous linear differential equations, Exact linear differential equations of nth order.

NUMERICAL ANALYSIS

Scheme of examination: **MM: 35**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Differences. Relation between differences and derivatives. Differences of a polynomial.

UNIT - II

Factorial function, Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Interpolation formula. Lagrange's interpolation formula.

UNIT - III

Central differences.Gauss's, Stirling's and Bessel's interpolation formulae. Numerical Differentiation. Derivatives from interpolation formulae.

UNIT - IV

Numerical integration, Newton-Cote's formula, Trapazoidal rule, Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

NUMERICAL ANALYSIS

Scheme of examination: **MM: 22**

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Differences. Relation between differences and derivatives. Differences of a polynomial.

UNIT - II

Factorial function, Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Interpolation formula. Lagrange's interpolation formula.

UNIT - III

Central differences.Gauss's, Stirling's and Bessel's interpolation formulae. Numerical Differentiation. Derivatives from interpolation formulae.

UNIT - IV

Numerical integration, Newton-Cote's formula, Trapazoidal rule, Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

REAL ANALYSIS AND METRIC SPACES

Scheme of examination: *MM: 35*

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Riemann integration - Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus.

UNIT II

Sequence and series of functions – Point wise and Uniform convergence, Cauchy's criterion, Weierstrass M-test, Abel's test, Dirichlet's test for uniform convergence of series of functions, Uniform convergence and Continuity of series of functions, Term by term differentiation and integration. Metric space - Definition and examples.

UNIT III

Metric space, definition & simple properties of open and closed sets, Interior and Closure of a set, Limit point of a set. Subspace of a metric space, Product space.

UNIT IV

Continuous mappings, Sequence in a metric space, Cauchy sequence. Complete metric space, Baire's theorem, Compact sets and Compact spaces, Connected metric spaces.

DIFFERENTIAL EQUATIONS - II

Scheme of examination: *MM: 35*

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Linear differential equations of second order. Linear independence of solutions. Solution by transformation of the equation by changing the dependent variable/the independent variable, Factorization of operators.

UNIT II

Method of variation of parameters, Method of undetermined coefficients. Partial differential equations of the first order. Lagrange's linear equation. Charpit's general method of solution.

UNIT III

Simultaneous differential equations. Existence and uniqueness theorem.

UNIT IV

Homogeneous and non-homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

NUMERICAL ANALYSIS – II & VECTOR CALCULUS

Scheme of examination: *MM: 22*

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Numerical solution of algebraic and transcendental equations. Bisection method, Regula-Falsi method, Method of iteration, Newton-Raphson method.

UNIT II

Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic simultaneous equations. Solutions of ordinary differential equations of first order with initial and boundary conditions using Picard's and modified Euler's method.

UNIT III

Runge – Kutta Method, Scalar point function. Vector point function. Differentiation and integration of vector point functions. Directional derivative.

UNIT IV

Gradient, Divergence, Curl and identities involving three operators. Gauss divergence theorems, Green’s and Stokes theorems (without proof) their application.

ABSTRACT ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Definition and simple properties of Groups and Subgroups. Cyclic group.

UNIT – II

Permutation Groups. Cosets, Lagrange's theorem on the order of subgroups of a finit order group.

UNIT – III

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

UNIT – IV

Definition and simple properties of Rings. Integral domain and field, Characteristics of a Ring and Field.

COMPLEX ANALYSIS - I

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Complex plane, connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (Statement only). Extended complex plane. Stereographic projection.

UNIT – II

Complex valued function - Limits, Continuity and Differentiability. Analytic function, Cauchy- Riemann equations (cartesian and polar form). Harmonic functions, Construction of an analytic function.

UNIT – III

Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Power series - Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

UNIT – IV

Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula Liouville' theorem. Taylor's theorem. Laurent's theorem. Maximum modulus theorem.

DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

B.Sc Semester V Maths Paper III P C 5009

DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination: MM: 22

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

LINEAR ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Subrings. Morphism of rings. Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields.

UNIT II

Definition, Examples and Simple properties of Vector spaces and Subspaces.

UNIT III

Linear combination, Linear dependence and Linear independence of vectors. Linear span, Direct sum and Complement of subspaces. Generation of subspaces, sum of subspaces.

UNIT IV

Basis and Dimension. Quotient space and its dimension.

COMPLEX ANALYSIS - II

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.

UNIT II

Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouche's theorem. Fundamental theorem of Algebra.

UNIT III

Conformal mapping. Bilinear transformation and its properties. Elementary mappings: w (z)=1/z,(z+1/z), z^2, e^z, sinz, cosz, and logz.

UNIT IV

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

ADVANCED DYNAMICS

Scheme of examination: MM: 22

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Work and energy; Cyclodial Motion

UNIT – II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circles

UNIT – III

Central orbits p-r equations. Apses. Time in an orbit. Kepler's laws of planetary motion.

UNIT – IV

Moments of inertia- M.I. of rods . circular rings, circular disks, solid and hollow sphares, Rectangular lamina, Ellipse and Triangle, Theorem of pareallel axis, Product of inertia.

DISCRETE MATHEMATICS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

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.

UNIT – II

Relations and Functions- Binary relations, Equivalence relations and Partitions, Partial ordered relations and Lattices, Chains and Antichains, Pigeon Hole principle.

UNIT – III

Finite State Machine - Equivalent machines, Finite State Machines as language recognizers. Discrete numeric functions and Generating functions. Recurrence relations and Recursive Algorithms - Linear Recurrence relations with constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating functions.

UNIT – IV

Boolean Algebras- Lattices and Algebraic structure, Duality, Distributive and Complement Lattices. Boolean Lattices, Boolean functions and expressions.

DIFFERENTIAL CALCULUS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Series - Infinite series and Convergent series. Tests for convergence of a series - Comparison test, D'Alembert's test, Cauchy's test, Raabe's test, De-Morgan-Bertrand's test, Cauchy's condensation test, Gauss's test, Alternating series. Absolute convergence. (Derivation of tests is not required).

UNIT – II

Taylor's theorem. Maclaurin's theorem. Power series expansion of sin x, cos x, e^x, $\log_e(1+x)$, $(1+x)^n$. Derivative of the length of an arc. Pedal equations.

UNIT – III

Curvature, Asymptotes.

UNIT – IV

Multiple points. Curve tracing of standard curves (Cartesian and Polar coordinates), Envelopes.

THREE-DIMENSIONAL GEOMETRY

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Sphere.

UNIT – II

Cone and Cylinder.

UNIT – III

Central Conicoids - Ellipsoid, Hyperboloid of one and two sheets, Condition of tangency for a plane, Normal plane sections.

UNIT – IV

Generating lines of hyperboloid of one sheet and its properties. Reduction of general equation of second degree in three-dimensions to standard forms.

THEORY OF NUMBERS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Divisibility - Division Algorithm, the Greatest Common Divisor, Euclidean algorithm. Greatest Common Divisor of more than two integers, least common multiple, least common multiple of n integers.

UNIT – II

Linear Diophantine equations, the equations - ax + by = c, ax + by + cz = d, Prime Numbers, Infinitude of primes, Fundamental theorem of Arithmetic. The sieve of Eratodhenes, the Goldbach conjecture, Fibonacci sequence.

UNIT – III

Congruence, properties of Congruence, Linear conguruence, Chinese remainder theorem. Congruence of higher degree.

UNIT – IV

Fermat's Factorization Method, Fermat's little theorem, Fermat's Last theorem, Wilson theorem, Euler's Factorization Method, Mersenne's Factorization Method.

GRAPH THEORY

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Groups, Rings, Fields; Definitions, simple examples and elementary properties only.

UNIT II

Graphs: Basic terminology, Multigraphs, Union, Join, Products and composition of graphs. Weighted graphs

UNIT III

Paths and circuits, Shortest paths, Eulerian paths and Circuits. Travelling Salesman problem. Planar graphs and Geometric dual graphs.

UNIT IV

Trees, Rooted tree, Digraphs; Simple digraph, Asymmetric digraphs, Symmetric digraphs and complete digraphs. Digraph and Binary relations. Matrix representation of graphs and digraphs.

INTEGRAL CALCULUS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Partial derivatives, Chain rules, Euler's theorem for homogeneous functions. Differentiation of implicit functions. Maxima and Minima of functions of two variables. Lagrange's multipliers.

UNIT II

Double integrals, Change of order of integration.

UNIT III

Triple integrals. Dirichlet's integral. Areas.

UNIT IV

Length, Volumes and Surfaces.

OPTIMIZATION THEORY

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

The linear programming problem formulation. L.P.P. matric notation. Graphical solution of linear programming problems. Basic solution. Some basic properties of convex sets, Theorems based on convex sets.

UNIT II

Fundamental theorem of L.P.P. Application of the Simplex method for solution of a L.P.P. to simple problems.

UNIT III

Duality. Fundamental theorem of duality, Properties and Simple problems of duality

UNIT IV

Assignment problems, Transportation problems. Total Marks

THEORY OF NUMBERS - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Number theoretic functions, the multiclipative funcation. The function ζ & σ, The Mobius function, Greatest integer function, Euler's Φ function, properties of Φ function. Application to Cryptography.

UNIT II

Quadratic Residues, Elementary properties, Legender symbols, Quadratic Reciprocity Law, Quadratic Congruence.

UNIT III

The Fermat Conjecture, Pythagorean Triples, Fermat's last theorem.

UNIT IV

Representation of integers as sum of two squares, sum of three or more squares. The Diophantine equation $X^2 + Y^2 = Z^2$, $X^4 + Y^4 = Z^4$, General integral solution of the equation $X^2 + Y^2 + Z^2 = W^2$, $(X,Y,Z,W)=1$

REAL ANALYSIS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Real numbers as complete ordered field, Propecties of continuous function on closed intervals

UNIT – II

Limit point, Bolzano-Weierstrass theorem, Closed and Open sets, Union and Intersection of such sets. Concept of compactness. Heine-Borel theorem. Connected sets. Properties of derivable function, Darboux's and Rolle's theorem.

UNIT – III

Real sequences - Limit and Convergence of a sequence, Monotonic sequences.

UNIT – IV

Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Notion of limit and continuity for functions of two variables.

DIFFERENTIAL EQUATIONS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations and equations reducible to homogeneous form.

UNIT – II

Linear equations and equations reducible to linear form. Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for x, y and p.

UNIT – III

Clairaut's form and singular solutions with extraneous Loci. Linear differential equations with constant coefficients. Complimentary function and particular integral.

UNIT – IV

Homogenous linear differential equations, Exact linear differential equations of nth order.

NUMERICAL ANALYSIS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Differences. Relation between difference and derivatives Differences of a polynomial. Factorial function.

UNIT – II

Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided differences, Interpolation formula. Lagrange's interpolation formula.

UNIT – III

Central differences. Gauss's Stirling's and Bessel's interpolation formulae. Numerical differences. Derivatives from interpolation formulae.

UNIT – IV

Numerical integration, Newton- Cote's formula, Trapazoidal rule, Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

OPERATIONS RESEARCH

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Assignment models, Mathematical formulation, Hungarian method, Variations of the assignment problem. Travelling salesman problem.

UNIT – II

Transportation models - Mathematical formulation, Initial basic feasible solution, Transportation algorithm for minimization problem, Degeneracy and unbalanced transportation problems.

UNIT – III

Theory of Games - Introduction, Basic definitions, Minimax (Maximin) criterion and optimal strategy, Saddle point, Minimax-Maximin principle for mixed strategy games. Inventory Models - Definition, Types of inventory models.

UNIT – IV

Fundamental theorem of game theory, Two-by-two games without saddle point, Arithmetic method for 2 X 2 games, graphical method for 2 X 2 games.

REAL ANALYSIS AND METRIC SPACE

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Riemann integration - Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus.

UNIT II

Sequence and series of functions - Pointwise and Uniform convergence, Cauchy's criterion, Weierstrass M-test, Abel's test, Dirichlet's test for uniform convergence of series of functions, Uniform convergence and Continuity of series of functions, Term by term differentiation and integration. Metric space - Definition and examples.

UNIT III

Metric space, definition & simple properties of Open and Closed sets, Interior and Closure of a set, Limit point of a set. Subspace of a metric space, Product space.

UNIT IV

Continuous mappings, Sequence in a metric space, Cauchy sequence. Complete metric space, Baire's theorem, Compact sets and Compact spaces, Connected metric spaces.

DIFFERENTIAL EQUATION - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Linear differential equations of second order. Linear independence of solutions. Solution by transformation of the equation by changing the dependent variable/the independent variable, Factorization of operators.

UNIT II

Method of variation of parameters, Method of undetermined coefficients. Partial differential equations of the first order. Lagrange's linear equation. Charpit's general method of solution.

UNIT III

Simultaneous differential equations. Existence and uniqueness theorem.

UNIT IV

Homogeneous and non-homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

NUMERICAL ANALYSIS – II & VECTOR CALCULUS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Numerical solution of algebraic and transcendental equations. Bisection method, Regula-Falsi method, Method of iteration, Newton-Raphson method.

UNIT II

Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic simultaneous equations. Solutions of ordinary differential equations of first order with initial and boundary conditions using Picard's and modified Euler's method.

UNIT III

Runge-Kutta method Scalar point function. Vector point function. Differentiation and integration of vector point functions. Directional derivative.

UNIT IV

Gradient, Divergence and Curl and identities involving there operators. Gauss divergence Theorems Green’s and Stoke’s Theorems (without proof) and their application.

OPERATIONS RESEARCH - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Measures of central Tendency, A.M., G.M., H.M., Median Mode

UNIT II

Probability theory - Probability distributions of a random variable, Standard deviation, Variance.

UNIT III

Mathematical expectation, Binomial, Poisson and Normal distributions.

UNIT IV

Queueing Theory - Introduction, Probability distributions in queueing systems. Models-Erlang model, general Erlang model, Model III(M/M/I): (N/FCFS).

ABSTRACT ALGEBRA

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Definition and simple properties of Groups and Subgroups. Cyclic group.

UNIT – II

Permutation Groups. Cosets, Lagrange's theorem on the order of subgroups of a finit order group.

UNIT – III

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

UNIT – IV

Definition and simple properties of Rings. Integral domain and field, Characteristics of a Ring and Field.

COMPLEX ANALYSIS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Complex plane, connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (Statement only). Extended complex plane. Stereographic projection.

UNIT – II

Complex valued function - Limits, Continuity and Differentiability. Analytic function, Cauchy- Riemann equations (cartesian and polar form). Harmonic functions, Construction of an analytic function.

UNIT – III

Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Power series - Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

UNIT – IV

Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula Liouville' theorem. Taylor's theorem. Laurent's theorem. Maximum modulus theorem.

DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

STATISTICS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Frequency distributions and measures of central tendency - A.M., G.M. H.M., Median, Mode.

UNIT – II

Measures of dispersion-mean deviation, root mean square deviation, variance, standard deviation. Skewness and Kurtosis, Moments of frequency distributions.

UNIT – III

Theory of probability - Events, probability, addition and multiplication theorem, conditional probability, Bayes theorem.

UNIT – IV

Random variable, probability distribution, moments, Mathematical expectation of sum and product of two random variates, co-variance of a variate, Moment generating and cumulant generating functions.

LINEAR ALGEBRA

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Subrings. Morphism of rings. Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields.

UNIT II

Definition, Examples and Simple properties of Vector spaces and Subspaces.

UNIT III

Linear combination, Linear dependence and Linear independence of vectors. Linear span, Direct sum and Complement of subspaces. Generation of subspaces, sum of subspaces.

UNIT IV

Basis and Dimension. Quotient space and its dimension.

COMPLEX ANALYSIS - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.

UNIT II

Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouche's theorem. Fundamental theorem of Algebra.

UNIT III

Conformal mapping. Bilinear transformation and its properties. Elementary mappings: w (z)=1/z,(z+1/z), z^2, e^z, sinz, cosz, and logz.

UNIT IV

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

ADVANCED DYNAMICS

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Work and energy; Cyclodial Motion

UNIT – II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circles

UNIT – III

Central orbits p-r equations. Apses. Time in an orbit. Kepler's laws of planetary motion.

UNIT – IV

Moments of inertia- M.I. of rods . circular rings, circular disks, solid and hollow sphares, Rectangular lamina, Ellipse and Triangle, Theorem of pareallel axis, Product of inertia.

STATISTICS - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

UNIT – I

Discrete probability distributions (Binomial, Poisson, Geometric and Hypergeometric).

UNIT II

Continuous probability distributions (Rectangular and Normal distributions).

UNIT III

Methods of least squares and curve fitting.

UNIT IV

Correlation and Regression, Multiple and partial correlation.

ALGEBRA - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit-1

Direct product of groups (External and Internal). Isomorphism theorems – Diamond isomorphism theorem, Butterfly Lemma, Conjugate classes (Excluding p-groups).

Unit - 2

Commutators, Derived subgroups, Normal series and Solvable groups, Composition series, Refinement theorem and Jordan-Holder theorem for infinite groups.

Unit - 3

Field theory – Extension fields, Algebraic and Transcendental extensions, Separable and inseparable extensions, Normal extensions. Splitting fields.

Unit -4

Galois theory – the elements of Galois theory, Automorphism of extensions, Fundamental theorem of Galois theory, Solutions of polynomial equations by radicals and Insolvability of general equation of degree five by radicals.

M.Sc Maths Semester I Paper II P C 11-1082

REAL ANALYSIS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Algebra and algebras of sets, Algebras generated by a class of subsets, Borel sets, Lebesgue measure of sets of real numbers, Measurability and Measure of a set, Existence of Non-measurable sets.

Unit - 2

Measurable functions, Realization of non-negative measurable function as limit of an increasing sequence of simple functions, Structure of measurable functions, Convergence in measure, Egoroff's theorem.

Unit – 3 Weierstrass's theorem on the approximation of continuous function by polynomials, Lebesgue integral of bounded measurable functions, Lebesgue theorem on the passage to the limit under the integral sign for bounded measurable functions.

Unit - 4

Summable functions, Space of square summable functions. Fourier series and coefficients, Parseval's identity, Riesz-Fisher Theorem.

M.Sc Maths Semester I Paper III P C 11-1083

DIFFERENTIAL EQUATIONS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Non-linear ordinary differential equations of particular forms. Riccati's equation –General solution and the solution when one, two or three particular solutions are known.

Unit - 2

Total Differential equations. Forms and solutions, necessary and sufficient condition, Geometrical Meaning Equation containing three and four variables, total differential equations of second degree.

Unit - 3

Series Solution: Radius of convergence, method of differentiation, Cauchy-Euler equation, Solution near a regular singular point (Method of Forbenius) for different cases, Particular integral and the point at infinity.

Unit - 4

Partial differential equations of second order with variable co-efficients-Monge's method.

M.Sc Maths Semester I Paper IV P C 11-1084

DIFFERENTIAL GEOMETRY

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Space curves, Tangent, Contact of curve and surface, Osculating plane, Principal normal and Binormal, Curvature, Torsion, Serret-Frenet's formulae, Osculating circle and Osculating sphere, Existence and Uniqueness theorems, Bertrand curves, Involute and Evolutes.

Unit – 2 Conoids, Inflexional tangents, Singular points, Indicatrix. Ruled surface, Developable surface, Tangent plane to a ruled surface. Necessary and sufficient condition that a surface $\zeta = f(\xi,\eta)$ should represent a developable surface. Metric of a surface, First, Second and Third fundamental forms. Fundamental magnitudes of some important surfaces, Orthogonal trajectories.

Unit - 3

Normal curvature. Pricipal directions and Principal curvatures, First curvature, Mean curvature, Gaussion curvature, Radius of curvature of a given section through any point on $z = f(x,y)$. Lines of curvature, Principal radii, Relation between fundamental forms.

Unit - 4

Asymptotic lines, Differential equation of an asymptotic line, Curvature and Torsion of an asymptotic line. Gauss's formulae, Gauss's characteristic equation, Weingarten equations, Mainardi-Codazzi equations. Fundamental existence theorem for surfaces, Parallel surfaces, Gaussian and mean curvature for a parallel surface.

M.Sc Maths Semester I Paper V P C 11-1085

DYNAMICS OF RIGID BODIES

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

D'Alembert's principle. The general equations of motion of a rigid body. Motion of centre of inertia and motion relative to centre of inertia. Motion about a fixed axis.

Unit - 2

The compound pendulum, Centre of percussion. Motion of a rigid body in two dimensions under finite and impulsive forces.

Unit - 3

Motion in three dimensions with reference to Euler's dynamical and geometrical equations. Motion under no forces, Motion under impulsive forces. Conservation of momentum (linear and angular).

Unit - 4

Lagrange's equations for holonomous dynamical system, Energy equation for conservative field, Small oscillations, Motion of a top, Hemilton's equations of motion, Hamilton's principle and principle of least action.

M.Sc Maths Semester I Paper VI P C 11-1086

CALCULUS OF VARIATION AND SPECIAL FUNCTION - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Calculus of variation – Functionals, Variation of a functional and its properties, Variational problems with fixed boundaries, Euler's equation, Extremals, Functional dependent on several unknown functions and their first order derivatives.

Unit - 2

Functionals dependent on higher order derivatives, Functionals dependent on the function of more than one independent variable. Variational problems in parametric form.

Unit - 3

Gauss hypergeometric function and its properties, Series solution of Gauss hypergeometric equation. Integral representation, Linear and quadratic transformation formulas, Contiguous function relations, Differentiation formulae, Linear relation between the solutions of Gauss

hypergeometric equation, Kummer's confluent hypergeometric function and its properties, Integral representation, Kummer's first transformation and series solution of Legendre's equation.

Unit - 4

Legendre polynomials and functions $P_n(x)$ and $Q_n(x)$.

ALGEBRA – II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Linear transformation of vector spaces, Dual spaces, Dual basis and their properties, Dual maps, Annihilator.

Unit - 2

Matrices of a linear maps, Matrices of composition maps, Matrices of dual map, Eigen values, Eigen vectors, Rank and Nullity of linear maps and matrices, Invertible matrices, Similar matrices.

Unit - 3

Determinants of matrices and its computations, Characteristic polynomial and eigen values.Real inner product space, Schwartzs inequality.

Unit – 4

Orthogonality, Bessel's inequality, Adjoint, Self adjoint linear transformations and matrices, Othogonal linear transformation and matrices, Principal Axis Theorem.

M.Sc Maths Semester II Paper VIII P C 11-2082

TOPOLOGY

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Topological spaces, Subspaces, Open sets, Closed sets, Neighbourhood system, Bases and sub-bases.

Unit – 2

Continuous mapping and Homeomorphism, Nets, Filters.

Unit - 3

Separation axioms (To, T_1, T_2, T_3, T_4). Compact and locally compact spaces. Continuity and Compactness.

Unit - 4

Product and Quotient spaces. Tychonoff's one point compactification. Connected and Locally connected spaces, Continuity and Connectedness.

M.Sc Maths Semester II Paper IX P C 11-2083

DIFFERENTIAL EQUATION - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Classification of linear partial differential equation of second order, Canonical forms, Cauchy's problem of first and second order partial differential equation.

Unit - 2

Linear homogeneous boundary value problem, Eigen values and eigen functions, Sturm-Liouville boundary value problems, orthogonality of eigen functions, Lagrange's identity, properties of Eigen functions, important theorems of sturm Liouville system, Periodic functions.

Unit - 3

Non-homogeneous boundary value problems, Non-homogeneous Sturm-Liouville boundary value problems (method of eigen function expansion). Method of separation of variables, Laplace, wave and diffusion equations.

Unit - 4

Green's Functions: Non-homogeneous Sturm-Liouville boundary value problem (method of Green's function), Procedure of constructing the Green's function and solution of boundary value problem, properties of Green's function, Inhomogeneous boundary conditions, Dirac delta function, Bilinear formula for Green's function, Modified Green's function.

M.Sc Maths Semester II Paper X P C 11-2084

RIEMANNIAN GEOMETRY AND TENSOR ANALYSIS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Geodesics, Differential equation of a geodesic, Single differential equation of a geodesic, Geodesic on a surface of revolution, Geodesic curvature and torsion, Gauss-Bonnet Theorem.

Unit - 2

Tensor Analysis– Kronecker delta. Contravariant and Covariant tensors, Symmetric tensors, Quotient law of tensors, Relative tensor. Riemannian space. Metric tensor, Indicator, Permutation symbols and Permutation tensors.

Unit - 3

Christoffel symbols and their properties, Covariant differentiation of tensors. Ricci's theorem, Intrinsic derivative, Geodesics, Differential equation of geodesic, Geodesic coordinates, Field of parallel vectors.

Unit - 4

Reimann-Christoffel tensor and its properties. Covariant curvature tensor, Einstein space. Bianchi's identity. Einstein tensor, Flat space, Isotropic point, Schur's theorem.

HYDRODYNAMICS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Kinematics of ideal fluid. Lagrange's and Euler's methods. Equation of continuity in Cartesian, cylindrical and spherical polar coordinates. Boundary surface.

Unit - 2

Stream-lines, path-lines and streak lines, velocity potential, irrotational motion.

Unit – 3 Euler's hydrodynamic equations. Bernoulli's theorem. Helmholtz equations. Cauchy's integral.

Unit - 4

Motion due to impulsive forces. Motion in two-dimensions, Stream function, Complex potential. Sources, Sinks, Doublets, Images in two-dimensions.

SPECIAL FUNCTIONS - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Bessel functions $J_n(x)$.

Unit - 2

Hermite polynomials $H_n(x)$, Laguerre and Associated Laguerre polynomials.

Unit - 3

Jacobi Polynomial: Definition and its special cases, Bateman's generating function, Rodrigue's formula, orthogonality, recurrence relations, expansion in series of polynomials.

Unit - 4

Chebyshev polynomials $T_n(x)$ and $U_n(x)$: Definition, Solutions of Chebyshev's equation, expansions, Generating functions, Recurrence relations, Orthogonality.

FUNCTIONAL ANALYSIS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit 1:

Normed linear spaces. Quotient space of normed linear spaces and its completeness. Banach spaces and examples. Bounded linear transformations. Normed linear space of bounded linear transformations.

Unit – 2

Equivalent norms. Basic properties of finite dimensional normed linear spaces and compactness. Reisz Lemma. Multilinear mapping. Open mapping theorem. Closed graph theorem. Uniform boundness theorem.

Unit – 3 Continuous linear functionals. Hahn-Banach theorem and its consequences. Embedding and Reflexivity of normed spaces. Dual spaces with examples. Inner product spaces. Hilbert space and its properties.

Unit – 4

Orthogonality and Functionals in Hilbert Spaces. Phythagorean theorem, Projection theorem, Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity, Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces.

M.Sc Maths Semester III Paper XIV P C 11-3082

VISCOUS FLUID DYNAMICS - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Viscosity , Analysis of stress and rate of strain, Stoke's law of friction, Thermal conductivity and generalized law of heat conduction, Equations of state and continuity , Navier- Stokes equations of motion.

Unit – 2

Vorticity and circulation, Dynamical similarity, Inspection and dimensional analysis, Buckingham theorem and its application, Non-dimensional parameters and their physical importance : Reynolds number, Froude number, Mach number, Prandtl number, Eckart number, Grashoff number, Brinkmann number, Non – dimensional coefficients : Lift and drag coefficients, Skin friction , Nusselt number, Recovery factor.

Unit – 3

Exact solutions of Navier – Stokes equations, Velocity distribution for plane couette flow, Plane Poiseuille flow, Generalized plane Couette flow, Hagen- Poiseuille flow, Flow in tubes of uniform cross-sections.

Unit – 4

Flow between two concentric rotating cylinders. Stagnation point flows : Hiemenz flow, Homann flow. Flow due to a rotating disc.

M.Sc Maths Semester III Paper XV P C 11-3083

CONTINUUM MECHANICS – I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit 1:

Cartesian Tensors, Index notation and transformation laws of Cartesian tensors. Addition, Subtraction and Multiplication of cartesian tensors, Gradient of a scalar function, Divergence of a vector function and Curl of a vector function using the index notation. ε-δ identity. Conservative vector field and concept of a scalar potential function. Stokes, Gauss and Green's theorems.

Unit 2:

Continuum approach, Classification of continuous media, Body forces and surface forces. Components of stress tensor, Force and Moment equations of equilibrium. Transformation law of stress tensor. Stress quadric. Principal stress and principal axes. Stress invariants and stress deviator. Maximum shearing stress.

Unit 3:

Lagrangian and Eulerian description of deformation of flow. Comoving derivative, Velocity and Acceleration. Continuity equation. Strain tensors. Linear rotation tensor and rotation vector, Analysis of relative displacements.

Unit – 4

Geometrical meaning of the components of the linear strain tensor, Properties of linear strain tensors. Principal axes, Theory of linear strain. Linear strain components. Rate of strain tensors. The vorticity tensor. Rate of rotation vector and vorticity, Properties of the rate of strain tensor, Rate of cubical dilation.

M.Sc Maths Semester III Paper XVI P C 11-3084

MATHEMATICAL PROGRAMMING - I

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Separating and supporting hyperplane theorems. Revised simplex method to solve Linear Programming problems, Bounded variable problems.

Unit – 2 Integer programming: Gomory's algorithm for all and mixed integer programming problems, Branch and Bound algorithm; Goal programming: Graphical goal attainment method, Simplex method for GPP.

Unit – 3

Separable programming: Piece-wise Linear approximations to non-linear functions, Reduction to separable programming problem to l.p.p., separable programming algorithm, fractional programming: computational procedure.

Unit - 4

Dynamic programming: Introduction, Bellman principle of optimality, solution of problems with finite number stages, solution of l.p.p. by dynamic programming.

M.Sc Maths Semester III Paper XVII P C 11-3085

INTEGRAL TRANSFORMS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Fourier transform – Definition and properties of Fourier sine, cosine and complex transforms. Convolution theorem. Inversion theorems. Fourier transform of derivatives.

Unit – 2 Mellin transform– Definition and elementary properties. Mellin transforms of derivatives and integrals. Inversion theorem. Convolution theorem.

Unit - 3

Laplace transform– Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform. Convolution theorem.

Unit – 4

Complex inversion formula. Infinite Hankel transform– Definition and elementary properties. Hankel transform of derivatives. Inversion theorem. Parseval Theorem.

M.Sc Maths Semester III Paper XVIII P C 11-3086

RELATIVISTIC MECHANICS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Relative Character of space and time, Principle of Relativity and its postulates, Derivation of special Lorentz transformation equations, Composition of Parallel velocities, Lorentz-Fitzgerald contraction formula, Time dilation.

Unit – 2

Simultaneity, Relativistic transformation formulae for velocity, Lorentz contraction factor, Particle acceleration, Velocity of light as fundamental velocity, Relativistic aberration and its deduction to Newtonian theory.

Unit - 3

Variation of mass with velocity, Equivalence of mass and energy, Transformation formulae for mass, Momentum and energy, Problems on conservation of mass, Momentum and energy, Relativistic Lagrangian and Hamiltonian.

Unit - 4

Minkowski space, Space-like, Time-like and Light-like intervals, Null cone, Relativity and Causality, Proper time, World line of a particle. Principles of Equivalence and General Covariance.

FUNCTIONAL ANALYSIS - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Adjoint of an operator on a Hilbert space. Self-adjoint, Positive, Normal and Unitary operators and their properties.Projection on a Hilbert space. Invariance. Reducibility. Orthogonal projections.

Unit – 2

Derivatives of a continuous map from an open subset of Banach space to a Banach space. Rules of derivation. Derivative of a composite, Directional derivative. Mean value theorem and its applications.

Unit - 3

Partial derivatives and Jacobian Matrix. Continuously differentiable maps. Higher derivatives. Taylor's formula.

Unit – 4

Inverse function theorem. Implicit function theorem. Step function, Regulated function, primitives and integrals. Differentiation under the integral sign. Riemann integral of function of real variable with values in normed linear space.

M.Sc Maths Semester IV Paper XX P C 11-4082

VISCOUS FLUID DYNAMICS – II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Concept of unsteady flow, Flow due to plane wall suddenly set in the motion (Stokes' first problem), Flow due to an oscillating plane wall (Stokes' second problem), Starting flow in plane Couette motion, Suction/injection through porous wall.

Unit - 2

Equation of energy, Temperature distribution : Between parallel plates, in a pipe, between two concentric rotating cylinders.

Unit – 3 Variable viscosity plane Couette flow, temperature distribution of plane Couette flow with transpiration cooling.Theory of very slow motion: Stokes' and Oseen's flows past a sphere.

Unit – 4

Concept of boundary layer , Derivation of velocity and thermal boundary equations in two-dimensional flow. Boundary layer on flat plate (Balsius-Topfer solution), Simple solution of thermal boundary layer equation for Pr = 1

M.Sc Maths Semester IV Paper XXI P C 11-4083

CONTINUUM MECHANICS – II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1 Law of conservation of mass and Eulerian continuity equation. Reynolds transport theorem. Momentum integral theorem and equation of motion.

Unit – 2

Kinetic equation of state. First and the second law of thermodynamics and dissipation function. Applications (Linear elasticity and Fluids) – Assumptions and basic equations. Generalized Hook's law for an isotropic homogeneous solid.

Unit – 3

Compatibility equations (Beltrami-Michell equations). Classification of types of problems in linear elasticity. Principle of superposition, Strain energy function, Uniqueness theorem, p-ρ relationship and work kinetic energy equation, Irrotational flow and Velocity potential.

Unit – 4

Kinetic equation of state and first law of Thermodynamics. Equation of continuity. Equations of motion. Vorticity-stream surfaces for inviscid flow, Bernoullis equations. Irrotational flow and velocity potential. Similarity parameters of fluid flow.

M.Sc Maths Semester IV Paper XXII P C 11-4084

MATHEMATICAL PROGRAMMING - II

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Convex function, Quadratic forms, constrained problem of maxima and minima, Lagrangian method, Non-linear programming: Formulation and Graphical method.

Unit – 2

Non-linear programming and its fundamental ingradients, Khun-Tucker necessary and sufficient conditions; Saddle point, Saddle-point theorems.

Unit – 3

Quadratic Programming: Kuhn-Tueker conditions, Wolfe method, Duality in Quadratic Programming.

Unit - 4

Beals method to solve QPP, Geometric Programming: Formulation, geometric arithmetic inequality, necessary conditions of optimality.

M.Sc Maths Semester IV Paper XXIII P C 11-4085

INTEGRAL EQUATIONS

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit – 1

Linear integral equations– Definition and classification. Conversion of initial and boundary value problems to an integral equation. Eigen values and Eigen functions. Solution of homogeneous and general Fredholm integral equations of second kind with separable kernels.

Unit - 2

Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations. Resolvent kernel and its results. Conditions of uniform convergence and uniqueness of series solution.

Unit – 3

Integral equations with symmetric kernels– Orthogonal system of functions. Fundamental properties of eigen values and eigen functions for symmetric kernels. Expansion in eigen functions and bilinear form. Hilbert-Schmidt theorem. Solution of Fredholm integral equations of second kind by using Hilbert-Schmidt theorem.

Unit - 4

Solution of Volterra integral equations of second kind with convolution type kernels by Laplace transform. Solution of singular integral equations by Fourier transform.

Classical Fredholm theory– Fredholm theorems. Solution of Fredholm integral equation of second kind by using Fredholm first theorem.

M.Sc Maths Semester IV Paper XXIV P C 11-4086

GENERAL RELATIVITY & COSMOLOGY

Scheme of examination: MM: 70

Note: In all five questions are to be answered .First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit. All questions will carry equal marks.

Unit - 1

Mach's principle, Newtonian approximation of equation of motion, Einstein's field equation for matter and empty space, Reduction of Einstein's field equation to Poisson's equation, Removal of clock paradox in General Relativity.

Unit – 2 Schwarzschild exterior metric, its isotropic form, Singularity and singularities in Schwarzschild exterior metric, Derivation of the formula $GM = c^2m$, Mass of sun in gravitational unit, Relativistic differential equation for the orbit of the planet.

Unit – 3

Three crucial tests in General Relativity and their detailed descriptions, Analogues of Kepler's laws in General Relativity, Trace of Einstein tensor, Energy-momentum tensor and its expression for perfect fluid, Schwarzschild interior metric and boundary condition.

Unit – 4

Lorentz invariance of Maxwell's equations in empty space, Lorentz force on charged particle, Energy-momentum tensor for electro-magnetic field. Einstein's field equation with cosmological term, Static cosmological

models (Einstein & de-Sitter models) with physical and geometrical properties, Non-static form of de-Sitter line-element and Red shift in this metric, Einstein space, Hubble's law, Weyl's postulate.

LINEAR ALGEBRA

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

Unit - I :

Linear transformation of vector spaces, Dual spaces, Dual Basis and their Properties, Dual maps, Annihilator.

Unit - II :

Matrices of a linear maps, Matrices of composition maps, matrices of dual map, eigen values, eigen vectors, Ranks and Nullity of linear maps and matrices. INvertible matrices, similar matrices.

Unit - III :

Determinants of matrices and its computations, characteristic polynomial and eigen values. Principal axis theorem.

Unit IV :

Real inner product space, Schwartz's inequality, orthogonality, Bessel's inequality, Adjoint, self adjoint linear transformations and matrices, orthogonal linear transformation and matrices.

MECHANICS II

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

Unit I

Hamilton's equation of motion, conservation of energy, Hamilton's principle and principle of lest action.

Unit - II

Kinematics of ideal fluid Lagrange's and Euler's methods. Equation of continuity in cartesian, cylindrical and spherical polar coordinated, Boundary surfaces stream lines, Path lines and streamlines velocity potential. Irrotational motion.

Unit III :

Euler's Hydrodmanical equations. Bernoulli's theorem, Helmholtz equations.

Lagrange's Hydrodynamical equations. Integral, equations of motions under impulsive forces.

Unit IV

Motion in two dimension, stream function, complex potential, soureces, sinks, doublets, image in two dimensions.

FUNCTIONAL ANALYSIS AND ADVANCED CALCULUS-I

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

UNIT I

Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity, Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces.

UNIT II

Adjoint of an operator in a Hilbert space. Self-adjoint, Positive, Normal and Unitary operators and their properties. Eigen values and eigen vectors of an operator. Spectrum of an operator. Spectral theorem.

UNIT III

Derivatives of a continuous map from an open subset of Banach space to a Banach space. Rules of derivation. Mean value theorem and its applications. Primitives and integral. Partial derivatives and Jacobian Matrix. Differentiation under the integral sign.

UNIT IV

Continuously differentiable maps. Higher derivatives. Taylor's formula. Inverse function theorem. Riemann integral of function of real variable with values in normed linear space. Existence and uniqueness of solutions of the type x' = f (t, x) ordinary differential equation.

CONTINUUM MECHANICS - II

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

UNIT I

The linear rotation tensor and rotation vector analysis of relative displacements. Geometrical meaning of the components of the linear strain tensor properties of linear strain tensors, Principal axes theory of linear strain. The linear strain components. The rate of strain tensors, the vorticity tensor. The rate of rotation vector and the vorticity properties of the rate of strain tensor, rate of cubical dilation compatibility equations in Lagrangian & Eularian form.

UNIT II

Reynolds transport theorem. The momentum integral theorem and the equation of motion, Kinetic equation of state. The first and the second law of thermodynamics and the dissipation function application (linear elasticity and fluids) assumptions and basic equation. Isotropic homogenous solid & principal axes of stress & strain.

UNIT III

Generalized Hook's law for an isotropic homogeneous solid compatibility equations, classification of type of problems in linear elasticity. The principle of superposition. The strain energy function. The uniqueness theorem.

UNIT IV

P-ρ relationship and the work kinetic energy equation. Irrotational flow and the velocity potential, Kinetic equation of state and first law of Thermodynamics. The equation of continuity. The equations of motion vorticity. Stream surfaces for inviscid flow. Bernoullis equation. Irrotational flow and velocity potential. Similarity parameters of fluid flow.

MATHEMATICAL PROGRAMMING - II

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

UNIT I

Global minimum and maximum. Saddle point, Necessary and Sufficient conditions for saddle point. Sufficient optimality theorm. Kuhn-Tucker theorem.

UNIT II

Convex separable programming algorithm. Kuhn-Tucker condition for optimization for Non Linear Programming Problem. Quadratic Programming, Wolf's method.

UNIT III

Beal's method.Duality in quadratic Programming. Quasiconvex, strictly quasiconvex and pseudoconvex functions – Differentiability properties.

UNIT IV

Dynamic programming, Principle of optimality due to Bellman, Solution of a Linear Programming Problem by dynamic programming.

INTEGRAL EQUATIONS

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

UNIT I

Definition and classification of linear integral equation. Conversion of initial and boundary value problems to an integral equation. Eigen values and Eigen functions. Solution of homogenous Fredholm integral equations of second kind with separable kernels.

UNIT II

Solution of Fredholm integral equation of second kind with separable kernels. Solution of Fredholm Volterra integral equation of second kind by method of successive substitutions and successive approximation. resolvent kernel and its result.

UNIT III

Integral equation with symmetric kernels. Complex Hillbert space, orthogonal system of functions, Fundamentals properties of eigen values and eigen function for symmetric kernels. Expansion in eigen functions

and symmetric kernels. Expansion in eigen functions and bilinear form. Hilbert-Schmidt theorem. solution of Fredholm integral equation of second kind by using Hilbert - Schmidt theorm.

UNIT IV

Classical Fredholm theory, Fredholm theorems, solultion of volterra integral equations with convolution type kernels by Laplace transform.

GENERAL THEORY OF RELATIVITY & COSMOLOGY

Scheme of examination: MM: 70

Note:

1. *Each paper is divided into four units*
2. *In the Examination, in all five questions will be set. One question will be of short answer type covering entire course. Four questions will be out of the four units taking one question form each unit wiht 100% internal choice.*

UNIT I

Geodesic principle, Newtonian approximation of relativistic equation of motion, Einstein's field equation and its Newtonian approximation, Schwarzchild external solution and its isotropic form, planetry orbits, analogues of keplers laws in general relativity.

UNIT II

Three crucial tests in general relativity (advance of perihelion of planet mercury, bending of light ray in gravitational field, gravitation red shift of spectral lines) Radar Echodelay, energy-momentum tensor for perfect fluid.

UNIT III

Schwarzchild internal solution, boundary conditions. Maxwell's equation, Transformation equations for the densities of electric charge and current. Propagation of electric and magnetic field strengths. Transformation equations for electromagnetic for potential vector, Transformation

equations for electric and magnetic field strengths Lorentz invariance of Maxwell's equation, Maxwell's equation in tensor form, Lorentz force on a charged particle, energy momentum tensor of an electromagnetic field, Einstein Maxwell's eq., Reissner-Nordstrom solution.

UNIT IV

Cosmology – Mach's principle, Einstein modified field equation with cosmological terms, static models of Einstein & desitter, Properties of Einstem & desitter universies, Red shift in nonstatic form of desitter line element, Einstien space and its applicability on Einstein & desitter universe, difference between Einstein & desitter universe, Hubble's law, Cosmological principle, Weyl's postulates.

B.Sc (Pass) Semester VI Paper I P C 6007-D

DISCRETE MATHEMATICS

Scheme of examination: MM: 35

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Sets and Propositions - Cardinality, Principle of inclusion and exclusion, Computability and formal languages - Ordered sets. Languages, Phrase, Structure, Grammars, Types of Grammars and Languages.

UNIT II

Groups, Rings, Fields, definitions, simple properties and simple examples only. Partial order relations and Lattices, Chains and Antichains, Pigeon Hole's principle.

UNIT III

Finite State Machine - Equivalent machines, Finite State Machines as language recognizers. Boolean Algebras- Lattices and Algebraic structure, Duality.

UNIT IV

Discrete numeric functions and Generating functions. Recurrence relations and Recursive Algorithms - Linear Recurrence relations with

constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating functions.

UNIT V

Graphs - Basic terminology, Multigraphs, Union, Join, Product and composition of graphs. Weighted graphs, Paths and circuits, Shortest paths, Eulerian paths and Circuits. Travelling Salesman problem, Trees, Rooted trees.

MECHANICS - II

Scheme of examination: MM: 35

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Motion in resisting medium – resistance varies as velocity and square of velocity.

UNIT II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a vertical circle.

UNIT III

Cycloidal motion, Work and Energy.

UNIT IV

Central orbits: p-r equations, Apses, Time in an orbit, Kepler's law of planetary motion.

UNIT V

Moment of inertia: M.I. of rods, Circular rings, Circular disks, Solid and Hollow spheres, Rectangular lamina, Ellipse and Triangle. Theorem of parallel axis. Product of inertia.