M.A./MSc.(Previous): Mathematics

Paper I: ADVANCED ABSTRACT ALGEBRA **Marks: 100**

Groups Conjugacy relation. Normalizer of an element, class equation of a finite group.Center of a group, Fundamental theorem on isomorphism of groups. Automorphism. Inner automorphism.Maximal subgroups.

Normal and subnormal series Composition series. Jordan Holder theorem solvable groups. Nilpotent groups.Commatator sub groups. Exterenal and internal direct product of groups. Cauchy theorem for finite groups.Sylow'stherom.

Canonical forms: similarity of linear transformations. Invariant spaces.Reduction to triangular forms.Nilpotent transformations.Index ofNilpotency. Invariants of a nilpotent transformations. The primary decomposition theorem. Jordan forms.

Field Theory :Extension fields. Algebraic and transcendental extensions splitting field.Separable and inseparable extension.Normal extension.Perfect fields.Finite fields.Galois extensions. Fundamental theorem of Galois theory. Solution of polynomial equations by radicals.
Insolvability of the general equations of degree 5 radicals.

Modules: cyclic modules. Simple modules.Semi-simple modules.Schuler's lemma free modules.

M.A./MSc.(Previous): Mathematics

Paper II: ADVANCED REAL ANYLISIS AND MEASURE THEORY **Marks: 100**

Definition and existence of Riemann-Stieltjes integral properties of the integral. Integration and differentiation. The fundamental theorem of calculus. Integrations of vector-valued functions. Rectifiable curves.

Rearrangements of terms of a series, Riemann's theorem , Functions of bounded variation.

Lebesgue outer measure, Measurable sets. Regularity, Measurable functions. Borel and Lebesgue measurability, Non-measurable sets.

Integration of the general integral, Integration of series. Riemann and Lebesgue integrals.The four derivatives,. Lebesgue differentiation theorem.Differentiation and integration.

The L_p-space,Convex function, Jensen's inequality, Holder and Minkowski inequalities, completeness of L_p-space convergence in Measure. Almost everywhere convergence.

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M.A./MSc.(Previous): Mathematics

Paper III: TOPOLOGY **Marks: 100**

Definition and example of topological spaces. Closed sets closure. Dense sub sets Neighborhoods, interior, Exterior and boundary. Accumulation points and derived sets.Base and subbases.Subspaces and relative topology.

Alternative methods of defining topology in terms of Kuratowski closure operator and Neighborhood system.

Continuous system and Homeomaphism.
First and second countable spaces, Lindelof's theorems, separable spaces, second countability and separability.

Separation axioms T_0, T_1, T_2, T_3, T_4; their characterization and basic properties, Urysohn's lemma, Tietze extension theorem.

Compactness, continuous functions and compact sets, basic properties of compactness. Compactness and finite intersection property.Sequentially and countably compact sets. Local compactness and one point compactification. Stone-vechcompactification.Compactness in matric spaces. Equivalence of compactness, countable compactness and sequential compactness in matrix spaces.

Connected spaces.

Tychonoff product topology in terms of standard subbase and its characterizations.Projection maps.Separation axioms and product spaces.Connectedness and product spaces. Compactness and product spaces(tychonoff'stheroum). Countability and product spaces.

M.A./MSc.(Previous): Mathematics

Paper IV: FLUID MECHANICS **Marks: 100**

Lagrangian and Eulerian methods.Stream lines, Stream tubes, equation of continuity, irrotational and rotational motion, circulation.Euler's dynamical equations, surface conditions.Velocity potential, Bernoulli's theorem.

Motion in two dimensions, stream function.Use of complex potential for irrotational flow. Circle theorem, uniqueness theorem, Kinetic energy of an infinite mass of fluid, constancy of circulation, flow past a moving cylinder, Balsius theorem, theorem of Kutta and Joukowskii, Rectilinear vortices.,Axi-Symmetric fluid motion, Stokes' stream function.

Wave motion in a gas, speed of sound, Equation of motion of a gas, Subsonic, Sonic and Supersonic flows of a gas, Isentropic gas flows, Flow through a nozzle. shock formation, Elementary analysis of normal and oblique shock waves.

Visocosity, Most general motion of a fluid element, stain quadric, stress quadric,relation between stress and rate of strain components.

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M.A./M.Sc. (Previous)
Mathematics
Paper-V (Optional Paper)

Any one of the following papers-

M.A./MSc.(Previous): Mathematics

Paper V(a): OBJECT ORIENTED PROGRAMMING USING C++ Marks: 100

Basics of C++ :Structure of main( ), Data Types , Variables, Constants and keywords, Operators, Header files, printf(), scanf(), Control flow (if-else, switch, break, while, do-while, for, continue, goto, Arrays, Strings , Structures and unions, Pointers.

Preliminaries of C++: cin, cout objects, Insertion and Extraction operators, Reference variables.

Functions in C++: Function prototyping, Default arguments, Inline functions, Call by reference, Return by reference, Function overloading.

Classes and Objects :Access specifiers, Defining data members & member functions, Creating objects, Accessing members of a class, Array of objects, Objects as function arguments, Returning objects, Constant & Static member functions, friend function.

Constructors &Destructors :Basics, 'this' pointer, Types of constructor (parameterized, copy, default), Memory allocation, Destructors.

Operator overloading :Operator function definition, Overloading all operators, Overloading using friend functions.

Inheritance :Basics, Single inheritance, Private member inheritance, multiple & multilevel inheritance, overloading new & delete operators

Files :Introduction, Classes for file stream operations, Opening & closing a file.

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M.A./MSc.(Previous): Mathematics

Paper V(b): GRAPH THEORY **Marks: 100**

Graphs : Definitions and examples, Graphs as models. Subgraphs, walks, paths and cycles, Connectedness, Matrix representation of graphs, Operations on graphs, connectedness algorithm.

Trees and connectivity : Definition and simple properties, Bridge, spanning trees, Caley's theorem. Connector problems.Kruskal's Algorithm, Prim Algorithm.Shortest path problems.The Breadth First Search Algorithm.The Back-tracking Algorithm. Dijkstra's Algorithm. Cut vertices, Connectivity.

Euler Tours and Hamiltonian Cycles : Euler Tours, Konigsberg Seven bridges problem Eulerian graphs. Fleury's Algorithm, Hierholzer's Algorithm. The Chinese postman Problem. Hamiltonian graphs. Dirac theorem.Closure of a graph.Bondy and Chavatal
Theorem.The travelling salesman problem.

Matchings : Matching and Augmenting paths, Berge theorem. The Marriage problem.The Personnel Assignment problem.The matching algorithm for bipartite graphs.The Hungerian Algorithm.The optimal assignment problem.The Kuhn-Munkrej Algorithm.

Networks : Max-Min Theorem, Separating sets, Menger's Theorem.

Ramsey Theory : Party Problem, relations among Ramsey numbers.

M.A./MSc.(Previous): Mathematics

Paper V(c): DIFFERENTIAL GEOMETRY OF MANIFOLDS **Marks: 100**

Difnition and examples of differentiable manifold.Differentiable functions, Differentiable curves, Tengent space,Vector fields, Lie bracket.

Invariant view point of connections. Covariant differentiation .Torsion. Curvature, Parallelism, Difference tensor of two connections, Lie derivative.

Riemannian Manifold, Riemannian connection, Riemannian curvature tensor and Ricci tensor, Idenitities of Bianchi, Sectional curvature.

Exterior product of two vectors, Exterior algebra of order r, Exterior derivative, Cartans's structural equations.

Submanifolds, Normals, Induced connection, Gauss formulae. Weingarten formulae, Lines of curvature, Mean curvature, Equations of Gauss and Codazzi.

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M.A./MSc.(Previous): Mathematics

Paper V(d): MATHEMATICAL MODELING **Marks: 100**

Mathematical Modelling: Need, techniques, classification and simple illustrations of mathematical modeling. Limitations of mathematical modelling.

Mathematical Modelling Through Ordinary Differential Equations of First Order: Linear and Non-linear Growth and Decay models. Compartment models.Mathematical modelling in Dynamics through ordinary differential equations of first order. Mathematical modelling of geometrical problems through ordinary differential equations of first order.

Mathematical Modelling Through System of Ordinary Differential Equations of First Order: Mathematical modelling in Population Dynamics. Mathematical modelling of epidemics.Compartment models.Mathematical modelling in Economics. Mathematical models in Medicine. Arm Race, Battles and International Trade in terms of system of ordinary differential equations, Mathematical modelling in Dynamics.

Mathematical Modelling Through Ordinary Differential Equations of Second Order: Mathematical modelling of planetary motions. circular motion and motion of satellites, Mathematical modelling through linear differential equations of second order, Miscellaneous mathematical models through ordinary differential equations of second order.

Mathematical ModellingThrough Partial Differential Equations: Situations giving rise to partial differential equation models. Mass-balance equations.Momentum-balance equations. Models for traffic flow on a highway.

M.A./MSc.(Previous): Mathematics

Paper VI: Viva-Voce **Marks: 100**

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