

Dr. Ram Manohar Lal Avadh University Faizabad  
Syllabus of M.A. /M.Sc. Mathematics (for affiliated colleges)

**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. Commutator sub groups. External and internal direct product of groups. Cauchy theorem for finite groups. Sylow's theorem.

**Canonical forms:** similarity of linear transformations. Invariant spaces. Reduction to triangular forms. Nilpotent transformations. Index of Nilpotency. 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. Insolubility of the general equations of degree 5 radicals.

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

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**Paper II: ADVANCED REAL ANALYSIS 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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**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 Homeomorphism.  
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-vech compactification. Compactness in metric spaces. Equivalence of compactness, countable compactness and sequential compactness in metric 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's theorem). Countability and product spaces.

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**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, Blasius theorem, theorem of Kutta and Joukowski, 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.

Viscosity, Most general motion of a fluid element, strain 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./M.Sc.(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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