MASTER OF SCIENCE (M.Sc.)

Course code - 202

<u>SUBJECT</u>

MATHEMATICS

Subject code – 03

M.Sc.(MATHEMATICS)

COURSE STRUCTURE

PREVIOUS YEAR

PAPER I – MSMT-101: REAL AND COMPLEX ANALYSIS   100 MARKS

PAPER II– MSMT-102: MODERN ALGEBRA   100 MARKS

PAPER III–MSMT-103: FLUID MECHANICS   100 MARKS

PAPER IV– MSMT-104: COMPUTER MATHEMATICS   100 MARKS

PAPER – MSMT-105P: PRACTICAL / Viva Voce (Based on Papers 101, 102, 103, 104)

                                                            100 MARKS

FINAL YEAR

PAPER I – MSMT-201: TOPOLOGY AND FUNCTIONAL ANALYSIS   100 MARKS

PAPER II – MSMT-202: OPERATION RESEARCH   100 MARKS

PAPER III – MSMT-203: SPACE DYNAMICS   100 MARKS

PAPER IV – MSMT-204: **(Any One from the following Papers)**   100 MARKS

      (i)   Computational Numerical Methods
      (ii)   Boundary Layer Theory
      (iii)   Magneto – Hydrodynamics
      (iv)   Graph Theory
      (v)   Linear Algebra
      (vi)   Measure theory and Integration

PAPER – MSMT-205P: PRACTICAL / Viva Voce (Based on Papers 201, 202, 203, 204)

                                        100 MARKS

Detailed Syllabus
M.Sc. (Previous) Mathematics

PAPER I

MSMT-101: Real and Complex Analysis

Unit -1

Taylor's Theorem for functions of two variables, Maxima and Minima of functions of three variables, Lagrange's method of undetermined multipliers.

Unit -2

Reimann Integral, Integrability of continuous and monotonic functions, fundamental theorem of integral calculus, Mean Value Theorem of integral calculus. Darbox sums and Darbox theorem.

Unit -3

Functions of a complex variable, concepts of limit, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations (Cartesian and polar form). Harmonic function, Orthogonal system, Milne theorem.

Unit -4

Complex integration, Line Integral,Cauchy's fundamental theorem of integration, Morera's theorem, Taylor's theorem, Laurent's series, Lieoville's theorem. Powder series, Analytic continuation.

Unit -5

Zeroes and singularities of analytic functions, Rouches theorem, Fundamental theorem of Algebra, Residue theorem, Contour integration.

PAPER II

MSMT-102: Modern Algebra

Unit – 1

Group, Subgroup, Cyclic group, Normal sub group, Lagranges theorem, Homomorphism, Isomorphism, Natural homomorphism, Cayley's theorem Quotient group, Fundamental theorem, Automorphism, Inner automorphism.

Unit – 2

Parmutations, Conjugate classes, centre and normalizer, conjugate elementary class equation, Theorem – I – If order of group $G=p^n$, then $Z(G) \neq e$, Theorem – II if $o(G) = p^2$ then group is Abelian. Cauchy's theorem for Abelian group. Sylow's theorems, Composition series, Jordan Holder theorem for finite group.

Unit – 3

Ring Theory, Ideals, maximal ideals and quotient rings, Homomorphism of rings, Fundamental theorems of homomorphism.

Unit – 4

Integral Domain, field, Quotient field, Prime field, Direct product of rings, polynomial rings, divisibility of polynomial, value of polynomial, Irreducibility of polynomials, Remainder theorem, Vector space.

Unit – 5

Linear Transformation Rank and nullity, Greatest common division of two polynomials, factorization theorem, unique factorization theorem, principal ideal domain and Euclidean domain.

PAPER III
MSMT-103: Fluid Mechanics

Unit – 1

Kinematics :- Lagrangian and Eulerian methods, steady and unsteady flows, Uniform and non-uniform flows, Stream lines, path lines and streak lines, Equation of continuity (Cartesian, polar and cylindrical coordinates), Equivalence of the two forms of equation of continuity, Velocity potential, Irrotational and rotational flows, Boundary surface, Stream function, Two dimensional source, Sink and doublet.

Unit – 2

Conservation of Momentum :- Euler's equation of motion of an inviscous fluid, Bernoulli's equation, conservation field of force, Integration of Euler's equation, Impulsive motion of a fluid, Energy equation, Application of Bernoulli's theorem.

Unit – 3

Irrotational Motion :- General motion of a fluid element, Vorticity,, Flow and circulation, Stoke's theorem, Kelvin's circulation theorem

Unit – 4

Study motion in parallel plane in circular tubes and in between circular cylinder, Motion of circular cylinder and sphere, Boundary layer Theory.

Unit – 5

Viscous Fluid Flow :- Viscosity, Reynold's number, Components of stress, Navier-Stoke's equation of motion, Boundary conditions, Equation of motion in cylindrical coordinates (without proof), Dissipation of energy,Due to Viscosity.

PAPER IV

MSMT-104: <u>Computer Mathematics</u>

Unit – 1

Computer Fundamentals, General Concepts of Computer organization and Memories. Number System:- Binary, octal, Decimal and Hexadecimal number system and their conversions,Binary Addition, subtraction, division, multiple, Complement.

Unit – 2

Boolean Algebra :- Basic Definitions, Sum of Products and Product of sums.

Unit - 3

The Algebra of Logic, Logic Circuits and Switching circuits, Karnaugh Maps, Range kutta method.

Unit – 4

Algorithms, Flowchart and simple Programming Techniques, Networks Analysis, forton Programming in 77 and 99.

Unit - 5

Matrices, Computer Programs of Evaluation of Inverse of matrices and Solution of Algebraic Equations, Gouss elimination and triangular method.

PAPER V
MSMT-105P: Viva –Voce
Viva – Voce based on papers I to IV

M.Sc. (Final) Mathematics

Paper I

MSMT-201: Topology and Functional Analysis

Unit – I :- Topological space : Definition and some examples (elementary concepts), Relative topology, weak topology, open basis, open sub-basis, continuity and homomorphism.

Unit -II :- **Compactness :** compact spaces, product spaces, compactness of metric spaces.

Separation : T_1, T_2, T_3 Spaces
Connectedness : connected spaces

Unit – III :- Banach spaces : Definition and some examples, continuous linear transformation, Hahn-Banach Theorem, The natural embedding of N in N.

Unit – IV :- The open mapping theorem, The conjugate of the operator, Hillbert spaces and its simple properties.

Unit – V :- Orthogonal components, orthogonal sets, the conjugate spaces, the adjoin of an operator, self-adjoin operators, normal and unitary operators. Adjoint of an operator, self-adjoint, normal and unitary operators.

Paper II

MSMT-202: Operation Research

Unit – I :- Introduction to operation research, operation research definition and origin. Essential features of O R approach, quantification of factors, stages in OR study Linear programming problems, convex sets, modeling problems of allocations,
Transportation and Assignment problems.

Unit – II :- Replacement, sequencing,

Unit – III :- Theory of games, dynamic programming.

Unit – IV :- Queuing Theory and reliability theory

Unit – V :- Inventory control

Paper III

MSMT-203: Space Dynamics

Unit – 1 Principal axes, momental ellipsoid, principle of conservation of momentum and energy.

Unit – II Equation of motion (Finite forces)

Unit – III Equation of motion (Impulsive forces)

Unit – IV Lagrange's equation in generalized coordinates.

Unit – V   Motion in three dimensions, Small Oscillations, motion of top, Hamilton's
Equations

Paper IV- MSMT-204:

(Any One from the following Papers)

(i)   Computational Numerical Methods

Unit - I   Solution of algebraic and transcendental equations in one variable by Regula-falsi method, Newton- Raphson method, Bairstow method.

Unit – II   Inversion of complex matrices, Escalator method, Gauss-seidel method, relaxation method.

Unit – III   Simple step and multi-step methods of numerical solution of differential equations, criterion of stability and consistency convergence of numerical methods.

Unit - IV   Algebraic eigen values and vectors, iterative method for finding eigen value and eigen vectors, Power method, Jacobi method.

Unit - V   Difference equations : Formation of difference equations, solution of difference equations : Linear difference equations, Homogeneous linear difference equations, existence and uniqueness theorem.

Paper IV- MSMT-204:

(ii)   Boundary Layer Theory

Unit I   The boundary layer concept; Boundary layer equation for incompressible flows.

Unit II   Compressible flows.

Unit III   Karman's integral conditions, the separation of boundary layer.

Unit IV   Approximate methods for the two dimensional steady boundary layer equations.

Unit V   Unsteady boundary layers. Thermal boundary layer in Laminar flows.

Paper IV - MSMT-204:

(iii)   Magneto – Hydrodynamics

Unit I   The Kinematics of MHO.

Unit II   Magneto – Hydrodynamic equations, boundary conditions.

Unit III   Alfven wave and shock waves.

Unit IV   Exact solution of channel flows, quasi one dimensional flows.

Unit V   Hydro magnetic boundary layer theory.

Paper IV - MSMT-204:

(iv) Graph Theory

Unit I   Introduction, Concept, paths circuits & Connectivity Planner graphs, Euler's Theorem & Kurteweaki's Theorems.

Unit II   Colouring of Maps and Graphs, Matrix, Representation of Graphs.

Unit III   Directed graphs, Graphic Theoretic Algorithms.

Unit IV   Graphs and net work analysis**.**

Unit V   Graphs theory in operation research.

Paper IV- MSMT-204:

(v) Linear Algebra

Unit I   Vector spaces, sub –spaces, Linear dependence and independence, bases dimension, direct sums, dimensions of a direct sum. Quotient spaces.

Unit II   Isomorphism, dual space, reflexivity, annihilator bilinear forms, linear transformation, transformation as vectors, products, polynomials of linear transforms, linear invertible transformation, matrices.

Unit III   Invariance, reducibility, Projections, ad joints, change of basis, similarity, quotient transformation, range and null space, rank and nullity.

Unit IV   Inner product space, orthogonality, Schwartz's inequality, Complete orthonormal sets.

Unit V   Projection theorems; Linear function, Natural isomorphism, self-ad joint transformation, Positive transformations, Isometrics, Projections, Eigen value and Eigen vectors, spectra theorem.

Paper IV - MSMT-204:

(vii) Measure theory and Integration

Unit I

   Length of an open set, concept of measure, Lebesgue outer measure and measurable sets, example of non-measurable set, Sigma algebra, Borel sets, and –sets, Outer and inner regularity of Lebesgue measure.

Unit II

   Set function, abstract measure spaces, properties of measures, some examples of measures, measurable spaces

Unit III

   Measurable functions, combinations of measurable functions, and limits of measurable functions.

Unit IV

Review of Riemann integral, integrable simple functions, the Lebesgue integration of a measurable function, integration with respect to a measure.

Unit V

Almost everywhere convergence, convergence in measure, Fatou's Lemma, monotone and dominated convergence theorems.

Paper V
MSMT-205P: <u>Viva – Voce</u>

Viva – Voce based on Papers I to IV