M. Sc. Previous & Final
MATHEMATICS
M.A./M.Sc. (Previous

Note—There shall be 4 compulsory papers, each carrying 100 marks. In each paper, at least two questions shall be asked from each Unit. A candidate shall be required to solve one question from each Unit.

Paper I—Real Analysis and Functions of a Complex Variable

Unit I—Metric Space & Riemann Integration : Continuity in metric space, properties of continuous functions, Uniform continuity, Differentiability, chain rule, Darboux Theorem, Taylor's Theorem. Lower and upper sums; R-integral of continuous functions; Monotonic functions; Fundamental theorem of integral calculus; Mean value theorem of integrations.

Unit II—Riemann Stieltije's Integrals & Uniform Convergence : Upper and lower integrals; Conditions of integrability; Mean value theorem; Fundamental theorem of integral calculus. Weierstrass M-test for sequences and series of functions, uniform convergence and continuity, uniform convergence and integration & differentiation.

Unit III—Analytic functions, Cauchy-Riemann equations, Conformal representation.

Unit IV—Complex Integration : Cauchy's fundamental theorem of integration, Morera's theorem; Taylor's theorem; Laurent's series; Lieoville's theorem.

Unit V—Zeros and singularities of analytic functions; Residence theorem and contour integration.

Paper II—Algebra

Unit I—Group Homomorphism : Isomorphism, Natural homomorphism; Cayley's theorem; Quotient group; Fundamental theorem; Endomorphism; Automorphism, Inner automorphism, Direct product.

Unit II—Conjugate classes centre and normalizer; conjugate elementary class equation. Theorem (1) of order od group $G = P^n$, then ZG/e; and Theorem (2) Groups of order p^2 are Abelain. Cauchy's theorem of Abelian group. Sylow's theorems Compositions series, Jordan Holder theorem for finite group.

Unit III—Ring Theory : Ideals, maximal ideals and quotient rings. Homomorphism of rings, Fundamental theorems of homormophism, integral domain field, quotient field, prime field, direct product of rings polynomial rings, divisibility of polynomial, value of polynomial, irreductibility of polynomials, remainder theorem, greatest common,

division of two polynomials, Factorization theorem, Unique factorization theorem, Principal ideal domain and Ehdudian domain.

Unit IV—Vector Spaces, Sub Spaces, Linear dependence and independence bases, dimension, direct sums, dimension of a direct sum, quotient spaces.

Unit V—Isomorphism, dual spaces, dual bases, reflexivity annihilators, bilinear forms, linear transformation, transformations as vectors, Products, Polynomials of linear transforms, linear investible transformations.

Paper III—Fluid Dynamics

Unit I—Irrotational Motion : Circulation, Cyclic constants, Green's theorem, Kelvin's minimum kinetic energy theorem, Stoke's stream functions and applications; Theorem of Blasins; Kutta & Joukowaski.

Unit II—Vortex motion; Vortex pair and circular cylinder; Infinite row of parallel vortices; Karman's street; Rectilinear vortex with circular and elliptic sections.

Unit III—Waves : Stationary waves; Long waves, Energy surface waves in deep water, Progressive waves reduced to steady motion, waves at the common surface of two liquids, Group velocity.

Unit IV—Viscosity; Reynold's Number; components of stresses, Navier-stokes equations of motion, Boundary conditions, Equations of motion in cylindrical and polar-spherical coordinates (without proof), Dissipation of energy.

Unit V—Steady motion in parallel planes, in circular tubes and in between circular cylinders, motion of circular cylinders and sphere; Boundary layer theory.

Paper IV (i) Computer Mathematics

Unit I—Computer Fundamentals Boolean Algebra, General Concepts of Computer organization & memories, Number System-Binary, Octal, Decimal and Hexadecimal number system and their conversions.

Unit II—Constants (Real and Integer) Integer Variable Name, Real Variable Name, Integer Expression, Real Expression, Arithmatics Operators, Arithmatic expressions, statement DO; IF Loops Flow Charts and Algorithms with reference to FORTRAN 77 or 90 Languages.

Unit III—Array, Dimensions, Functions, Library Functions, ASCII Codes; Simple programs in FORTRAN 77 or 90.

Unit -Matrices; Computer Programs of Evaluation of Inverses of matrices and solution of algebraic equations.

Unit V—Finite difference technique (Runge Kutta Methods) for the solution of ordinary differential equations with simple Computer Programs.

Note—Only regular Candidate can offer this paper.

Practical based on Paper IV **50 Marks**

(Duration of Practical Examination will be 3 hours)

Paper IV (ii) Mathematical Statistics

Unit I—Theory of Sampling : Sampling, sampling of attributes; Mean and Standard deviation in simple sampling of attributes; Large samples; Tests of significance, sampling distribution of mean and fiducial limits for unknown mean.

Unit II—X^2-distribution and its properties; Test of significance based on X^2-distributions.

Unit III—t-distribution and its properties; Tests of significance based on t-, F-and Z-distributions.

Unit IV—Theory of Estimation : Characteristics of estimators; concept of consistency unbiasedness, and efficiency, Methods of estimation, Cramer-Rao inequality.

Unit V—Stochestic Process : Basic elements of stochestic process; Marcov process; classification of Marcov process; Bernoulli process and Poisson process.

Note—Electronic calculator can be used in paper IV (ii).

MATHEMATICS
M.A./M.Sc. (Final)

Note—There shall be three compulsory papers (I), (II), (III). Besides this every candidate shall be required to choose any one paper (as paper IV) out of the given list besides a viva voce. Each paper including viva-voce shall carry 100 marks. At least two questions shall be asked from each unit from each paper. A candidate shall be required to solve one question from each unit.

Paper I—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 homomorphising compactness : Compact spaces : Product spaces; Compactiers of matric spaces.

Unit II—Separation T_1, T_2, T_3 spaces and Housdorff spaces; Connectedness; Connected spaces; Components of a space and totally disconnected space and locally connected spaces.

Unit III—Banach spaces : Definition and some examples; Continuous linear transformation, Halm-Banach theorem, The Natural embedding of N in N.

Unit IV—The open mapping theorem, The conjugate of the operator, closed graph theorem, Hilbert spaces and its simple properties.

Unit V—Orthogonal components Orthogonal sets, the conjugate spaces; The adjoints of an operators, Self adjoint operator, Normal and Unitary operators.

Paper II—Operation Research

Unit I—Linear programming problems; some theorems on convex sets; Modelling problems of allocations. Transportation and Assignments.

Unit II—Replacement, Sequencing, Inventory Control (Deterministic Models only)

Unit III—Theory of games; Dynamic programming.

Unit IV—Quencing Theory.

Unit V—Non-linear programming simple problems on integer programming.

Note—Electronic calculator cab be used in Paper II.

Paper III—Space Dynamics

Unit I—Principal axes, Principle of conservation of momentum and energy, sudden fixtures.

Unit II—Equations of motion (Finite forces)

Unit III—Lagrange's equations in gerneralized coordinates.

Unit IV—Motion in three-dimensions.

Unit V—Motion of top & Hamilton's equations.

Paper IV—A Student will offer any one course out of the following as Paper IV

1. Boundary Layer Theory. 2. Magneto-hydrodynamics. 3. Theory of Relativity. 4. Theory of Elasticity. 5. Measure Theory. 6. Graph Theory. 7. Information Theory. 8. Computational Numerical Methods. 9. Computer programming. 10. Linear Algebra. 11. Fuzzy Mathematics. 12. Bio-mathematics.

Paper IV (1) Boundary Layer Theory

Unit I—The boundary Layer concept; Boundary layer equations 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 (2) 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 solutions of channel flows, quasi one dimensional flows.

Unit V—Hydromagnetics boundary layer theory.

Paper IV (3) Theory of Relativity

Unit I—Michelson and Norkey's Experiment. Lorentz transformation, Fitzgerald contraction, Hamilton Principle.

Unit II—Mass, Momentum and energy, Minkowskils 4-dimensional world.

Unit III—Contravariant and covariant vector multiplication, contraction and quotient law of tensors, transformation, fundamental tensor, associated tensor.

Unit IV—Christoffel's 3 index symbols, geodesic, covariant differentiation, Reimann-Christoffel tensor, Principle of equivalence condition for flat space time.

Unit V—Einstein's law of Gravitation's solution, planetary orbit, three crucial texts, stress, curvature of space time. Energy momentum tensor, cosmological models.

Unit IV—(4) Theory of Elasticity

Unit I—(a) Analysis of stress; stress-tensor, surface and body forces, plane stress, principal stresses and principal planes, Mohr's diagram, uniform stress and pure shear, isotropic and deviation tensors.

(a) Analysis of Strain, compoments of strain, types of strain, equations of comparibility.

Unit II—Equations of Elasticity : Genralized Hook's law, elastic constants for isotropic medium, strain energy in isotropic medium, equations of elasticity, dynamical equations of elasticity derived from energy principle.

Unit III—(a) Plane strain and plane stress problems, generalised plane stress, Airy's Stress function.

(b) Plane problems in polar coordinates, axially symmetric displacement Airy's stress function, thick with circular cross-section.

Unit IV—Torsion : Problem of Saint Venant, torsion function, Prandtl's stress function, stress lines, hollow shafts Bar with eliptic cross-section, equilateral triangle, rectangular cross-section.

Unit V—(a) Flexure of beams, Bending under terminal couples Bending under transverse lead, shear centre, Beam of elliptic cross-section, Beams under lateral leads.

(b) Thin plates, basic assumptions, stress resultant and movements, examples of pure bending.

Paper IV (5) Measure Theory

Unit I—Limits, components & differences, Rings & Algebras, Generated rings and J-rings, Menetens classes.

Unit II—Measure on rings, Measure on Intervals, Properties of measure, Outer Measures, measureables sets.

Unit III—Properties of Induced Measures, Extension, Completion & Approximation Inner Measures, Lebseque Measure, Non-Measurable sets.

Unit IV—Measure spaces, Measurable functions, combination of measurable functions, Sequences of Measurable functions, Pointwise convergence, convergence in measure.

Unit V—Integrable simple functions, sequences of simple Integrable functions, sequences of Intergrable functions, properties of integrable.

Unit IV (6) Graph Theory

Unit I—Introduction, Concepts, Paths, Circuits & Connectivity planar Graphs, Euler's Theorem & Kurateweaki's Theorems.

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

Unit III—Directed graphs, Graphis, Theoretic Algorithms.

Unit IV—Graphs and Net work analysis.

Unit V—Graphs theory in operations research.

Paper IV (7) Information Theory

Unit I—Information Concept and Processing : Definition, need, quality, value and concept of information, Category and Level of Information in Business Organisation, Data concepts and Data processing, Data Representation.

Unit II—Information Representation : Information contents; Introduction to information representation in digital media. Text, Images, Audio, Video, Elementary Concepts in information, preservation, Data compression Jpeg, Mpeg, Introduction to DOS, WINDOWS.

Unit III—Computer Hardware and Information : Definition and classification of computer, RAM/ROM, Computer Hardware, CPU, Various, I/O devices, Peripherals, Storage Media and Software definition, Introduction to word and Powerpoint.

Unit IV—Computer Networks and Communication : Need for Data Transmission over distances, Types of Data Transmission, networking of computers-LAN, WAN, Basic concepts in computer networks, Client-server architecture.

Unit V—Internet and World Wide Web : Introduction to HTML, Gopher, FTP, Tolnet, Web Browsers, Net surfing, Search engines, E-Mail, Digital Signatures, Network security, Firewall.

Paper IV (8) Computational Numerical Methods

Unit I—Solutions of algebraic and transcedental equations in one variable by Regula-Falsi method, Newton-Rephson method, Bairstow method, iterative method & Graeffe's root-squaring method.

Unit II—Matrix inversion by the escalator methods; Iterative methods : Jacobi's method, Gauss-Seidel method & relaxation method; Inversion of complex metrices Improvement in the accuracy of an inverse.

Unit III—Simple step and multi-step methods of numberical solution of differential equations : Criterion of stability and consistancy; convergence of numberical methods.

Unit IV—Algebraic-eigen values and vectors; Iterative method for finding eigen values and eigen vectors; Power method, Jacobi's method; Complex eigen values.

Unit V—Difference equations : Formation of difference equations; Solution of difference equations : Linear difference equations; Homogeneous linear difference equations; Existance and uniqueness theorem; Methods of variation of parameters and generating functions.

Note—Electronic calculator can be used in paper IV (8).

Paper IV (9) Computer Programming

Unit I—Constants (Real and Integer) Integer variable name, Real variable Name, Integer Expression, Real Expression, Arithmetic operators, Arithmetic Expressions, Statement DO. F, loop, sequentials, C-Language.

Unit II—Array, Dimensions, Functions, Library functions, C-Language.

Unit III—Finite difference Techniques (Richard's Method, Lesonen method, Crank-Nicolson method and McNold method) with error analysis, stability, convergence and consistency.

Unit IV—Finite element techniques (Galerkin method, weighted Usidual method, Ritz method, least square method) with error analysis, stability, convergence and consistency.

Unit V—Application of finite difference techniques for the solution od ordinary and partical differential equations in one and two dimensions, applications of finite element technique for one dimensional boundary value problems.

Paper IV (10) 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 spaces, reflexivity, annihilator bilinear forms, linear transformation, transformations as vectors, products, polynomials of linear transforms, linear invertible transformations, matrices.

Unit III—Invariance, reducibility, Projections, adjoints, change of basis, similarity, quotient, transformations, range and null space, rank and nullity.

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

Unit V—Projection theorems; Linear functions, Natural isomorphism, Self-adjoint transformation, Positive transformations, Isomatrices, Projections, Eigen values and eigen vectors, spectra theorem.

Paper IV (11) Fuzzy Mathematics

Unit I—Classical sets to Fuzzy sets, Fuzzy sets versuscrisp sets.

Unit II—Operation on Fuzzy sets.

Unit III—Fuzzy Arithmatic.

Unit IV—Fuzzy relations.

Unit V—Fuzzy logic.

Paper IV (12) Bio-Mathematics

Unit I—Mathematical Modelling in population, single species, Models, Steady States, Stability, Exponential and logistic growth models.

Unit II—Single species models with Age. Structure, Population Models Involving Age structure, Continuous time, Discrete time, Density Dependent Age Structure Population Model.

Unit III—Predator-Prey Systems, two special models, two dimensional model-without and with carrying capacity competition models.

Unit IV—Epedmic models, S. I. S. models S. I. R. model S. I. R. S. Model.

Unit V—Bio-Fluid Dynamics, Poisecuille flow, Blood flow in rigid and elastic artilleries sedeimentation of red blood cells trans capillary exchange.

Note—Electronic calculators can be used in the Paper II and IV (8)

Paper V—Viva-Voca.