B. Sc. Part - I:- MATHEMATICS (HONOURS)

PAPER-I

Twelve questions to be set, Six to be answered selecting at least one from each group. One question will be objective and it will be compulsory. This question will carry 20 marks. Rest questions are each of 16 marks.

Group-A: Set Theory & Trigonometry

Set, Subsets, Power Set, Algebra of Sets, De Morgan's Laws, Cartesian Product of sets, relation, equivalence relation, Definition and examples of partial and total order relation, Countable and uncountable sets, Countability of rational, Real And algebraic number system, Countability of unions.(Two Questions)

Hyperbolic function, Resolution into factors.(Two Question)

Group-B: Matrices (Two Questions)

Sum old product of matrices, symmetric and skew symmetric, matrices, Transpose, Adjoint and inverse of a matrix, Solutions of a system of linear equations with three unknown.

Group-C: Linear Programming (Two Questions)

Convex sets & their properties, Linear programming problems and their graphical solution, Theory of simplex method and their simple applications.

Group-D: Theory of Equations (Three Questions)

Fundamental theorem of Algebra, Relation Between roots and coefficients of a polynomial equation, Evaluation of symmetric functions of roots of cubic and biquadratic equations, Solutions of cubic equation, Descartes rule of signs.

Paper-II

Twelve Questions to be set. Six to be answered selecting at least one from each group. One questions will be objective and it will be compulsory. This Question will carry 20 marks and rest questions are each of 16 marks.

Group-A: Differential Calculus

Successive differentiation, Leibnitz theorem, Tangents and Normal, Curvature Asymptotes Partial Differentiation, Euler's theorem, Exact Differential inderminate from L. Hospital rule.(Three Questions)

Group-B: Integral Calculus (Two Question)

Integration of rational and irrational, Function Notion of integral as limit of sum, Evaluation of definite integrals, Reduction formulae, Curve tracing, Areas of curves, Length of curves, Volumes and surface areas of solids of revolution.

Group-C: Analytical Geometry Of 2 Dimensions (Three Question)

Condition for the general equation of second degree to represent parabola, ellipse and hyperbola and reduction into standard forms, Equations of Tangents and normal of general equation and their forms in their particular conic section, Equation of polar, chord of contact, pair of tangents in case of parabola, ellipse, Hyperbola and their special properties, Polar equation of conic section-Tangents and normals.

Group-D: Analytical Geometry Of 3 Dimension (Three Question)

Rectangular, Spherical, Polar and cylindrical co-ordinates, Angle between

straight lines, Equation of planes and straight lines, Shortest distance between lines, sphere, Cones Cylinder, Equations of conicoide, Normal and Cojugate diameters of ellipsolid.

B. Sc. Part - I:- MATHEMATICS (GENERAL)

Stress should be given on development of ideas and problems, theories rather than on solving problem. Problems should be short and intelligent.

Paper-I

1. Set theory- Three question to be set and two questions to be answered.

2. Abstract Algebra- Four question to be set and three question to be answered.

3. Real Analysis- Four question to be set and three question to be answered.

4. Trigonometry- Three question to be set and two questions to be answered.

Set Theory : General form of De Morgen Laws, Cartesian product of sets, equivalence relation induced by a partition of a set, Fundamental theorem or equivalence relation, Composition and factorization of mapping, set mapping, countability of rational, real and algebraic number system.(**Three questions**).

Abstract Algebra: Binary Operation, Notions of group, Abelian group with examples, Sequences of identity elements in a group, Cancellation laws in group, Definition of Sub-group and cyclic group with example, Definition of rings, Integral domains and field and their examples (Two Questions).

Matrices, operations of matrix algebra, Kinds of matrices, Transpose adjoint and inverse of the matrix, Product of determinants, Solution of consistent Systems of Linear equation by Cramers rule.(Two Questions).

Real Analysis: Sequences of real numbers and their limits, Bounder Sequence, Monotonic sequence, Cauchy's general Principle of convergent.(One Questions).

Convergent and divergent series, Convergence of series of positive term, Comparison tests, Cauchy's root test, D' Alembert's ratio test and Reabe's test, Alternating Series and Leibnitz Test, Absolutely convergent series and continuity and differentiability of real function of a single real variable and properties of continuous function.(Three Question).

Trigonometry: De Moivre's Theorem and its application to the expansion sinx , cos x, tan X, Gregory's series, hyperbolic function.(three Questions).

B. Sc. Part – I:- MATHEMATICS (SUBSIDIARY)

Answer eight questions selecting at least one from group.

Time: 3 Hours   *PAPER-I*   **Total Marks- 100**

Group-A: Set Theory Abstract Algebra (Four Questions)

Rational of sets and their algebra, Cartision products, Notion of relation and mapping and their Classification, Equivalence relation and partition of sets.

Binary operation, Notions of Group, Sub Group, Cycle group and permutation group , Elementary Concepts of ring, integral domain and field with examples.

Group-B: Matrices and Linear Programming (Four Questions)

Matrices and its algebra, Kinds of Matrices (unitary matrix Hermitian Matrix),Transpose, Adjoint, inverse and orthogonal matrices, Notions of Rank of matrix.

Convex set and their properties L.P.P. problem and their graphical solution, Theory of simplex method and their simple applications.

Groups-C: Trigonometry and Real Analysis

De Moivre's Theorems and its application, Complete arguments and Hyperbolic function series Gregories series. (Two Questions)

Real Analysis (three questions)

Sequence and their convergence, Cauchy's general principle of convergence, convergent and divergent series of the positive terms, Comparison test, Cauchy's root test, D. Almberts test, Alternating series, Continuity and differentiability of real function of a single real valuable and simple continuity and discontinuity of function of single variable and their properties.

Group-D: Analytical Geometry Of two Dimensions

System of circles, Coaxial Circles, General Equation of second degree and its reduction to standard from of parabola, Ellipse and Hyperbola, Equations of tangents and normal for general equation and their form in case of particular conics. (Two Questions)

Group-E: Analytical Geometry of Two Dimensions

Relations and notions between different system of Co-ordinates, Direction cosines, Angle between two straight lines, Equation of planes and straight line, Condition for coplanarity of straight lines. (Two Questions)

B. Sc. Part - II:- MATHEMATICS (HONOURS)

PAPER-III

Twelve questions to be set, Six to be answered selecting at least one from each group. One question will be objective and it will be compulsory. This question will carry 20 marks. Rest question are each of 16 marks.

Real Analysis I & Abstract Algebra I

Group-A: Real Analysis-I (Four questions)

Dedekind's theory of real numbers ,sequence and its convergence, Cauchy's sequence, Cauchy's general principle for convergence, Monotonic sequence, Canter's construction of real numbers, properties of real numbers.

Continuity and Differentiability of a function of real variable, properties of continuous and discontinuous function, Rolle's theorems, Mean value theorem, Taylor's, Lagrange's and Cauchy'sform of remainders in Taylors expansion,Taylor's and Maclarin's series of elementary function.

Group-B: Infinite Series (Three Questions)

Infinite series and their convergence, Comparison test, Cauchy root test, Raabe's test Cauchy's condensation test, Integral test, Leibnitz's test, Gauss Test, Kummer's Test, De Morgan and Parrande's test,Bertrand test, Absolute convergence and rearrangement of series, Pringsheim's theorem, Cauchy's multiplication of series and its convergence.

Group-C: Algebra (Four Questions)

Binary operation notions of group, Abelian group and non-abelian group with examples, uniqueness of Identity elements and inverse element in a group, Different ways of defining group , Concept of sub-group and cycle group with examples, intersection of sub-group, Sub-group of cyclic group concepts of rings integral domain and field and their examples and general properties, Cancellation law, Divisions of Zero, A finite integral domain as a field.

Cosets, order of an element, Lagrange's theorem, Group of residue classes, permutations group Cayley's theorem, Homomorphism and isomorphism of Group, Normal sub-group, Kernal of a group homomorphism, Isomorphism theorem for cyclic group, Factors group, Fundamental theorem of homomorphism of group, Ring of residue classes, Ring of matrices, subring ideals, ring homomorphism and ring, Isomorphism, Kernal of a Homomorphism, Quotient rings, Fundamental theorem of homomorphism of rings.

Paper-IV

Twelve question to be set, Six to be answer selecting at least one from each group, one question will be objective and it will be compulsory. This question will carry 20 marks and rest question are each of 16 marks.

Group-A

Vector Calculus (Two Questions)

Products of Three and four vectors Differentiation of vectors functions, Differentiation of product of two vectors, Gradient Divergence and curl of a vector function and deduction, Moments of a localized vector about a point work done by a force, Scalar moment of a vector about a directed line.

Group-B

Differential Equations (Three Questions)

Formation and solution of differential equation, Differential equation of the first order, Separation of Variables, Homogeneous form, Linear equation of first order, Clairaut's from, Geometrical application of first order, differential equation, Linear differential equation of second order with constant coefficients, C.F. and P.I. Orthogonal Traiectories.

Group-C

Statics (Via-Vector) (Three Questions)

Reduction of a force system to a force and a couple, equation of the resultant Principle of virtual work in two dimension, stable equilibrium, Energy test for stability, Catenary Poinsot's central axis pitch, Null lines.

Group-D: Dynamics

S.H.M. Simple Pendulum, Elastics String and springs, Hook's Law

(One Questions)

Components of velocities and acceleration, Cartesian, radial and transverse, tangential and normal, Projectile motion in non-resisted medium (One questions).

Motion of a particle under central force, Differential equation of central orbit in polar and pedal forms Newton's law of gravitation and planetary orbit, Kepter's laws.

B. Sc. Part – II:- MATHEMATICS (GENERAL COURSE)

Answer eight questions selecting at least one from group.

Time: 3 Hours   ***PAPER-II***   **Total Marks- 100**

Stress should be given on development of ideas and theories rather than on solving problems, Problems should be short and intelligent.

Calculus and Analytical Geometry

1. Differential Calculus: Four question to be set. Three questions to be answered.   **2. Integral Calculus:** Four questions to be set. Three questions to be answered.   **3. Analytical Geometry:** Three question to be set. Two questions of two dimensions to be answered. **4. Analytical Geometry:** Three question to be set. Two questions of three dimensions to be answered.

(1) Differential Calculus: Successive differentiation, Leibnitz's theorems, Statement of Taylor's series and Maclacrin's series expansion using them partial derivatives Euler's theorem, Exact Differential, Tangents and Normal Sub tangent, Sub Normal Polar Sub Tangent, Polar Sub Normal instrinsic and pedal equation, Curvature, Asymptotes.

(2) Integral Calculus: Integration of rational function formula, Definite integral as limit of a sum reduction formula, Rectification and quadrature, Surface and volume of single solids of revolution moment of inertia, center of gravity (Four Question)

(3) Analytical Geometry Of two Dimensions: System of circles, Coaxial, circles change of axis standard equation of parabola, ellipse and hyperbola conditions for the general equation of the second degree to represents parabola ellipse and hyperbola and its reduction into standard from, Equation of tangent and normal in case of general equation (using Calculus) and their forms in case of particular conic section (three questions)

(4) Analytical Geometry of three Dimensions: Rectangular spherical, polar and cylindrical co-ordinates, Direction consines, Angle between Straight lines, Equations of Planes and straight lines, Shortest distance between lines, coplanar lines, Equations of sphere and cylinder.(Three questions)

B. Sc. Part – II:- MATHEMATICS (SUBSIDIARY COURSE)

Group-A

Eight Question to be answered selecting at least two from each group.

Differential Calculus (Three Questions): Leibnitz theorem, Taylor's series and Maclaurin's series, partial derivatives, Eular's theorem, Indeterminate forms, Equation of Tangents and normal Asymptotes, Formula of radius of curvature in different co-ordinates system, Maxima and Minima of functions of single variable.

Integral Calculus (Three Questions): Integration by summation method, Reduction formula rectification and quadrature with simple examples, Volume and surface of solid of revolution, Moment of Inertia.

Differential Equations (Three Questions): Differential equation of first order and first degree, separation of variable Homogeneous equation and Linear forms, Differential equation of first order and higher degree, Claireul's form Linear differential equation of second order with constant coefficients, orthogonal trajectories.

Group-B

Vector Analysis (Three Questions)

Classification of Vector, Triple products, Differentiation of a vector function, Differentiation of a product of two vector, Gradient of a scalar, Gradient of a scalar, Divergence and curl of a vector function in Cartesion co-ordinates.

Group-C

Mechanics (Three Questions)

Coplanar force system, Necessary and sufficient condition for equilibrium of a particles, Necessary condition for a system of forcesacting on a particle to be in equilibrium, Definition of equipollent force system, Reduction of a general plane force system, Equation of the line of action of the resultant Principle of virtual work (Two Questions)

Basic concepts of Mechanics, Basic Law of Mechanics, Intertial frames of reference, work and energy Principle, conservative field and potential energy, Principle of conservation of energy for a particle.

Rectilinear Motion: Uniformly accelerated motion (including connected system) Resisted motion, Harmonic Oscillate Damped and force vibrations, Elastic spring and strings, Hook's Law, Vertical and Horizontal vibrations of a particle attached to an elastic string.

Motion in Plane: Components of velocity and acceleration, Cartesian, radial and transverse tangential and normal (Three Questions)

B. Sc. Part - III:- MATHEMATICS (HONOURS)

Real Analysis II

Twelve questions to be set. Six to be answered selecting at least one from each group. One question and it will be compulsory. This will carry 20 marks and rest question are each of 16 marks.

Group- A

Function of two variables, Limit, repeated limits, Moore, Osgood Theorem, Continuity and differentiability of function of two variable, Young's and Schwarz condition of equality of *fxy* and *fyx*, Implicit function theorem, Taylor's theorem, Maxima, Minima of Functions of two variables, Lagrange's method of undermined multipliers.(Three Questions)

Groups- B

Definition and existence of Riemann integral of bounded function, Darboux Condition of integrability, Riemann Integrability of continuous functions and monotonic function, Riemann integral of function with finite number of limit points, Riemann integral as the limit of a sum, the fundamental theorem of integral calculus, Mean Value theorem.(Two Questions)

Improper integral, convergence of an improper integral, comparison tests, Dirichlet's test, Beta and Gamma functions, their properties and relationship, differentiation under integral sign.(One Questions)

Double and triple integrals, changes of order of integration, Line, surface and volume integrals Green's Gauss's and stokes theorem.(One Questions)

Group- C

Weierstrass Sequence and series of functions and their pointwise convergence, Uniform convergence of sequence and series of functions, Wire strass M-test, uniform convergence and continuity, Dini's test, Abel's test, Dirichlet's Test, Uniform convergence and integration, Uniform convergence and differentiation.(Two Question)

Infinite product and its convergence and their mutual relations, Double series, Sum by rows, Sum by columns, Pringsheim's Theorem, Elementary notions of metric spaces and topological spaces.

Paper- IV

Twelve questions to be set. Six to be answered selecting at least one from each group. One question will be objective and it will be compulsory. This question will carry 20 marks and rest question are each of 16 marks.

Group- A

(Group Theory)

Centre, Normalizer, Conjugacy, class equation, auto morphisms, inner auto morphisms, Commutator and commutator sub group, Direct Product of two groups, Solvable groups, Finite Groups.(Three Questions)

Group- B

(Ring)

Division ring, Polynomial ring, Imbedding of a ring without unity in a ring with unity, Imbedding of a ring and integral domain in a field, Characteristics of a field, Field of quotients, Polynomials over commutative ring, Euclidean domains, Principal ideal domains, Unique Factorization domains.   *(Four Questions)*

Group- C

(Linear Algebra)

Vector spaces, Subspaces, Bases and dimension, Linear Transformation, Algebra of linear transformation, Matrix and linear transformation, Rank and nullity of a linear transformation, Direct sum of sub-spaces, characteristics value, characteristics vector, Cayley Hamilton theorem.(Four Questions)

Paper- VII

Twelve question to be set. Six to be answered, selecting at least one from each group. One question will be objective and it will be compulsory. This question will carry 20 marks and rest questions are each of 16 marks.

Group- A

(Mechanics)

Motion in a resisting medium, motion of a body about a fixed point, Angular velocity relation between angular velocity and linear velocity of a point of the body general motion of a body.   *(One Questions)*

Moment of inertia, Definitions and standards results, Moment ellipsoid and perpendicular axis theorem, Principal axis of inertia (existence of principal axis of inertia at point), Determination of principal axis of inertia, Equimomental systems.   *(One Questions)*

Angular momentum and Kinetic energy of a rigid body rotating about a fixed point, Kinetic energy of a rigid body in a general motion.

Principle of linear momentum, Angular momentum and energy for a rigid body, D'Alembert's principle and general equations of motion of a rigid body, Motion about a fixed axis, Compound pendulum.   *(Two Questions)*

Group- B

(Attraction and Potential)

Attraction and potential, Attraction and potential of rod, Rectangular and circular dies, Spherical shells, sphere (Laplace's and Poisson equations), Theorem of equipotential surface.   *(Two Questions)*

Hydrostatics

Pressure at a point, Thrust on a Plane surface, Centre of pressure, Equilibrium of floating bodies.(Two Questions)

Group- C

(Differential Equations)

Second order equations with variable coefficients, Solution of second order differential equations with variable coefficients, Method of variation of parameters, Total Differential equation in three independent variables, Simultaneous differential equations, Lagrange's Linear partial differential equations, standard forms, Charpits method, Partial differential equations of higher order with constant coefficients, Monge's method.   *(Three Questions)*

Ten question to be set in each optional paper and five questions to be answered.

Paper- VIII : Numerical Analysis

100 Marks

Finite, Central and Divided difference, interpolation, Inverse Interpolation, Numerical Differentiation, Numerical Integration, Trapezoidal, Simpson's 1/3rd and 3/8th rules, Weddle's rule, Gauss quandrature formula of integration, Gregory's formula and the Euler Maclaurin's formula*.*   *(Three Questions)*

Solution of difference equation of the first order, General equations, Linear difference equations with constant coefficients, solution of ordinary differential equations- one step method : Euler's modified method Picard's and Runge- Kutta's methods of solution and Milne- Simpson's Method.   *(Three Questions)*

Simultaneous Linear Equations: Gauss elimination, Gauss- Seidel's, Jordan's and relaxation methods (simple problems).   *(Two Questions)*

Finding roots of polynomial equations: Regula falsi, Bisection, Newton- Raphson method for several variables, iterative method and its generalization, significant figure and errors of computation.   *(Two Questions)*

PAPER-VIII

(Spherical Trigonometry and Astronomy)

(Two Questions)

Spherical triangle, Definition, Fundamental Formula (Cosine, Sine, Sine-Cosine, Cotangent), Napier's rule, D'Alemberts analogies, right angle triangle

(Astronomy)

(Eight Questions)

Celestial sphere: Definition: Different System of Co-ordinates, Phenomenon of rising and setting of stars, Twilight.   *(Two Question)*

Solar system, Two body problem, Equation of relative motion.   *(One Questions)*

Area integral, Kepler's law, Anomalies, Kepler's Equations.   *(One Questions)*

Stationary points phase of planet, Refraction, Simpson's- Bradlay's and Cassini's formulas, Effect of refraction in the position of a body.   *(Two Questions)*

Annual Aberration, Effect of the aberration on celestial latitude and longitude, Effect of aberration on right ascension and declination, Parallax, Effect of Parallax on latitude, longitude, right ascension and declination.   *(Two Questions)*

PAPER-VIII: (Number Theory)

The basic representation theorem, Linear Diophantine equation, fundamental theorem of Arithmetic, Fermat's little theorem and Wilson's Theorem.   ***(Two Questions)***

Basic properties of Congruences, Residue System, Euler's thorem; Chinese Remiander theorem; Multiplicative arithmetic functions, the Euler's function ϕ (n), μ, (n) and their simple properties; Moblus Inversion formula, Perfect numbers and the function *r (n).*

(Three Questions)

The quadratic Reciprocity law; Euler's criterion. The legendre symbol and its properties and applications, Gauss, Lemma Gauss quadratic reciprocity law, Quandratic congruences with composite moduli.

(Three Questions)

Representation of integers as sums of squares; Sums of two squares. Thue's lemma, Feemat's theorem, sums of four squares and Euler's lemma, Lagrange's theorem.

(Two Questions)

PAPER -VIII (Probability Theory)

Event, Probability of an event, sample space, probabilies a finite sample space, Mutually exclusively events and complementary events, independent events, conditional probability.   ***(One question)***

Axoms for probability in finite sample spaces, product rule of probabilities in a sample space, Baye' s theorem , Random variables and their probability functions. Mathematical expectation and moment of a random variable, Mean absolute deviation, variance, standard variation, Chebyshev's theorems for a probability distribution and frequency distribution of measurements.   ***(Three questions)***

Convergence of a sequence of random variables, convergence in distributions, convergence in probability, almost sure convergence, convergence in a quadratic mean, Halley/ Bary theorem.   ***(Three questions)***

Complex valued random variables, characteristic function, Inversion theorem , continuity theorem, Distrubution and Kolomogarow 's inequality, weak and strong laws of large numbers.   ***(Three questions)***

B. Sc. Part – III:- MATHEMATICS (GENERAL COURSE)

(1996-98)

MATHEMATICS

[100 Marks

Stress should be given on development of ideas and theories lether than on solving problems. Problems should be short and intelligent.

1. Vector Analysis: Three questions to be set. Two questions to answered.

2. Mechanics: Two questions from, statics and three questions from Dynamics to be set. Four questions to be answered.

3. Differential Equation: Three questions to be set. Two questions to be answered.

4. Linear programming: Three quest ions to be set. Two questions to be answered.

Vector Analysis: Classification of Vectors. Triple products, Differentiation of a Vector functions, Differentiation of a product of two vectors. Gradient of a scalar, diveraence and curl of a vector in Cartesian co-ordinates

(Three questions)

Mechanics: Reduction of general plane force system, Equation of the line of action of the resultant of coplaner forces, Necessary conditions for a system of coplaner forces to be in equilibrium. Principle of virtual work.

(Two questions)

Basic laws of mechanics in absolute frame of reference simple Harmonic motion Elastic springs and Strings. Hook's law Motion in a plane, components of velocity and acceleration Cartesian, radial and transverse, tangential and normal.

(Three questions)

Differential Equations: Formation and solution of differential equation; Differential equation of the first other, Separtion of variables. Homogeneous, forms, exact differential equations of the first order but not of the first degree including clairaut's forms. Linear differential equations of second order with constant co-efficient complementry functions and particular integrals, orthogonal trajectory.

(Three questions)

Linear Programming: Convex sets and their properties, Linear programming problem. Graphical solutions. Theory of simplex method and tneir simple applications. Assignment and transporations problems.

(Three questions)