SECTION – A: MATHEMATICS

UNIT – 1

SETS, RELATIONS AND FUNCTIONS: Sets and their representation, Union, Intersection and compliment of sets, and their algebraic properties, power set, Relation, Types of relation, Equivalence relation, Functions, one-one, into and onto functions, composite functions.

UNIT – 2

MATHEMATICAL INDUCTION: Principle of Mathematical Induction and its simple applications.

MATHEMATICAL REASONING: Statements, Logical operations and, or, implies, implied by, if and only if. Understanding of tautology, contradiction, Converse and Contra positive.

UNIT – 3

QUADRATIC EQUATIONS & THEORY OF EQUATIONS:
Quadratic equations in real and complex number system and their solutions. Reminder and Factor Theorems, common Roots, General Quadratic expression, Finding the range of a function, Location of roots, Solving inequalities using location of roots.

THEORY OF EQUATIONS: The relation between the roots and coefficients in an equation; Solving the equation when two or more roots of it are connected by certain relations; Equations with real coefficients, imaginary roots occur in conjugate pairs and its consequences; Transformation of equations, Reciprocal equations.

UNIT – 4

BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS

Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

UNIT – 5

SEQUENCES AND SERIES: Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers. Relation between A.M. and G.M. Sum to n terms of special series $\sum n, \sum n^2, \sum n^3$. Arithmetic - Geometric progression.

UNIT – 6

PERMUTATIONS & COMBINATIONS:
Definition of linear and circular permutations; To find the number of permutations of n dissimilar things taken 'r' at a time. To prove $n_{P_r} = (n-1)_{P_r} + r\,(n-1)_{P_{r-1}}$ from the first principles; To find number of Permutations of n Dissimilar things taken 'r' at a time when repetition of things is allowed any number of times.; To find number of circular Permutations of n Different things taken all at a time.; To find the number of Permutations of 'n' things taken 'r' at a time when some of them are alike and the rest are dissimilar; To find the number of combinations of 'n' dissimilar things taken 'r' at a time; To prove i) If $n_{C_r} = n_{C_s}$ then n = r+s or r=s ii) $n_{C_r} + n_{C_{r-1}} = (n+1)_{C_r}$.

UNIT - 7

MATRICES AND DETERMINANTS: Matrices, algebra of matrices, types of matrices, determinants and matrices of order two and three. Properties of determinants, evaluation of determinants, area of triangles using determinants. Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test for consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices, and rank of matrix.

UNIT - 8

VECTOR ALGEBRA: Algebra of Vectors – angle between two non-zero vectors – Linear combination of vectors – Geometrical applications of vectors. Scalar and vector product of two, three and four vectors and their application.

UNIT- 9

THREE DIMENSIONAL GEOMETRY: Co-ordinates of a point in space, Distance between two points, Section formula, Direction ratios and direction cosines, Angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, Intersection of a line and a plane, Coplanar lines.

UNIT- 10

TRIGONOMETRY: Trigonometric ratios, Compound angles, multiple and sub-multiple angle, Transformations, Trigonometric expansions using Demovier's Theorem. Trigonometric equations, Inverse Trigonometry and Heights and distances(only 2D problems).

UNIT – 11

PROPERTIES OF TRIANGLES: Sine rule, cosine rule, Tangent rule, projection rule, Half angle formulae and area of triangle. In-circle and ex-circle of a Triangle. Pedal Triangle, Ex-central Triangle, Geometry relation of Ex-centres, Distance between centres of Triangle. m-n Theorem, problems and quadrilateral, regular polygon, solution of Triangle (Ambiguous cases).

COMPLEX NUMBERS: Definitions, Integral Power of iota(i), Algebraic operations with complex numbers, square root of a complex number, Geometrical representation of a complex number, Modz, Arg of Z, polar term of Z, Eulors form of Z, Conjugate of Z, Properties of conjugate, solving complex equations, Demovre's Theorem, Properties of $\sqrt[3]{1}$, $\sqrt[4]{1}, \sqrt[n]{1}$, Geometrical applications of complex numbers.

UNIT – 12

LIMITS, CONTINUITY AND DIFFERENTIABILITY (LCD): Real - valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order upto two.

UNIT – 13

APPLICATIONS OF DERIVATIVES: Rate of change of quantities, Errors and approximations, Tangent and normals, maxima and minima of functions of one variable, mean value theorems (Rolle's, lagrange's, Intermediate value theorem).

UNIT - 14

INDEFINITE INTEGRATION: Fundamental Integration formulae, Method of integration, Integration by parts, Integration by substitution, Integration of Rational and Irrational Algebraic functions, Integral of the form $\int x^m (a+bx^n)^p dx$ Integration using Euler's substitution. Reduction formulae over indefinite integrals, Integration using differentiation.

UNIT - 15

APPLICATIONS OF INTEGRALS: Integral as limit of a sum. Fundamental Theorem of integral calculus. Problems on all the properties of definite integrals. Libnitz rule. Determining areas of the regions bounded by curves**.**

UNIT - 16

CO-ORDINATE GEOMETRY: Locus: Definition of locus; Equation of locus and its illustration on complete geometry; Translation & Rotation of axes and its illustrations

STRAIGHT LINES : Different forms of straight lines, distance of a point from a line, lines through the point of intersection of two given lines, angular bisectors of two lines, Foot of perpendicular, Image point (vs) point, point (vs) line and line (vs) line. Concurrences of lines, centroid, orthocenter, incentre and circumcentre of triangle.

UNIT - 17

CIRCLES: Equation of a circle-Standard form-centre and radius-Equation of a circle with a given line segment as diameter- Equation of circle through three non-colinear points-parametric equations of a circle. Position of a point in the plane of the circle- power of a point-Def. of a tangent-Length of tangent. Position of a straight line in the plane of the circle-condition for a straight line to be a tangent– chord joining two points on a circle - equation of the tangent at a point on the circle – point of contact – Equation of normal. Chord of contact-Pole, Polar-conjugate points and conjugate lines-Equation of chord with given mid point. Relative positions of two circles-circles touching each other-externally, internally, common tangents-points of similitude-Equation of tangents from an external point. Angle between two intersecting circles. Conditions for Orthogonalities. Concepts of Radical axis and Radical Centre.

UNIT - 18

PARABOLA, ELLIPSE, HYPERBOLA AND POLAR CO-ORDINATES:
a) PARABOLA: Conic sections-parabola-Equation of parabola in standard form-Different forms of parabola; parametric equations. Equation of tangent and normal at a point on the parabola (cartesian and parametric)- condition for a straight line to be a tangent.

b) ELLIPSE: Equation of Ellipse in standard form, parametric equations. Equation of tangent and normal at a point on the Ellipse (Cartesian and parametric) condition for a straight line to be a tangent.

c) HYPERBOLA: Equation of hyperbola in standard form-parametric equations, Rectangular Hyperbola.; equation of tangent and normal at a point on the hyperbola (Cartesian and parametric) condition for a straight line to be a tangent. Asymptotes.

UNIT - 19

DIFFERENTIAL EQUALITIONS: Ordinary differential equations, their order and degree. Formation of differential equations. Solution of differential equations by the method of separation of variables, solution of homogeneous, Non-Homogenous, linear differential equations. Bernoulli's Equation, Orthogonal Trajectory. Applications of Differential equations.

UNIT - 20

PROBABILITIES, RANDOM VARIABLES & DISTRIBUTIONS AND STATISTICS :

PROBABILITY: Random experiment, random event, elementary events, exhaustive events, mutually exclusive events, Sample space, Sample events, Addition theorem on Probability. Dependent and independent events, multiplication theorem, Baye's theorem.

RANDOM VARIABLES & DISTRIBUTIONS: Random variables, Distributive functions, probability distributive functions, Mean, variance of a random variable; Bernoulli trials and Binomial distributions.

STATISTICS: Measures of Dispersion; Calculation of Mean, Median, Mode of grouped and ungrouped data, Calculation of Standard Deviation, Variance and Mean deviation for grouped and ungrouped data.