PART 3 - MATHEMATICS (35 Questions)

UNIT 1: Sets, Relations and Functions
Sets and their representations, union, intersection and complements of sets and their algebraic properties, relations, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings.

UNIT 2: Complex Numbers
Complex numbers in the form a+ib and their representation in a plane. Argand diagram. Algebra of complex numbers, modulus and argument (or amplitude) of a complex number, square root of a complex number. Cube roots of unity, triangle inequality.

UNIT 3: Matrices and Determinants
Determinants and matrices of order two and three, properties of determinants, evaluation of determinants. Addition and multiplication of matrices, adjoint and inverse of matrix.

UNIT 4: Applications of Matrices and Determinants
Computing the rank of a matrix-test of consistency and solution of simultaneous linear equations using determinants and matrices.

UNIT 5: Quadratic Equations
Quadratic equations in real and complex number system and their solutions. Relation between roots and coefficients, nature of roots, formation of quadratic equations with given roots; symmetric functions of roots, equations reducible to quadratic equations.

UNIT 6: Permutations and Combinations
Fundamental principle of counting: permutation as an arrangement and combination as selection, meaning of P(n,r) and C(n,r). Simple applications.

UNIT 7: Mathematical Induction and its Applications
Stating and interpreting the principle of mathematical induction. Using it to prove formula and facts.

UNIT 8: Binomial Theorem and its Applications
Binomial theorem for a positive integral index; general term and middle term; Binomial theorem for any index. Properties of binomial coefficients. Simple applications for approximations.

UNIT 9: Sequences and Series
Arithmetic, geometric and harmonic progressions. Insertion of arithmetic, geometric and harmonic means between two given numbers. Relation between A.M., G.M. and H.M. arithmetic, geometric series, exponential and logarithmic series.

UNIT 10: Differential Calculus
Polynomials, rational, trigonometric, logarithmic and exponential functions. Inverse functions. Graphs of simple functions. Limits, continuity, 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 up to two.

UNIT 11: Applications of Differential Calculus
Rate of change of quantities, onotonic - increasing and decreasing functions, maxima and minima of functions of one variable, tangents and normals, Rolle's and Lagrange's mean value theorems.

UNIT 12: Integral Calculus
Integral as an anti-derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Integral as limit of a sum. Properties of definite integrals. Evaluation of definite integrals; Determining areas of the regions bounded by simple curves.

UNIT 13: Differential Equations
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 and linear differential equations and those of the type $d2y / dx2 = f(x)$.

UNIT 14: Straight Lines in Two Dimensions
Cartesian system of rectangular co-ordinates in plane, distance formula, area of a triangle, condition for the collinearity of three points and section formula, centroid and in-centre of a triangle, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes. Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line. Equations of internal and external bisectors of angles between two lines, coordinates of centroid, orthocentre and circumcentre of a triangle, equation of family of lines passing through the point of intersection of two lines, homogeneous equation of second degree in x and y, angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines, condition for the general second degree equation to represent a pair of lines, point of intersection and angle between two lines.

UNIT 15: Circles in Two Dimensions

Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle in the parametric form, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to the circle, length of the tangent, equation of the tangent, equation of a family of circles through the intersection of two circles, condition for two intersecting circles to be orthogonal.

UNIT 16: Conic Sections in Two Dimensions
Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard form, condition for $y = mx+c$ to be a tangent and point(s) of tangency.

UNIT 17: Vector Algebra
Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product. Application of vectors to plane geometry.

UNIT 18: Measures of Central Tendency and Dispersion
Calculation of mean, median and mode of grouped and ungrouped data. Calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.

UNIT 19: Probability
Probability of an event, addition and multiplication theorems of probability and their applications; Conditional probability; Baye's theorem, probability distribution of a random variate; binomial and poisson distributions and their properties.

UNIT 20: Trigonometry
Trigonometrical identities and equations. Inverse trigonometric functions and their properties. Properties of triangles, including, incentre, circumcentre and orthocenter, solution of triangles.