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## MATHEMATICS

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**1. Algebra :** Elements of Set Theory, Algebra of Real and Complex numbers including De Moivre's Theorem Polynomials and polynomial equations, Relations between Coefficients and Roots, Symmetric functions of roots.

Elements of Group Theory: Sub-Groups, Cyclic groups, permutation groups and their elementary properties.

**2. Vector Spaces and Matrices :** Vector Space, Linear dependence and independence sub-space, basis and Dimensions. Finite Dimensional Vector spaces Linear transformation of a finite dimensional vector space, matrix representation, singular and non-singular transformations, Rank and nullity.

**3. Matrices:** Addition, Multiplication, Determinants of metric, properties of determinants of order inverse of a matrix, Cramer's rule.

**4. Geometry and Vector :** Analytic geometry of straight lines and conics in Cartesian and polar coordinates, three dimensional geometry for planes straight lines, sphere, cone and cylinder, addition, subtraction and products of vectors and simple application to geometry.

**5. Calculus :** Functions, sequences, series, limits continuity, Derivatives, Application of Derivatives, rates of changes, Tangents, normal, maxima, minima, Rolle's theorem, means value theoran of Lagranga and Cauchy, asymptotes curvature methods of finding indefinite integrals, definite integrals, fundamental theorem mean value theorans of integral calculus, application of definite integrals to area, length of a plane curve, volume and surfaces of revolution.

**6. Ordinary differential equations :** Order and degree of differential equation, first order differential equations, singular solution, geometrical interpretation, second order equations with constant coefficients.

**7. Mechanics :** Concepts of particles, Lamina, Rigid, Body, Displacement, Force, Mass. Weight Motion, Velocity, Speed, Acceleration Parellelogram of forces. Parellelogram of velocity, acceleration, resultant, equilibrium of coplanar forces, moments couple, friction, centre of mass gravity, laws of motion, motion of a particle in a straight line, simple harmonic motion, motion under conservative forces, motion under gravity projectile, escape velocity, motion of artificial satellite.

**8. Elements of Computer programming :** Binary system, Octal and Hexadecimal conversion to and from decimal systems, codes, bits, bytes and words in computer, Arithmetic and logical operations on numbers, precisions and Shift/Rotate operator, algorithms and flow charts.

**9. Static's :** Equilibrium of a system of particles, work and potential energy, friction, catenary's principle of virtual work, stability of equilibrium, equilibrium of forces dimensions,

**10. Dynamics :** Degree of freedom and constraints, rectilinear motion simple motion, motion in a plane, Projectiles, constrained motion, work and energy, conservation of energy, motion under impulsive forces, Kepler's laws, orbits under central motion of varying mass, motion under resistance.

**11. Complex analysis :** Analysis function, Cauchy-Riemann equations, Cauchy's integral formula, power series, Taylor's series, Laurent's series, Cauchy's residue theorem, contour integration, Conformal mapping, transformations.

**12. Probability :** Sample space, Events, Algebra of events, probability-classical, axiomatic approaches, combinatorial problems, geometric problems, Probability and Baye's theorem, Random variables and probability, Distribution and continuous, Mathematical expectations, Binomial, poisson and normal joint distribution of random variables, independence, central limit theorem in probability.

**13. Statistics :** Concepts of population, sample, variable, attribute, parameter and measures of location and dispersion, Moments, skewness and kurtosis. Sample random sampling and sampling distribution of sample means and proportions.