APPLIED MATHEMATICS

I. **Vector Calculus (10%):**
    - Vector algebra
    - Scalar and vector products of vectors
    - Gradient, Divergence and Curl of a vector
    - Line, Surface and Volume integrals
    - Green's, Stokes' & Gauss theorems

II. **Statics (10%):**
    - Composition and resolution of forces
    - Parallel forces and couples
    - Equilibrium of a system of coplanar forces
    - Center of mass of a system of particles and rigid bodies
    - Equilibrium of forces in three dimensions.

III. **Dynamics (10%):**
    - Motion in a straight line with constant and variable acceleration
    - Simple Harmonic Motion (SHM)
    - Conservative forces
    - Principles of energy
    - Tangential, normal, radial and transverse components of velocity and acceleration
    - Motion under central forces
    - Planetary orbits
    - Kepler laws

IV. **Ordinary differential equations (20%):**
    - Equations of the first-order, Separable equations & exact equations, First-order linear equations, Orthogonal trajectories, Non-linear equations reducible to linear equations, Bernoulli and Riccati equations.
    - Equations with constant coefficients, Homogeneous and inhomogeneous equations, Cauchy-Euler equations, Variation of parameters.
    - Ordinary and singular points of a differential equation, Solution in series, Bessel and Legendre equations, Properties of the Bessel functions & Legendre polynomials.

V. Fourier series and partial differential equations (20%):

- Trigonometric Fourier series, Sine and Cosine series, Bessel inequality, Summation of infinite series, Convergence of the Fourier series.
- Partial differential equations of the first order, classification of partial differential equations of second order, boundary value problems, solution by the method of separation of variables, problems associated with Laplace equation, wave equation and the heat equation in Cartesian coordinates.

VI. Numerical Methods (30%):

- Solution of nonlinear equations by bisection, secant and Newton-Raphson methods, the fixed-point iterative method, order of convergence of a method.
- Solution of a system of linear equations, diagonally dominant systems, the Jacobi and Gauss-Seidel methods.
- Numerical differentiation and integration, trapezoidal rule, Simpson's rules, Gaussian integration formulas.
- Numerical solution of an ordinary differential equation, Euler and modified Euler methods, Runge- Kutta methods.