Paper: Applied Mathematics (100 Marks)

I. Vector Calculus (10%)

Vector algebra; scalar and vector products of vectors; gradient divergence and curl ofa vector; line, surface and volume integrals; Green's, Stokes' and Gauss theorems.

II. Statics (10%)

Composition and resolution of forces; parallel forces and couples; equilibrium of a system of coplanar forces; centre 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; conservative forces and principles of energy.
- Tangential, normal, radial and transverse components of velocity a ND acceleration; motion under central forces; planetary orbits; Kepler laws;

IV. Ordinary differential equations (20%)

- Equations of first order; separable equations, exact equations; first order linear equations; orthogonal trajectories; nonlinear 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 and 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 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 Eulermethods; Runge-Kutta methods.

SUGGESTED READING

S.No.	Title	Author
1.	An Introduction to Vector Analysis	Khalid Latif,
2.	Introduction to Mechanics	Q.K. Ghori
3.	An Intermediate Course in Theoretical Mechanics	Khalid Latif,
4.	Differential Equations with Boundary Value Problems	D. G. Zill and M. R. Cullen
5.	Elementary Differential Equations	E.D. Rainville, P.E. Bedientand R.E. Bedient
6.	Introduction to Ordinary Differential Equations	A.L.Rabenstein
7.	Advanced Engineering Mathematics	E. Kreyszig
8.	An Introduction to Numerical Analysis	Mohammad Iqbal
9.	Numerical Analysis	R.L Burden and J.D Faires
10.	Elements of Numerical Analysis	F. Ahmad and M.A Rana
11.	Mathematical Methods	S. M. Yousaf, Abdul Majeed and Muhammad Amin