

Total Marks: 200

PAPER - I (Marks: 100)

### **Course Outline**

**Note:** Candidates will be asked to attempt any two questions from Section A and any three questions from Section B.

#### **SECTION A**

##### **Vector Analysis:**

Vector algebra, scalar and vector product of two or more vectors, Function of a scalar variable, Gradient, divergence and curl, Expansion formulae, curvilinear coordinates, Expansions for gradient, divergence and curl in orthogonal curvilinear coordinates, Line, surface and volume integrals, Green's, Stoke's and Gauss's theorems

##### **Statics:**

Composition and resolution of forces, Parallel forces, and couples, Equilibrium of a system of coplanar forces, Centre of mass and centre of gravity of a system of particles and rigid bodies, Friction, Principle of virtual work and its applications, equilibrium of forces in three dimensions.

#### **SECTION B**

##### **Dynamics:**

Tangential, normal, radial and transverse components of velocity and acceleration, Rectilinear motion with constant and variable acceleration, Simple harmonic motion, Work, Power and Energy, Conservative forces and principles of energy, Principles of linear and angular momentum, Motion of a projectile, Ranges on horizontal and inclined planes, Parabola of safety. Motion under central forces, Apse and apsidal distances, Planetary orbits, Kepler's laws, Moments and products of inertia of particles and rigid bodies, Kinetic energy and angular momentum of a rigid body, Motion of rigid bodies, Compound pendulum, Impulsive motion, collision of two spheres and coefficient of restitution.

#### **PAPER - II (Marks: 100)**

**Note:** Candidates will be asked to attempt any two questions from Section A. one question from Section B and two questions from Section C.

#### **SECTION - A**

##### **Differential Equations:**

Linear differential equations with constant and variable coefficients, the power series method.

Formation of partial differential equations. Types of integrals of partial differential equations. Partial differential equations of first order Partial differential equations with constant coefficients. Monge's method. Classification of partial differential equations of second order, Laplace's equation and its boundary value problems. Standard solutions of wave equation and equation of heat induction.

#### **SECTION B**

##### **Tensor:**

Definition of tensors as invariant quantities. Coordinate transformations. Contravariant and covariant laws of transformation of the components of tensors. Addition and multiplication of tensors, Contraction and inner product of tensors The Kronecker delta and Levi-Civita symbol. The metric tensor in Cartesian, polar and other coordinates, covariant derivatives and the Christoffel symbols. The gradient. divergence and curl operators in tensor notation.

## SECTION C

### Elements of Numerical Analysis:

Solution of non-linear equations, Use of  $x = g(x)$  form, Newton Raphson method, Solution of system of linear equations, Jacobi and Gauss Seidel Method, Numerical Integration, Trapezoidal and Simpson's rule. Regula falsi and interactive method for solving non-linear equation with convergence. Linear and Lagrange interpolation. Graphical solution of linear programming problems.

### Suggested Books

	<b>Title</b>	<b>Author</b>
1	Classical Mechanics	Goldstein
2	Lactures on Ordinary Differential Equations	Hille, E.
3	Lectures on Partial Differential Equations	Petrovosky, I.G.
4	Mechanics	Symon, G.F.
5	Mechanics	Ghori, Q. K.
6	Mathematical Pyysics, An Advanced Course	Mikhin, S.G.
7	Ordinary Differential Equations	Easthan, M.S.P.
8	Principles of Mechanics	Synge and Griffith
9	Principles of Mechanics	Hauser
10	Partial Differential Equations	Sneddon, I.N.
11	Theoratical Mechanics	Beckker
12	Theoratical Mechanics	Bradsbury
13	Theory of Ordinary Differential Equations	Goddington, E.A. and N. Livenision
14	Vector and Tensor Methods, Cartesian Tensors	Charlton Jeffreya