

B.Sc. (Part—I) Examination

PHYSICS

Paper—I

(Mechanics and Properties of Matter)

Time—Three Hours]

[Maximum Marks—40

Note :— (1) All questions are compulsory.

(2) Draw neat and clean diagram wherever necessary.

EITHER

1. (a) State Newton's laws of motion and state their limitations. 3
- (b) Derive an equation for radial and transverse components of velocity in polar coordinates. 3
- (c) Define :
 - (i) Inertial frame of reference
 - (ii) Non-inertial frame of reference. 2

OR

2. (p) State Kepler's laws for planetary motion and derive Kepler's second law. 4
- (q) What is central force ? Obtain an equation of motion of a particle moving under central force. 4

EITHER

3. (a) State and explain Newton's law of gravitation. 2

(b) State and explain law of conservation of energy and momentum. 3

(c) Obtain an equation for angular momentum of a system of N particles about a fixed point. 3

OR

4. (p) Obtain an expression for gravitational potential due to a spherical shell at a point outside the shell. 3

(q) Define centre of mass and show that centre of mass moves with constant velocity when no external force act on the system of 'n' particles. 3

(r) *State Gauss's equation in gravitation. 2

EITHER

5. (a) Define radius of gyration and give its physical significance. 2

(b) State and prove parallel axis theorem. 3

(c) M.I. of a circular disc about an axis passing through its centre is $\frac{mr^2}{2}$. Find its M.I. about :
(i) diameter
(ii) tangent perpendicular to plane
(iii) tangent in the plane. 3

OR

6. (p) Derive an equation for M.I. of a solid sphere about its tangent. 3

(q) Radius of gyration of a hollow spherical shell about its diameter is 1.5 cm. Find its radius of gyration about a tangent. 3

(r) M.I. of a thin uniform rod about a transverse axis passing through its centre of mass is $\frac{ml^2}{12}$. Find its M.I. about a parallel axis passing through one end. 2

EITHER

7. (a) Define :
(i) Neutral surface
(ii) Plane of bending. 2

(b) Derive an expression for depression of a centre of beam of uniform cross-section supported at two ends and loaded at the centre. 3

(c) A rectangular bar of length 1 m and square cross-section of side 5×10^{-3} m, is supported horizontally on two knife edges at its ends and loaded in the middle by a mass of 0.1 kg. If the depression at the midpoint is 1.96 mm, calculate the Young's modulus of the material of bar. 3

OR

8. (p) What is angle of twist and angle of shear ? Obtain relation between them. 3

(q) Derive an equation for the torque required for twisting a cylinder and hence define torsional constant. 4

(r) State Hooke's Law. 1

EITHER

9. (a) Deduce Poiseuille's formula for the flow of a liquid through narrow tube. 4
(b) State and prove Bernoulli's theorem. 4

OR

10. (p) Explain surface tension on the basis of molecular theory. 3
(q) Obtain Euler's equation for motion of an ideal fluid. 3
(r) Calculate the work done in spraying a spherical drop of water of 0.005 m radius into a 1000 droplets of equal size. S.T. of water = 75×10^{-3} N/m. 2