

**B.Sc. (Part-I) Semester-I Examination****PHYSICS****(Mechanics, Properties of Matter Waves and Oscillation)**

Time : Three Hours]

[Maximum Marks : 80

**Note :—** (1) **ALL** questions are compulsory.

(2) Draw suitable and neat diagram wherever necessary.

1. (a) Fill in the blanks : 2
- (i) According to Kepler's first law of planetary motion, each planet revolves in an \_\_\_\_\_ with Sun at its focus.
- (ii) The angular momentum of a body remains constant if external \_\_\_\_\_ acting on a body is zero.
- (iii) In standing wave, the distance between the two successive nodes is \_\_\_\_\_.
- (iv) S.I. unit of surface tension is \_\_\_\_\_.
- (b) Choose the correct alternative : 2
- (i) The SI unit of intensity of gravitational field is :
- (a) N/kg (b) N/kg<sup>2</sup>  
(c) Nm<sup>2</sup>kg (d) Nkg
- (ii) The moment of linear momentum is called :
- (a) Couple (b) Torque  
(c) Impulse (d) Angular momentum
- (iii) In compound pendulum the centre of suspension and centre of oscillation are :
- (a) Changeable  
(b) Not changeable  
(c) Inter changeable  
(d) At equal distance from C.G. of compound pendulum

(iv) In standing waves, the distance between node and adjacent antinode is :

- (a)  $\lambda$  (b)  $\lambda/2$   
 (c)  $\lambda/4$  (d)  $\lambda/8$

(c) Answer in one sentence : 4

- (i) Define radius of gyration.  
 (ii) What is cantilever ?  
 (iii) Define streamline flow.  
 (iv) What is elasticity ?

**EITHER**

2. (a) Derive an expression for gravitational potential due to spherical shell at a point outside the shell. 6  
 (b) State and prove Gauss's theorem in gravitation. 4  
 (c) State Newton's law of gravitation. 2

**OR**

3. (p) Define :  
 (i) Gravitational field  
 (ii) Gravitational potential  
 (iii) Intensity of gravitational field. 3  
 (q) Derive an expression for the acceleration due to gravity at a depth 'd' below the surface of earth. 3  
 (r) Discuss variation of acceleration due to gravity with altitude. 3  
 (s) State Kepler's laws of planetary motion. 3

**EITHER**

4. (a) Derive an expression for M.I. of a thin uniform rod about an axis passing through its centre and perpendicular to its length. 5  
 (b) State and prove law of conservation of linear momentum. 4  
 (c) The moment of inertia of sphere about its diameter is  $\frac{2}{5}MR^2$ . Calculate its moment of inertia about the tangent. 3

**OR**

5. (p) State and prove theorem of parallel axes. 6  
 (q) Give the analogy between linear and rotational motion. 3  
 (r) Calculate moment of inertia of a disc of mass 1 kg and radius 10 cm about an axis passing through its center and perpendicular to its plane. 3

**EITHER**

6. (a) Solve the differential equation of S.H.M. to obtain expression for displacement of a particle performing S.H.M. 6  
 (b) Show that oscillations of a loaded spring are Linear S.H.M. Hence obtain an expression for time period of its oscillations. 6

**OR**

7. (p) Obtain differential equation of damped harmonic oscillations. 4  
 (q) Derive the expression for periodic time of bifilar oscillations with parallel threads. 4  
 (r) Derive an expression for time period of simple pendulum. 4

**EITHER**

8. (a) Explain piezoelectric method for the production of the ultrasonic waves. 6  
 (b) What are Lissajous figures ? Obtain an expression for the resultant of two S.H.M.'s at right angles to each other and of same time period. 6

**OR**

9. (p) Derive Newton's formula for velocity of longitudinal waves through medium. 6  
 (q) State any four industrial applications of ultrasonic waves. 4  
 (r) What are ultrasonic waves ? 2

**EITHER**

10. (a) Derive an expression for depression at the loaded end of light beam clamped horizontally at the other end. 6  
 (b) Determine modulus of rigidity of material of wire by Torsional pendulum. 6

**OR**

11. (p) Explain the terms (i) Angle of twist, (ii) Angle of shear. 4
- (q) Obtain relation between three elastic constants  $Y$ ,  $K$  and  $\eta$ . 3
- (r) Define stress and strain. 2
- (s) A bar of length 1 m, breadth 2.5 cm and thickness 0.5 cm is supported at two ends and loaded at the centre. The depression observed in middle of the beam is 0.5 cm when a load of 100 gm is applied. Calculate Young's modulus. 3

**EITHER**

12. (a) State and prove Bernoulli's theorem. 6
- (b) State and prove Stoke's law. 4
- (c) Define :
- (i) Streamline flow
- (ii) Critical velocity. 2

**OR**

13. (p) Obtain Poiseulle's formula for the steady flow of liquid in a narrow tube. 6
- (q) What is the significance of Reynold's number ? 2
- (r) What is turbulent flow ? 2
- (s) What is coefficient of viscosity ? 2