

## 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 second law, \_\_\_\_\_ of the planet remains constant.

(ii) SI unit of angular momentum is \_\_\_\_\_.

(iii) The fundamental frequency is called \_\_\_\_\_ harmonics.

(iv) The force of attraction between the molecules of same liquid is called \_\_\_\_\_.

(b) Choose the correct alternative :

2

(i) The intensity of gravitational field of the earth is maximum at \_\_\_\_\_.

(a) Poles

(b) Centre of earth

(c) Equator

(d) Same everywhere

(ii) The SI unit of moment of inertia is

(a)  $\text{Kg.m}^2$ (b)  $\text{Kg/cm}^2$ (c)  $\text{Kg.m/s}^2$ (d)  $\text{gm.m/cm}^2$ 

(iii) The time period of simple pendulum is inversely proportional to :

(a) Length of simple pendulum

(b) Acceleration due to gravity

(c) Square root of acceleration due to gravity

(d) None of the above

(iv) In standing wave the distance between successive nodes is \_\_\_\_\_.

- (a)  $\lambda$  (b)  $\lambda/2$   
 (c)  $\lambda/4$  (d)  $3\lambda/4$

(c) Answer in **one** sentence. 4

- (i) What is rigid body ?  
 (ii) State SI unit of modulus of rigidity.  
 (iii) Define critical velocity.  
 (iv) Define elasticity.

**EITHER**

2. (a) Derive an expression for gravitational potential due to a solid sphere at a point outside the sphere. 6  
 (b) State and prove Kepler's third law of planetary motion. 6

**OR**

3. (p) State and explain Newton's law of gravitation. 3  
 (q) State and explain : 6  
 (i) Gravitational field  
 (ii) Gravitational intensity  
 (iii) Gravitational potential.  
 (r) A sphere of mass 19 kg is attracted by another sphere of mass 150 kg when their centres are separated by a distance of 0.28 meters with a force of  $2.45 \times 10^{-6}$  N. Calculate the gravitational constant. 3

**EITHER**

4. (a) Derive an expression for moment of inertia of solid sphere about its diameter. 6  
 (b) State and prove law of conservation of angular momentum. 4  
 (c) Define radius of gyration. 2

**OR**

5. (p) State and prove theorem of parallel axes. 6  
 (q) State and explain moment of inertia. 3  
 (r) Moment of inertia of circular ring about an axis passing through its centre and perpendicular to its plane is 200 gm.cm<sup>2</sup>. If radius of ring is 5 cm, find the mass of ring. 3

**EITHER**

6. (a) Define compound pendulum and obtain an expression for its periodic time. 6  
 (b) Explain damped oscillations, forced oscillations and resonance. 6

**OR**

7. (p) Obtain differential equation of linear S.H.M. 4  
 (q) Define angular S.H.M. and show that the vibration of bar magnet in uniform magnetic field is angular S.H.M. 5  
 (r) Show that time period of oscillation of loaded spring is  $T = 2\pi\sqrt{\frac{m}{k}}$  3

**EITHER**

8. (a) Explain propagation of transverse waves in the stretched string. 6  
 (b) Explain the piezoelectric oscillator for the production of ultrasonic waves. 6

**OR**

9. (p) Describe the construction and working of Kundt's tube. 6  
 (q) What are Lissajous figures? 2  
 (r) State the medical and industrial applications of ultrasonic wave. 4

**EITHER**

10. (a) Derive an expression for depression of beam supported at two ends and loaded at middle. 6  
 (b) Define and explain three elastic constants  $\gamma$ ,  $K$  and  $\eta$ . 6

**OR**

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

**EITHER**

12. (a) Derive an equation of continuity. 6
- (b) Obtain an expression for terminal velocity. 4
- (c) What is significance of Reynold's number ? 2

**OR**

13. (p) State and prove Bernoulli's theorem. 6
- (q) State Stoke's law. 2
- (r) Define coefficient of viscosity. 2
- (s) Give SI unit and dimensions of surface tension. 2