

AP-394

B.Sc. (Part-I) Semester-I Examination

1S : PHYSICS

**(Mechanics, Properties of Matter, Waves &
Oscillations)**

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 :

- (i) The acceleration due to gravity at the poles is _____.
- (ii) Time period of second's pendulum is _____.
- (iii) The fundamental frequency is _____ harmonic.
- (iv) Surface tension of liquid decreases with increasing _____.

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(b) Choose the correct alternative :

- (i) Kepler's second law is about :
 - (a) Elliptical Orbit (b) Period
 - (c) Area (d) Volume

(ii) The modulus of elasticity is dimensionally equivalent to :

- (a) Strain
- (b) Stress
- (c) Surface tension
- (d) Viscosity

(iii) At resonance, the amplitude of oscillation is :

- (a) Minimum
- (b) Maximum
- (c) Zero
- (d) Varying with time

(iv) The moment of linear momentum is called :

- (a) Couple
- (b) Torque
- (c) Impulse
- (d) Angular Momentum

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(c) Answer in **one** sentence :

- (i) What is the SI unit of radius of gyration ?
- (ii) What is Poisson's ratio ?

(b) State and prove Bernoulli's theorem. 6

(c) What is Reynold's number ? Give its significance. 3

OR

13. (p) Derive Stoke's formula for a small sphere falling through viscous liquid. 5

(q) Define surface tension. Give its unit and dimensions. 2

(r) Explain the Jaeger's method to determine surface tension. 5

OR

9. (p) Obtain an expression for the velocity of transverse waves along a stretched string. 5
- (q) State Newton's formula for the velocity of sound in air. Explain Laplace correction. 3
- (r) What is Piezoelectric effect ? Explain the production of ultrasonic waves by Piezoelectric oscillator. 4

EITHER

10. (a) Show that the couple required per unit angular twist in the case of cylindrical wire is $C = \pi \eta r^4 / 2L$. 7
- (b) Obtain an expression for the periodic time of a Maxwell's needle. 5

OR

11. (p) Define Beam and Neutral axis. Derive an expression for the depression at the loaded end of the light beam clamped horizontally at the other end. 7
- (q) What are torsional oscillations ? Derive an expression for the periodic time of a Torsional Pendulum. 5

EITHER

12. (a) Define :
- (i) Streamline flow
 - (ii) Turbulent flow
 - (iii) Critical velocity. 3

(iii) Define cohesive force.

(iv) State continuity equation for streamline flow.

4

EITHER

2. (a) Define universal gravitational constant. Obtain relation between gravitational constant and acceleration due to gravity on earth's surface. 3
- (b) Define gravitational potential. Obtain an expression for gravitational potential due to spherical shell at a point outside the shell. 6
- (c) The acceleration due to gravity on the surface of planet is 10 m/sec^2 . If radius of planet is 6400 km, calculate acceleration due to gravity at height 3600 km above surface. 3

OR

3. (p) State Kepler's Laws of Planetary Motion. 3
- (q) Derive Kepler's Law for Areal Velocity. 5
- (r) Obtain an expression for the acceleration due to gravity at a depth 'd' below the surface of earth. 4

EITHER

4. (a) What is Moment of Inertia ? Give its physical significance. 2
- (b) State and prove theorem of parallel axes. 5
- (c) Derive an expression for the moment of inertia of solid cylinder about its geometric axis passing through its centre of mass and perpendicular to its length. 5

OR

5. (p) The moment of inertia of sphere about its diameter is $\frac{2}{5} MR^2$. Calculate its moment of inertia about the tangent. 4
- (q) State and prove law of conservation of angular momentum for system of particles. 4
- (r) Uniform rod of length 'L' and mass 'M' rotates about an axis passing through one of its end. Calculate moment of inertia about this axis. 4

EITHER

6. (a) What is compound pendulum ? Obtain an expression for the periodic time of compound pendulum. 5
- (b) Define linear simple harmonic motion and obtain differential equation of SHM. 3

- (c) Solve the differential equation of damped harmonic motion and show that velocity of a particle decreases exponentially. 4

OR

7. (p) Define the angular SHM. Show that the vibrations of bar magnet in uniform magnetic field is angular SHM. 5
- (q) Show that total energy of a particle performing SHM is conserved. 4
- (r) A mass of 50 gm is attached to a spring having spring constant 0.2. Determine time period of oscillation. 3

EITHER

8. (a) Obtain the resultant displacement due to superposition of two SHMs of the same frequency, acting at right angles to each other, having phase difference ' ϕ '. Discuss the special cases of resultant motion when phase angle is 0 and $\pi/2$. 8
- (b) What are ultrasonic waves ? State applications of ultrasonic waves. 4