

**B. Sc. ELECTRONICS**  
**First Semester**  
**Applied Physics**  
**(BSE-02)**

**Duration: 3Hrs.**

**Full Marks: 70**

**(PART-B: Descriptive)**

**Duration: 2 hrs. 40 mins.**

**Marks: 50**

**1. Write briefly on the following: (any five)**

**2×5=10**

- a) What are the essential requirements for the satellite to be geostationary?
- b) What is viscosity? Find its expression.
- c) Explain why the path of a spinning ball through air becomes curved.
- d) Find the moment of inertia of a circular ring
  - i. About an axis through its centre and perpendicular to its plane
  - ii. About its diameter.
- e) What is resonance? State its conditions.
- f) What is the principle of sonar system?
- g) Two aeroplanes A and B are approaching towards each other and their velocities are 108 km/hr and 144 km/hr respectively. The frequency of a note emitted by A as heard by the passenger in B is 1170 Hz. Calculate the frequency of the note heard by the passenger in A.

**2. Answer the following questions: (any five)**

**3×5=15**

- a) State Kepler's three law of planetary motion.
- b) State and prove Bernoulli's theorem.
- c) Calculate the moment of inertia of a rectangular lamina about an axis through its centre and parallel to one of its sides.
- d) Define surface tension. Write the molecular theory of surface tension (1+2)
- e) Derive the relation 
$$K = \frac{Y}{3(1-2\sigma)}$$

f) Show that total energy of a Simple Harmonic Motion is

$$E = \frac{1}{2} m\omega^2 r^2.$$

g) The displacement of a wave is represented by,

$$y = 0.25 \times 10^{-3} \sin (500t - 0.025x),$$

Where y, t and x are expressed in cm, second and meter respectively.

Calculate,

- a) Amplitude
- b) Time period
- c) Angular frequency.

**3. Answer the following in details: (any five)**

- a) Find the moment of inertia of a solid sphere 4+1=5
  - i. About its diameter
  - ii. About a tangent
- b) Find the gravitational potential due to a spherical shell at a point outside it. 5
- c) Discuss the working principle of a siphon. Mention the condition for working of a siphon. 3+2=5
- d) Define capillarity. How the surface tension can be determined using the action of capillarity. 1+4=5
- e) What is compound pendulum? Derive the time period for the compound pendulum. 1+4=5
- f) Derive the equation for the amplitude of a forced vibration 5
- g) Prove that, 5

$$\text{Twisting couple of a cylinder} = \frac{\pi\eta\theta}{2l} a^4$$

Where the symbols have usual meaning.

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*(The figures in the margin indicate full marks for the questions)*

**Duration: 20 minutes**

**Marks – 20**

**PART A- Objective Type**

**Choose the correct answer from the following options. 1×20=20**

- 1) When no external torque acts on a rotating body, then
  - a) Angular momentum decreases
  - b) Angular momentum increases
  - c) Angular momentum remains constant
  - d) Body stops rotating.
- 2) The ratio of acceleration due to gravity of earth to that of moon is
  - a) 1:6
  - b) 6:1
  - c) 3:2
  - d) 2:3
- 3) For how many points the time period of a compound pendulum are same?
  - a) 2
  - b) 3
  - c) 4
  - d) 5
- 4) The ratio of escape velocity to that of an orbital velocity is
  - a) 1:2
  - b) 2:1
  - c)  $1:\sqrt{2}$
  - d)  $\sqrt{2} : 1$
- 5) The gravitational field at the centre of a spherical shell
  - a) Is directly proportional to the square of its radius
  - b) Is inversely proportional to the square of its radius
  - c) Remains constant throughout
  - d) Is zero
- 6) Bending moment of a cantilever supported at both ends is,
  - a)  $\frac{WL^3}{3YI}$
  - b)  $\frac{WL^2}{48YI}$
  - c)  $\frac{WL^3}{48YI}$
  - d)  $\frac{WL}{3YI}$

7) Poisson's ratio of a body is defined as

- a)  $\frac{\text{longitudinal strain}}{\text{longitudinal stress}}$
- b)  $\frac{\text{longitudinal strain}}{\text{lateral strain}}$
- c)  $\frac{\text{longitudinal stress}}{\text{longitudinal strain}}$
- d)  $\frac{\text{lateral strain}}{\text{lateral stress}}$

8) The speed of efflux of a liquid through an orifice is equal to

- a) Escape velocity
- b) Orbital velocity of a planet
- c) Velocity of a freely falling body through a height  $h$
- d) None of these

9) The ratio of excess of pressure inside a liquid drop to that of a soap bubble is

- a) 1:2
- b) 1:1
- c) 2:1
- d) 1:4

10) In Bernoulli's theorem, which of the following is conserved?

- a) Mass
- b) Energy
- c) Linear momentum
- d) Angular momentum

11) The S.I. unit of coefficient of viscosity,  $\eta$  is

- a)  $\text{Nsm}^{-2}$
- b)  $\text{Nms}^{-2}$
- c)  $\text{Ns}^{-1}\text{m}^{-1}$
- d)  $\text{Nsm}^{-1}$

12) When there is no external forces, the shape of a liquid drop is determined by

- a) Surface tension
- b) Viscosity of the liquid
- c) Density of the liquid
- d) Temperature of air only

13) The value of surface tension depends upon

- a) Nature of solid in contact with liquid
- b) Nature of liquid
- c) Both nature of solid and liquid in contact
- d) None of these

14) The relation between velocities with temperature is

- a)  $\frac{v_t}{v_0} = \sqrt{\frac{T_t}{T_0}}$
- b)  $v_t \cdot v_0 = T_t \cdot T_0$
- c)  $\frac{v_t}{v_0} = \frac{T_t}{T_0}$
- d)  $v_t \cdot v_0 = \sqrt{T_t \cdot T_0}$

- 15) The natural frequency of 440mm length of a pure iron rod having  $\rho = 7.25 \times 10^3 \text{kgm}^{-3}$  and  $Y = 115 \times 10^9 \text{Nm}^{-2}$  is,
- $4.02 \times 10^2 \text{ Hz}$
  - $3.525 \times 10^3 \text{ Hz}$
  - $3.02 \times 10^2 \text{ Hz}$
  - $4.525 \times 10^3 \text{ Hz}$
- 16) A progressive wave is represented by
- $A = \sin \omega t$
  - $A = \sin(\omega t) \cos(kt)$
  - $A = \sin(\omega t - kx)$
  - $A = \cos kx$
- 17) Which of the following remains unchanged when the wave propagates from air to water?
- Velocity
  - Wave length
  - Frequency
  - Intensity
- 18) Doppler's effect is exhibited by
- Sound waves only
  - Light waves only
  - Both light and sound waves
  - Ultrasonics
- 19) Production of beat is due to
- Interference
  - Diffraction
  - Polarization
  - Refraction
- 20) Ultrasonic waves are
- Longitudinal
  - Transverse
  - Vibrations of other particles
  - Sometimes longitudinal and sometimes transverse.

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