APPLIED PHYSICS-I

Course Code: DPH-101
Time: 3 Hours
Full Marks: 100

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1. Choose the correct answers from the four options given in each question. **1×10 = 10**

i. The gravitational force acting between any two bodies is always
[A] Attractive [B] Repulsive [C] Neutral [D] Can`t predict

ii. As we go from equator to poles of the Earth, the value of 'g'
[A] Increases [B] Decreases [C] Remains same [D] Can`t predict

iii. If heat has to flow from one position to another, there must exist
[A] Density gradient [B] Velocity gradient
[C] Temperature gradient [D] None of the above

iv. Work done per unit volume in stretching a wire is
[A] Stress × Strain [B] Stress / Strain
[C] ½ × Stress × Strain [D] Zero

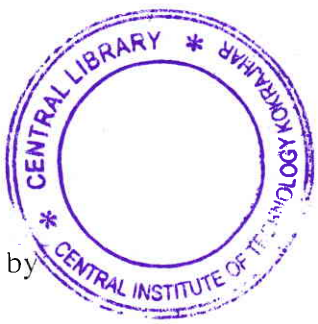
v. SI unit of Poisson`s ratio is
[A] Nm [B] N/m^2 [C] m^3 [D] Unitless

vi. The product of a vector quantity with a scalar results
[A] a scalar quantity [B] a collinear vector
[C] always a null vector [D] a perpendicular vector

vii. The relation between a linear velocity(v) and angular velocity(ω) is given by
[A] $\vec{v} = \vec{\omega} \times \vec{r}$ [B] $\vec{\omega} = \vec{v} \times \vec{r}$ [C] $\vec{v} = \vec{r} \times \vec{\omega}$ [D] $\vec{\omega} = \vec{r} \times \vec{v}$

viii. Impulse of a force is given by:
[A] the rate of change of momentum [B] the change in momentum
[C] conservation of linear momentum [D] all of the above

ix. In the motion of a simple pendulum, the restoring force is
[A] directly proportional to the displacement
[B] directed opposite to the direction of displacement
[C] maximum at the extreme positions
[D] all of the above



x. In the expression $y = 0.5\sin 4\pi t$, the time period of oscillation is given by
[A] 0.5sec [B] 4 sec [C] 2sec [D] 1sec

2. (a) State Hook's Law of elasticity.

(b) Define Coefficient of elasticity.

(c) What is Poisson's ratio?

(d) A rod of length 2m and cross-sectional area of $50mm^2$ stretched by 0.5 mm when a mass of 250 kg is hung from its lower end. Determine the Young's modulus of the material of the rod.

$2 + 2 + 2 + 4 = 10$

3. (a) Is acceleration due to gravity a vector or scaler quantity? What is its SI unit?

(b) On the earth the value of 'G' is 6.67×10^{-11} N m^2 kg^{-2}. What is its value on the surface of Moon and why it is known as universal constant of gravitation?

(c) State and explain Newton's law of gravitation. What is the nature of the force of gravitation?

$2 + 2 + 6 = 10$

4. Write definitions of the following quantities:

(a) Strain

(b) Bulk modulus

(c) Specific heat

(d) Coefficient of thermal conductivity

(e) Joule's Mechanical equivalent of heat. $2 \times 5 = 10$

OR

(a) What do you mean by centre of mass?

(b) Where is centre of mass located in case of a uniform rigid body? Give example.

(c) If a 50 kg woman and a 70 kg man sit on a see-saw, 5m long, where will be the centre of mass for the system?

(d) Write the difference between thermal capacity and water equivalent.

$2 + 2 + 3 + 3 = 10$

5. (a) What is a unit? What is the need of measurement and unit in engineering and science?

(b) Define a fundamental and derived quantity. Write the seven fundamental quantities with their SI units.

(c) State the parallelogram law of vector addition.

(d) What do you mean resolution of a vector?

(e) Define scalar and vector products of two vectors $\vec{A}$ and $\vec{B}$.

$3+6+2+2+3 = 15$

6. (a) State the three laws of motion.

(b) Show that the 1st law and the 3rd law of motion are contained in 2nd law of motion.

(c) State the law of conservation of momentum with an example.

$3+4+3 = 10$

7. (a) What is a circular motion?

(b) Derive the relation between linear velocity (v) and angular velocity (ω) of a body moving in a circular path of radius(r).

(c) What do you mean by centripetal and centrifugal force?

(b) Find the expression of the bending of a cyclist 'θ' while negotiating along a curve path of radius (r) with a velocity (v).

1 + 3 + 2 + 4 = 10

8. (a) Define a simple harmonic motion.

(b) Derive the equation of a simple harmonic motion.

(c) Show that the expression $y = r\sin\omega t$ is a solution of the equation of simple harmonic motion.

(d) Define the terms: displacement, amplitude, frequency and time period

2+3+3+2 = 10

OR

(a) Define transverse and longitudinal waves with examples.

(b) What is the Newton's formula for velocity of sound in air? Write its Laplace's correction.

(c) What is effect of temperature and pressure on the velocity of sound?

4 + 4 + 2 = 10

9. (a) Derive the relation between the coefficients of linear expansion (α), superficial expansion (β) and cubical expansion (γ).

(b) Discuss the anomalous expansion of water.

10 + 5= 15