

Note :

- 1) All questions are compulsory.
- 2) Neat diagrams must be drawn wherever necessary
- 3) Figures to the right indicate full marks.
- 4) Use of only logarithmic table is allowed.
- 5) All symbols have their usual meanings unless otherwise stated.
- 6) Write answers of both sections in same answer book.

SECTION - I

Q.1 Select and write the most appropriate answer from the given alternatives for each subquestion. (7)

- i) Bernoulli's theorem is consequence of.....
 - a) Conservation of mass
 - b) Conservation of energy
 - c) Conservation of linear momentum
 - d) Conservation of angular momentum

- ii) A particle of mass 0.01 kg travels with velocity given by $(4\hat{i} + 16\hat{k})\text{ms}^{-1}$. After some time, its velocity becomes $(8\hat{i} + 20\hat{j})\text{ms}^{-1}$. The workdone on the particle during this interval of time is
 - a) 0.32 J b) 9.6 J
 - c) 6.9 J d) 0.96 J

- iii) The pitch of sound wave is its
 - a) frequency b) amplitude
 - c) velocity d) intensity

- iv) As temperature of water increases, its viscosity.....
 - a) remains unchanged b) decreases
 - c) increases
 - d) increases or decreases depending on external pressure

- v) A force is given by $F = at + bt^2$, where t is the time, then the dimensions of a and b are.....
 - a) $[M^1L^1T^{-4}]$ and $[M^1L^1T^1]$
 - b) $[M^1L^1T^{-1}]$ and $[M^1L^1T^0]$
 - c) $[M^1L^1T^{-3}]$ and $[M^1L^1T^{-4}]$
 - d) $[M^1L^1T^{-3}]$ and $[M^1L^1T^0]$

- vi) A projectile is fired with velocity 'v' perpendicular to plane which is inclined at an angle θ to the horizontal, the angle of projection is
- a) $v^2 \tan^2 \theta / g$ b) $2v^2 \sin^2 \theta / g$
 c) $2v^2 \tan \theta \sec \theta / g$ d) $2v^2 \sec \theta / g$
- vii) Friction causes loss of
- a) power b) energy
 c) charges d) displacement

Q.2 Attempt any **six** :

(12)

1. What are the benefits of gas thermometer over mercury thermometer ?
2. At what temperature the speed of sound in air will double than its speed at N.T.P. ?
3. Define the term moment of force about a point. State its SI unit and dimensions.
4. A large water tank has a hole at a distance of 5m from free water surface. Find the velocity of water through hole, if the radius of hole is 2 mm.
5. State Pascal's law and state its two applications.
6. A man throws a ball to maximum horizontal distance of 80m. Calculate its maximum height (take $g = 9.8 \text{ m/s}^2$)
7. Distinguish between transverse and longitudinal mechanical wave (any two points)
8. Velocity of sound in gas is 498 m/s and in air is 332 m/s. What is ratio of wavelength of sound waves in gas to air.

Q.3 Attempt any **three** :

(9)

1. Derive an expression for pressure exerted by liquid column.
2. The magnitude of two forces are in ratio 2:3. The resultant of two forces is 50N. If angle between two forces is 60° . Find the magnitude of each force.
3. State three laws of static friction.
4. A 3 kg ball and 4 kg ball having speed 7m/s and 5m/s approaches one another. Find their speeds after collision if coefficient of restitution is 0.75

Q.4 a) Obtain an expression for the terminal velocity of small spherical body falling under gravity through viscous fluid. (7)

- b) Calculate total energy per unit mass possessed by water at a point where pressure is $0.1 \times 10^5 \text{ N/m}^2$, velocity is 0.02 m/s and height of water from ground level is 10 cm {density of water = 1000 kg/m^3 , $g = 9.8 \text{ m/s}^2$ }

OR

Q.4 a) What is elastic collision ? In head on perfectly elastic collisions of two bodies, derive the expression for velocities of the bodies in terms of their masses and velocities before collision.

- b) The mass of moon is 0.0123 times mass of earth and separation between them is $3.84 \times 10^8 \text{ m}$. What is location of centre of mass as measured from centre of earth.

