PHYSICS QUESTION PAPER

Time : 2 Hrs. **Max . Marks : 40**

Note : *(i)* *All questions are compulsory.*
(ii) *Neat diagrams must be drawn wherever necessary.*
(iii) *Figures to the right indicate full marks*
(iv) *Use of only logarithmic table is allowed.*
(v) *All symbols have their usual meaning unless otherwise stated.*
(vi) *Answer to every question must be written on a new page*

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question : [8]

(i) In stationary wave, antinodes are the points where there is ..... . (1)

(a) minimum displacement and minimum pressure change
(b) minimum displacement and maximum pressure change
(c) maximum displacement and minimum pressure change
(d) maximum displacement and maximum pressure change

(ii) Out of the following equations which is WRONG? (1)

(a) $\dot{\tau} = \dot{r} \times \dot{F}$ (b) $\vec{a}_r = \vec{\omega} \times \vec{v}$

(c) $\vec{a}_t = \vec{\alpha} \times \vec{r}$ (d) $\dot{v} = \vec{r} \times \vec{\omega}$

(iii) The acceleration of a particle in SHM is ..... . (1)

(a) maximum = $a\omega^{-}$, when it passes through mean position
(b) maximum = $a\omega^2$, when it attains the extreme position
(c) minimum = $a\omega^2$, when it passes through its mean position
(d) minimum = $a\omega$ when it attains the extreme position

(iv) When transverse wave is propagated through the medium the successive particles A and B are on trough, then the phase difference between A and B in radian is ..... (1)

(a) π (b) 2π

(c) 3π (d) 4π

(v) $[M^{-1} L^{3} T^{-2}]$ are the dimensions of ..... . (1)

(a) acceleration due to gravity

(b) gravitational constant

(c) gravitational force

(d) gravitational potential energy

(vi) From the stress against strain graph, the behaviour of the wire between elastic limit and yield point is ..... (1)

(a) perfectly elastic

(b) formation of neck

(c) perfectly plastic

(d) elastic but with permanent deformation

(vii) The r. m. s. velocity of the gas molecules moving with velocities 2 m/s, 4 m/s and 6 m/s is ..... . (1)

(a) 2·8 m/s (b) 3·0 m/s

(c) 3·8 m/s (d) 4·32 m/s

(viii) A thin ring has mass 0·25 kg and radius 0·5 m. Its M.I. about an axis passing through its centre and perpendicular to its plane is ..... . (1)

(a) 0·0265 g-cm^{-} (b) 0·0625 kg-m^{2}

(c) 0·625 kg-m^{-} (d) 6·25 kg-m^{2}

Q. 2. (A) Attempt any ONE : **[8]**

(i) A cylindrical glass tube is 35 cm long. If both ends of the tube are open. what is the fundamental frequency of vibration of air column? Neglect end correction.
(Velocity of sound in air = 350 m/s) (2)

(ii) A liquid rises to a height of 5 cm in a glass capillary of radius 0·02 cm. What will be the height of the same liquid in a glass capillary of radius 0·04 cm? (2)

(B) Attempt any TWO :

(i) Derive an expression for the kinetic energy of a body of mass M rotating uniformly about a given axis. Hence show that

$$\text{rotational kinetic energy} = \frac{1}{2M} \times \left(\frac{L}{K}\right)^2$$ (3)

(ii) What is banking of roads? Obtain an expression for the maximum safety speed of a vehicle moving along a curved horizontal road. (3)

(iii) State and explain Prevost's theory of heat exchanges. (3)

Q. 3. (A) Attempt any ONE : **[8]**

(i) State S. I. unit of angular momentum. Obtain its dimensions. (2)

(ii) Obtain the relation between linear velocity and angular velocity. (2)

(B) Attempt any TWO

(i) State any 'six' assumptions on which the kinetic theory of gases is based. (3)

(ii) Define three modulii of elasticity. State their formulae. (3)

(iii) State Kirchhoff's law of radiation and prove it theoretically. (3)

Q. 4. (A) Attempt any TWO : **[8]**

(i) Draw a neat and labelled diagram of Searle's apparatus used to determine Young's modulus of the material of a wire. (2)

(ii) Why specific heat of a gas at constant pressure is always greater than the specific heat of a gas at constant volume? (2)

(iii) A particle performing S.H.M. starts from extreme position. Plot the graphs of velocity and displacement against time. (2)

(B) Attempt any ONE :

(i) Explain analytically how stationary waves are formed. What are nodes and antinodes? Show that the distance between two adjacent nodes or antinodes is $\frac{\lambda}{2}$. (4)

(ii) Explain why the angle of contact is acute for kerosene-glass pair and is obtuse for mercury-glass pair. (4)

Q. 5. Attempt any TWO : **[8]**

(i) If the earth were made of wood, the mass of wooden earth is 10% as much as it is now without the change in its diameter. Calculate the escape velocity of spaceshot from the surface of wooden earth.

Radius of earth $R = 6400$ km.

Mass of earth $M = 6 \times 10^{24}$ kg

Constant of gravitation $G = 6{\cdot}67 \times 10^{-11}$ Nm^2/kg^2 (4)

(ii) A transverse wave of amplitude 0·01 m and frequency 500 Hz is travelling along a stretched string with a speed of 200 m/s. Find the displacement of a particle at a distance of 0·7 m from the origin after 0·01s. Also find the phase difference between the point where wave reaches from the origin. (4)

(iii) The period of simple pendulum is found to increase by 50% when the length of the pendulum is increased by 0·6 m. Calculate the initial length and initial period of oscillation at a place where $g = 9{\cdot}8$ m/s . (4)