PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. All parts carry equal marks. **(14 x 3 = 42)**

(i) From the Stokes' law, the drag force can be expressed as $F_D = 6\pi\eta rv$, then find the dimensions of co-efficient of viscosity η?

(ii) $\bar{A}$ and $\bar{B}$ are two mutually pendicular vectors equal in magnitude. Show their sum and difference through Head to Tail Rule with neat diagram.

(iii) Given $|\bar{A}| = 3.2$, $|\bar{B}| = 5.1$ and $\theta = 60°$ between $\bar{A}$ and $\bar{B}$. Find $|\bar{A}\cdot\bar{B}|$ and $|\bar{A}\times\bar{B}|$

(iv) Briefly explain the circumstances in which velocity $\bar{v}$ and acceleration $\bar{a}$ of a car are:
(a) Parallel (b) Anti parallel

(v) The horizontal range of a projectile is 4 times of its maximum height ($R = 4H$). What is its angle of projection?

(vi) When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?

(vii) Express power (P) as scalar product of force ($\bar{F}$) and velocity ($\bar{v}$).

(viii) Derive a mathematical relation for orbital velocity and prove that $v_o \propto \frac{1}{\sqrt{r}}$

(ix) A circular disc of $49kg$ and radius $50cm$ is rotating at a speed of 120 rev/min. Calculate its K.E?

(x) Explain how swing is produced in a fast moving cricket ball? (Bernoulli effect)

(xi) What is meant by banking of roads? Also show that $v = \sqrt{gr\tan\theta}$

(xii) The deviation of second order diffracted image formed by an optical grating having $5000 lines/cm$ is $32°$. Calculate the wavelength of light used.

(xiii) A body of mass m suspended from a spring with force constant k, vibrates with f_1. When its length is cut into half and same body is suspended from one of the halves, the frequency is f_2. Find out $\frac{f_1}{f_2}$?

(xiv) Why does sound travel faster in solids than in gases?

(xv) What will be the wavelength of the note emitted by a closed organ pipe $32.4cm$ long at $0°C$?

(xvi) Prove that speed of sound through Hydrogen is 4 times as compared to its speed in Oxygen. Whereas $\rho_{Hydrogen} : \rho_{Oxygen} = 1:16$

(xvii) An oil film spreading over a wet footpath shows colours. Explain how does it happen?

(xviii) If the Young's double slit experiment is performed in water, what will happen to the interference pattern?

(xix) Briefly explain the working principle of Carnot engine.

(xx) Discuss that increase in entropy means degradation of energy.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 3 a. Explain vector and scalar products of two vectors with neat diagrams. **(05)**

b. Describe time of flight and range of projectile using diagram. Derive mathematical formulae for both. **(04)**

c. Show that $S = v_i t + \frac{1}{2}at^2$ is dimensionally correct. **(04)**

Q. 4 a. State and explain Bernoulli's Equation giving all details of it with diagram. **(05)**

b. Show that earth's gravitational field is a conservative field. **(04)**

c. The earth rotates on its axis once a day so that its original time $T_1 = 24$ hours. Suppose, by some process the earth expands so that the radius becomes double as large as at present. Determine T_2 (new time required for one revolution) after expansion using law of conservation of angular momentum. **(04)**

Q. 5 a. Show that motion of a simple pendulum is SHM. Derive formulae for its time period. **(05)**

b. Prove that $v_t = v_0 + (0.61)t$ **(04)**

c. Derive $C_p - C_v = R$ **(04)**

Important formulae:

- $v_{orbital} = \sqrt{\frac{GMe}{r}}$
- $\omega = \frac{2\pi}{T}$
- $\sin(2\theta) = 2\sin\theta\cos\theta$
- $R = \frac{vi^2\sin(2\theta)}{g}$
- $H = \frac{vi^2\sin^2\theta}{2g}$
- $K.E_{rot} = \frac{1}{2}I\omega^2$
- $I_{disc} = \frac{1}{2}mr^2$
- $I_{sphere} = \frac{2}{5}mr^2$