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) Briefly describe necessary conditions for SHM.

(ii) What is torque? Define torque as vector product of $\vec{r}$ and $\vec{F}$.

(iii) For $\vec{A}$ show that $|\vec{A}| = \sqrt{A_x^2 + A_y^2}$

(iv) Find the change in momentum for an object subjected to a given force for a given time and state law of motion in terms of momentum.

(v) Two balls are projected in directions at $15°$ and $45°$ with the horizontal. If both attained the same range then find the ratio of their initial speeds.

(vi) Calculate the work done in kilojoules in lifting a mass of 10kg at a steady velocity through a vertical height of $10m$?

(vii) If radius of moon is $\frac{1}{6}$ times radius of earth and gravity on moon is $\frac{1}{5}$ times gravity on earth, then find the escape velocity at the surface of moon?

(viii) Show that angular momentum $L = mvr$

(ix) Find the relation between linear velocity and angular velocity.

(x) Discuss working principle of aerofoil.

(xi) Show that in SHM, the acceleration is zero when the velocity is greatest and the velocity is zero when the acceleration is greatest.

(xii) Discuss the interchanging between K.E. and P.E during SHM.

(xiii) As a result of distant explosion, an observer senses a ground tremor and then hears the explosion. Explain the time difference in it.

(xiv) The speed of sound in air at $0°C$ is $332ms^{-1}$. What will be its speed at $25°C$?

(xv) Under what conditions two or more sources of light behave as coherent sources?

(xvi) In Young's double slit experiment, if the distance between the slits is halved and distance between slit and screen is doubled, then find the change in fringe width?

(xvii) A garden hose of inner radius $1.25cm$ carries water at $2.60ms^{-1}$. The nozzle at the end has radius $0.30cm$. How fast does the water emerge out through the nozzle?

(xviii) Show that $\frac{n_2}{n_1} = \tan i_p$ (polarization of transverse waves)

(xix) Is it possible to convert internal energy (ΔU) into mechanical energy? Explain with an example.

(xx) Describe the terms 'specific heat' and 'molar specific heat' of gases.

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 two conditions of equilibrium. **(04)**

c. What are the dimensions and units of gravitational constant G in the formula $F = \frac{Gm_1m_2}{r^2}$? **(04)**

Q. 4 **a.** Explain and derive a mathematical relation for Absolute Potential Energy. **(05)**

b. What is meant by moment of inertia of a body? Derive a formula for it. **(04)**

c. What is the aero foils lift (in newtons) on a wing of area $88m^2$ if the air passes at speed over its top surface at $280ms^{-1}$ and bottom surface at $150ms^{-1}$? **(04)**

Q. 5 **a.** Explain Doppler's effect in detail with its special cases. **(05)**

b. The radius of sphere 'r' is measured with a Vernier Callipers as $(r \pm \Delta r) = (2.25 \pm 0.01)cm$. Calculate the volume of sphere. **(04)**

c. A Carnot engine utilizes an ideal gas. The source temperature is $227°C$ and sink temperature is $127°C$. Find the efficiency of the engine. Also find heat input from the source and heat rejected to the sink when $10000J$ of work is done? **(04)**

Important formulae:

- $Fringe\ Spacing = D\frac{\lambda}{D}$
- $R = \frac{v_i^2 \sin(2\theta)}{g}$
- $Work = \vec{F} \cdot \vec{d}$
- $v_f = v_o + (0.61)t$
- $v = r\omega$
- $v_{esc} = \sqrt{2gR}$
- $Weight = mg$
- $v_o = x_o\sqrt{\frac{k}{m}}$
- $\%Efficiency = \left(\frac{T_1 - T_2}{T_1}\right) \times 100\% = \left(\frac{Q_1 - Q_2}{Q_1}\right) \times 100\%$