



THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED

Q.1. Answer the following short questions:

(6x5=30)

- i. Discuss a particular motion in which restoring force is directly proportional to the displacement (x) from equilibrium position. Also discuss uniform circular motion and show that $a_x = -\omega^2 x$. (where a is acceleration and ω is angular frequency).
- ii. If the displacement in SHM is $x = A \cos(\omega t + \phi)$, then show that $a_x = -\omega^2 x$. Also find the expressions for Amplitude (A) and Phase (ϕ).
- iii. Differentiate different types of mechanical waves. Also elaborate the principle of superposition.
- iv. Graphically illustrate Beat phenomenon. Also derive a mathematical expression for the Beat frequency.
- v. Describe various mechanisms of heat transfer.
- vi. Differentiate reversible and irreversible processes. Also elaborate different thermodynamic temperature scales.

Q.2. Answer the following questions:

(3x10=30)

- a. What is a Carnot Engine and Carnot Cycle? Derive an expression for the thermal efficiency of the Carnot Engine.
- b. For various relative rest and moving states of source and listener of sound, what will be the impact on the frequency heard by the listener.
- c. Using kinetic theory for an ideal gas, derive expressions for the gas pressure and molecular kinetic energies.