



THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED

Q.1. Answer the following short questions: (6x5=30)

- i.** For a body exhibiting simple harmonic motion, write down and explain the mathematical expressions for displacement, velocity and acceleration. Apply these expressions to find the phase angle and amplitude.
- ii.** Explain principle of superposition. Derive an expression for the mechanical wave-equation.
- iii.** Discuss the construction of the heat engine operating in reverse. Also derive an expression for its coefficient of performance.
- iv.** What is Doppler's effect? Apply Doppler's effect to find the frequency change due to a moving listener and stationary source.
- v.** What are cyclic processes and isolated system? Also discuss various kinds of thermodynamic processes.
- vi.** (a) Is the first law of thermodynamics a generalization of the principle of conservation of energy?
(b) As an ideal gas undergoes an isothermal (constant-temperature) expansion at temperature T , its volume changes from V_1 to V_2 . How much work does the gas do?
(2 + 3)

Q.2. Answer the following questions: (3x10=30)

- a.** As an application of simple harmonic motion, show that Hooke's law can be derived from the vibration of molecules (a two-atom system).
- b.** What is kinetic theory of the ideal gas? Find an expression for the pressure exerted by the gas on the wall of the container. Also derive a relation for average translational kinetic energy of a molecule of an ideal gas.
- c.** What is Carnot cycle? Find an expression for the efficiency of a Carnot engine.