University of Information Technology & Sciences (UITS)
Faculty of Science & Engineering
Department of Computer Science and Engineering
Term Final Examination, Spring – 2025
Course Title: Engineering Physics
Course Code: PHY -0533111

Full Marks: 50   **Time: 3 Hours**

(Answer all the questions; Figures on the right margin indicate full marks)

1. (a) Write down the postulates of kinetic theory of gases.   [2]

   (b) Derive an expression for pressure exerted by the gas molecule in a vessel and hence [5] show that root mean square speed, $C = \sqrt{\frac{3P}{\rho}}$; where P is pressure exerted by the gas molecules, ρ is the mass per unit volume and C is the root-mean- square speed of the gas molecules.

   (c) At what Celsius temperature will oxygen molecules have the same root mean square [3] speed as that of hydrogen molecules at -100°C.

2. (a) State and explain first law of thermodynamics.   [3]

   (b) If the state of a system is specified by pressure (P), volume (V), temperature (T) and [7] entropy (S), then applying the laws of thermodynamics, show that
   $$\left(\frac{\partial P}{\partial T}\right)_S \left(\frac{\partial V}{\partial S}\right)_T - \left(\frac{\partial P}{\partial S}\right)_T \left(\frac{\partial V}{\partial T}\right)_S = 1$$

3. (a) What is the Maxwell's law of equipartition of energy? Explain.   [2]

   (b) Applying first law of thermodynamics, prove that PV^γ = constant.   [5]
   (Symbols have their usual meaning).

   (c) Determine the value of γ for a monoatomic gas.   [3]

4. (a) What is meant by interference of light? Write down the conditions to form interference fringes of light. [3]

   (b) Show that the intensity distribution due to interference of plane monochromatic light waves coming from two sources of equal intensity is given by $I = 4a^2 Cos^2 \frac{\delta}{2}$; where the symbols have their usual meaning and hence explain energy distribution diagram for maximum and minimum intensities. [7]

5. (a) What do you mean by polarization of light and polarizing angle? [2]

   (b) State and explain Brewster's law. Prove that the reflected and refracted rays are perpendicular to each other when light is reflected at the polarizing angle at the surface of a transparent medium. [5]

   (c) The refractive index of plastic is 1.25. Calculate the angle of refraction for a ray of light incident at the polarizing angle. [3]

   OR

   (a) Explain Fermat's Principle of stationary time. [2]

   (b) Derive the laws of reflection of light using Fermat's Principle. [5]

   (c) Green light of wavelength 5100 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 200 cm away is 2 cm, find the slit separation. [3]