University of Information Technology & Sciences (UITS)
Faculty of Science & Engineering
Department of CSE
Mid Term Examination, Spring - 2024
Course Title: Engineering Physics
Course Code: PHY -0533111

Marks: 20   **Time: 1 Hour**

*(Answer any **two** out of **three** questions)*

1.
   a) What do you understand by Simple Harmonic Motion (SHM) ?   [2]

   b) Deduce the differential equation of SHM and solve it for the displacement of a particle.   [5]

   c) A particle performs SHM which is represented by the equation $x = 10 \sin\left(10t - \frac{\pi}{6}\right)$; where x is measured in metre, t in second and the phase angle in radian. Calculate the time period, frequency and epoch angle of the particle.   [3]

2.
   a) Define wave and oscillation, time period & frequency of a vibrating particle.   [2]

   b) Derive an expression for total energy of a particle oscillating simple harmonically.   [5]

   c) Discuss the change of potential energy (PE) and kinetic energy (KE) for an oscillating particle. When are the PE and KE maximum ?   [3]

3.
   a) What are meant by Lissajous Figures ?   [2]

   b) Derive an expression for composition of two Simple Harmonic Oscillations of equal time periods, different amplitudes and different phases acting at right angles.   [5]

   c) Draw the figures for $\alpha = \pi$ or 2π; $\frac{\pi}{2}$; $\frac{\pi}{2}$ and a = b.   [3]

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Term Final Examination, Spring – 2024
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Marks: 50   **Time: 3 Hours**

(Answer All Questions)

1. (a) What are the fundamental postulates of kinetic theory of gases? [2]

   (b) Obtain an expression for pressure exerted by the gas molecule in a vessel and hence show that kinetic energy per unit volume of the gas is $\frac{1}{2}\rho\overrightarrow{C^2}$, where ρ is density of gas and $\overrightarrow{C^2}$ is root mean square velocity. [5]

   (c) The number of molecules per cc of a gas is 2.7×10^{19} at 273 K and 76 mm pressure. Calculate the number of molecules per cc of the gas at 0° C and 10^{-6} mm pressure of mercury. [3]

   OR

   (a) What is meant by mean free path? [2]

   (b) Explain theorem of equipartition of energy. [5]

   (c) Calculate the mean free path of a gas molecule, given that the molecular radius is 2.0×10^{-10} m and the number of molecule per cc is 3.0×10^{19}. [3]

2. (a) Write down and discuss the First law of thermodynamics. [2]

   (b) Find the relation between temperature and volume in case of adiabatic process, TV^{γ} = constant, where symbols have their usual meaning. [5]

   (c) Calculate work done for isothermal process applying First law of thermodynamics. [3]

3. (a) Define Carnot engine and efficiency of Carnot engine. [2]

   (b) Derive an expression for work done by a working substance in a complete Carnot cycle. [6]

   (c) A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased? [2]

4. (a) What are coherent sources? Explain the importance of such sources in the phenomenon of interference 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 $I = 4a^2 Cos^2 \frac{\delta}{2}$; (Symbols have their usual meaning), and hence explain energy distribution diagram for maximum and minimum intensities. [7]

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

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