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

Marks : 20   **Time : 1 Hour**

(Answer all questions)

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

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

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

   OR

   (a) What are meant by Lissajous' Figures? [2]

   (b) Derive an expression for composition of two Simple Harmonic Oscillations (SHO) if these two SHO act simultaneously on a particle in perpendicular direction at constant time period and different amplitude & phase angle. [5]

   (c) Draw the Lissajous' Figures for $\alpha = \pi$ or 2π; $\frac{3\pi}{2}$; and $\frac{\pi}{4}$ [3]

2. (a) Define transverse and longitudinal waves. [2]

   (b) Deduce the equation of stationary wave and hence explain the nodes and antinodes of the wave with figure. [5]

   (c) A particle performs Simple Harmonic Wave which is represented by the equation $y = 10 \sin(10t - 5x)$; where y is measured in meter, t in second and the phase angle in radian. Calculate the time period, frequency, velocity and wavelength of the particle. [3]

Term Final Examination, Autumn / 2024
Course Title: Engineering Physics
Course Code: PHY -0533111

Marks: 50   Time: **3 Hours**

(Answer all the questions)

1. (a)   What do you mean by kinetic theory of gases?   [2]

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

   (c)   The number of molecules per cc of a gas is 2.7×10^{19} at N.T.P. Calculate the number of   [3]
         molecules per cc of the gas at 0° C and 10^{-6} mm pressure of mercury; where density of
         mercury, ρ is 13.6gm/cm³

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

   (b)   Prove that the mean kinetic energy of a gas molecule is directly proportional to the   [4]
         absolute temperature of a gas.

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

   OR

   (a)   Define isothermal and adiabatic process.   [3]

   (b)   Obtain an expression for mean free path and explain it.   [4]

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

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

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

   (c)   Show that the slope of an adiabatic curve is γ times that of the isothermal.   [3]

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4. (a) What are coherent sources? Explain the importance of such sources in interference phenomenon. [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? [3]

(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 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. [2]