SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

February 2022

Course Code: **PHY137**

Course: **FUNDAMENTALS OF PHYSICS**

Question Paper No. : **UGF055** Max. Marks:**100**

PART - A

Answer any FOUR questions **4 x 20 = 80 Marks**

1. (a) Describe Young's double slit experiment and (i) obtain condition for bright and dark fringes on the screen and (ii) expression for fringe width. (13)

   (b) A particle of mass 0.2 kg undergoes SHM according to the equation: $x(t) = 3\sin\left(\pi t + \frac{\pi}{4}\right)$. [$t$ is in sec and x in m]

   (i) What is the time period of oscillation?

   (ii) What is the initial velocity when the SHM starts?

   (iii) At what instants is the particle's energy purely kinetic? (7)

2. Deduce the Maxwell's equations for the propagation of electromagnetic wave in non-conducting to obtain an expression for (i) velocity, (ii) impedance and (iii) Poynting vector.

3. (a) When a thin sheet of transparent material of thickness 6.3 X 10^{-4} cm is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the sixth fringe. If λ = 5460 A^0, find the refractive index of the sheet. (5)

   (b) Explain the concept of production of polarized beam of light from addition of two SHM acting at right angle. Also, sketch resultant compositions of two SHM of the same frequency but different phase (any three cases only). (10)

   (c) Discuss the importance of displacement current and explain how Ampere's law is modified to explain time varying fields. (5)

4. (a) By considering Hall effect experiment, determine Hall coefficient, carrier concentration & mobility of charge carriers. (15)
   (b) Discuss how the cubic, Tetragonal and monoclinic Bravais lattices are distinguished using unit vectors and Angles with neat diagram. (5)

5. (a) Obtain Schrödinger time dependent equation from the wave equation. (10)
   (b) Describe the working principle of CO_2 laser. (10)

6. (a) In photoelectric effect experiment, it has been determined that photoelectrons released from Zinc by UV light were stopped by a voltage 4.3 V. Find maximum kinetic energy and velocity of electrons. (5)
   (b) Discuss various types of optical fiber using the combination of mode of propagation and refractive index profile of the core. (10)
   (c) Define entropy and how does it change in case of reversible and irreversible process. (5)

PART - B

Answer the following **1 x 20 = 20 Marks**

7. (a) With the help of half wave plate/quarter wave plate/polarizer, construct and sketch the optical system to obtain unpolarized light to linearly polarized light and linearly polarized to circularly polarized light, then circularly polarized light to linear polarized light. (5)
   (b) Express Ampere's circuital and Faraday laws and convert them from integral form to differential form. (5)
   (c) For a light source at mean wavelength 11500 A°, the coherence time 2.7×10^{-8} sec., calculate the (i) coherence length (ii) spectral width (iii) purity factor. (5)
   (d) If the position of a 5 KeV electron is located within 2A°, what is the percentage of uncertainty in its momentum. (5)

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