

Duration: 1.5 hrs

Marks:45

N.B. : (1) Question No 1 is Compulsory.

(2) Attempt any two questions out of the remaining four.

(3) Assume suitable data, if required and state it clearly.

1 Attempt any FIVE [15]

(a) What is the difference between spontaneous and stimulated Emission.

(b) The N.A. of an optical fiber is 0.5 & core R.I. is 1.54. Find R.I. of cladding.

(c) What is antireflection coating? What should be the refractive index and minimum thickness of the coating?

(d) Show that the divergence of a curl of a vector is zero.

(e) Calculate the wavelength of de-Broglie waves associated with mass 1 kg moving with a speed of 10^3 m/sec.(f) An electron is confined in a box of length 10^{-8} m. Calculate minimum uncertainty in its velocity.

(g) Define drift velocity and Mobility. Write its unit.

2 (a) What is resonant cavity? Explain its use in the generation of laser beams [05]

(b) Derive an expression for numerical aperture of a step index optical fiber. [05]

(c) The diameter of 5th dark ring in Newton's ring experiment was found to be 0.42 cm. Determine the diameter of 10th dark ring. [05]3 (a) What is gradient? If $\Phi = 3(x^2y - y^2x)$, find $\nabla\Phi$ at the point (1, -2, -1). [05]

(b) Derive Schrodinger's Time Independent wave equation for matter waves. [05]

(c) Explain mobility of electrons. The resistivity of Cu is 1.72×10^{-8} ohm-m. Calculate the mobility of electrons in Cu given that number of electrons per unit volume is $10.41 \times 10^{28} \text{ m}^{-3}$ [05]

4 (a) Show that for an intrinsic semiconductor, Fermi level lies midway of conduction band and valence band. [05]

(b) Obtain the condition for maxima and minima for the interference in thin film of uniform thickness in a reflected light. [05]

(c) Calculate velocity and de-Broglie wavelength of alpha particle of energy 1 keV. Given: mass of alpha particle as 6.68×10^{-27} kg [05]

5 (a) Explain the following terms in optical fiber: (a) Total internal reflection (b) Critical angle (c) Acceptance angle (d) Attenuation (e) Numerical aperture [05]

(b) State and explain Maxwell's fourth equation.

(c) Explain applications of LASER in industry and medical field. Discuss any one of them in details
