

FE Sem-I (NEP-2020) June 2026

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^{28} 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
