Paper / Subject Code: N10412 / Applied Physics

FE (Sem I) | All branches | NEP 2020 | Winter25 | (24/12/25)

Duration: 1.5 hrs **[Max 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) Explain optical resonator in LASER?

(b) An optical fiber of core refractive index of 1.50 is to be clad to ensure that TIR will take place for a light ray with critical angle 85°. What minimum refractive index is allowed for cladding?

(c) Find the minimum thickness of soap film which appears dark (Wavelength 5896 A°) in reflection when light is incident normally on the film. Given refractive index of the film is 1.33.

(d) What do you mean Curl of vector. Write its significance.

(e) Write the properties of matter waves.

(f) The ground state energy of an electron in an infinite well is 1 eV. What will be the ground state energy if the width of the well is doubled?

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

2 (a) List and briefly explain any two industrial applications of laser. **[05]**

(b) Derive an expression for acceptance angle of a step index optical fiber. **[05]**

(c) Obtain an expression for minimum thickness of anti-reflecting film. **[05]**

3 (a) Find Curl of vector F $(x^2y + xy^2z + 3x^2z^2)$ at point (1,-1,1) **[05]**

(b) Derive the Schrodinger's Time Dependent differential equation for matter waves **[05]**

(c) Show that the intrinsic Fermi level lies in the middle of the band gap. **[05]**

4 (a) Calculate electron and hole concentration in intrinsic silicon at room temperature if it electric conductivity is 4×10^{-4} mho/m. Given that mobility of electron is 0.14 m^2/V-Sec mobility of holes is 0.04 m^2/V-Sec. **[05]**

(b) Derive the condition for maxima due to interference of light reflected from thin film of uniform thickness. **[05]**

(c) Calculate velocity and de-Broglie wavelength of alpha particle of energy 1keV. 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) Deduce Maxwell's second equation in differential and integral form. **[05]**

(c) With the help of neat diagram, explain construction and working of He Ne laser. **[05]**

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