Paper / Subject Code: N10412 / Applied Physics

19/12/2024 FE- ALL BRANCHES SEM-I (NEP-2020) APPLIED PHYSICS QP CODE: 10070779

[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 (a) What is metastable state? What is the role of metastable state in LASER? An optical fiber has an acceptance angle of 30° and core refractive index of (b) calculate refractive index of cladding? Explain why an excessively thin film appears black in reflected light? (c) Show that the divergence of a curl of a vector is zero. (d) State the properties of matter waves. (e) An electron is bound in an 1D potential well of width 2 A° but of infinite height. (f) Find its energy values in the ground state and in first excited state. (Given: Planck constant is 6.634x10⁻³⁴ J-Sec) Write Fermi Dirac distribution function and explain the terms involved in it With the neat energy level diagram, explain the construction and working of He [05] Ne Gas laser. (b) Derive an expression for numerical aperture of a step index optical fiber. [05] In a Newton's ring arrangement, a drop of liquid of refractive index 1.33 is [05]placed in between the lens and plate. The diameter of 9th dark ring is found to be 0.58 cm. Obtain the radius of curvature, if the wavelength of light is 6000 A°. What is gradient? If $\emptyset = 3(x^2y - y^2x)$, find $\nabla \emptyset$ at the point (1, -2, -1). [05] Prove that electron cannot reside inside the nucleus of an atom. (b) [05] Predict the effect on the electrical properties of a silicon at room temperature if [05]every millionth silicon atom is replaced by an atom of indium. Given: Concentration of silicon atoms are 5 x 10²⁸ /m³ intrinsic conductivity of silicon is $4.4 \times 10^{-4} / \Omega$ -m mobility of holes is 0.048 m² / volt-sec.

Duration: 1 1/2 hours

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4	(a)	Show that for an intrinsic semiconductor, fermi level lies midway of	[05]
		conduction band and valence band.	
	(b)	With the experimental set up of Newton's ring, explain the determination of	[05]
		refractive index of a liquid.	N. T.
	(c)	An electron and a photon each have a wavelength of 2A°. What are their	[05]
		momentum and energies?	
5	(a)	Compare Step Index fiber and Graded Index Fiber.	[05]
	(b)	State and explain Maxwell's fourth equation.	[05]
	(c)	What is Lidar technology and how does it work?	[05]

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