

**1E3102**

Roll No. \_\_\_\_\_

Total No. of Pages: **3****1E3102****B. Tech. I - Sem. (Main / Back) Exam., - 2023****1FY2 – 02 Engineering Physics****Time: 3 Hours****ersahilkagyan.com****Maximum Marks: 70***Instructions to Candidates:*

*Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)*

1. NIL2. NIL**PART – A****[10×2=20]****(Answer should be given up to 25 words only)****All questions are compulsory**

- Q.1 Excessively thin film appears dark why?
- Q.2 What do you mean by resolving power of an optical instrument?
- Q.3 What is normalized and orthogonal wave function?
- Q.4 Explain total internal reflection.
- Q.5 What are the relation between Einstein's Coefficients? Explain them.
- Q.6 What is Hall effect?
- Q.7 What is scalar and vector field?

- Q.8 Define curl and divergence of a vector.
- Q.9 What do you mean by spectral purity?
- Q.10 What will be the effect on diameters in Newton's ring experiment if film is of  $\mu$  refractive index?

## PART – B

[5×4=20]

### (Analytical/Problem solving questions)

#### Attempt any five questions

- Q.1 Two coherent sources of intensity ratio  $\alpha$  interfere. Prove that in the interference pattern  $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}} = \frac{2\sqrt{\alpha}}{1 + \alpha}$
- Q.2 A single slit is illuminated by light composed of two wavelengths  $\lambda_1$  and  $\lambda_2$ . One observes that due to diffraction, the first minima obtained for  $\lambda_1$  coincides with the second diffraction minima of  $\lambda_2$ . What will be the relation between  $\lambda_1$  and  $\lambda_2$ ?
- Q.3 A laser beam has a power of 50 mw. It was an aperture of  $5 \times 10^{-3}$  m and wavelength 7000 Å. A beam is focused with a lens of focal length 0.2 m. Calculate the area spread and intensity of the image.
- Q.4 An optical fibre has a numerical aperture of 0.2 and cladding refractive index of 1.59. Determine the acceptance angle for the fiber in water which has a refractive index of 1.33.
- Q.5 An electric field of 100 V/M is applied to a sample of n-type semiconductor whose Hall coefficient is  $-0.0125 \text{ m}^2/\text{Coulomb}$ . Determine the current density in the sample assuming mobility of electrons is  $0.36 \text{ m}^2/\text{V/S}$ .
- Q.6 Derive Laplace's and Poisson's equations starting from the differential form of Gauss's Law.
- Q.7 Find the probability that a particle is in one dimensional box of length  $l$  can be found between  $0.45 l$  and  $0.55 l$  for the ground and first excited states.

**PART – C**

[3×10=30]

**(Descriptive/Analytical/Problem Solving/Design Questions)**

**Attempt any three questions**

- Q.1 Describe and explain the formation of Newton's rings in reflected monochromatic light. How can these be used to determine the wavelength of light? Derive the formula used. [6+4=10]
- Q.2 (a) Derive the Schrodinger time dependent equation and explain the physical meaning of wave function  $\psi$ . [8]
- (b) What do you mean by degeneracy? [2]
- Q.3 (a) Discuss the formation of energy bands in solids. [5]
- (b) Classify the solids on the basis of energy bands and discuss the conductivity in semiconductors. [3+2=5]
- Q.4 Derive the formula for curl and divergence for electrostatic field and static magnetic field. [5+5=10]
- Q.5 (a) What is an optical fibre? Obtain an expression for numerical aperture of step index optical fibre. [5]
- (b) Explain visibility of fringes as a measure of coherence. [5]
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