

1E3102

Roll No.

Total No. of Pages: **4****1E3102****B. Tech. I - Sem. (Main/Back/Re-back) Exam., Jan.-2026****1FY2-02 Engineering Physics****Time: 3 Hours****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 questions 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 Why Newton's rings are circular in shape?
- Q.2 Draw intensity distribution curve for a Plane Transmission diffraction grating.
- Q.3 Define degeneracy of energy levels for a free particle in a 3D potential box.
- Q.4 Mention boundary conditions for the Wave function.
- Q.5 What is fractional refractive index change in Optical Fibers?
- Q.6 What are the essential requirements of a laser?

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- Q.7 Mention physical significance of Fermi Dirac distribution function.
- Q.8 Write two differences between Covalent and Metallic bonds.
- Q.9 Prove that divergence of a field is a scalar.
- Q.10 Write one application of Biot-Savart Law?

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

- Q.1 In a Newton's rings experiment, the diameter of the 15th ring was found to be 0.590 cm and that of the 5th ring was 0.336 cm. If the radius of curvature of the Plano convex lens is 200 cm. Calculate the wavelength of light used.
- Q.2 The distance between the first and the sixth minima in the diffraction pattern of a single slit is 0.5 mm. The screen is 0.5 m away from the slit. If the wavelength of light used is 5000 Å, determine the slit width.
- Q.3 Consider a one-dimensional particle which is confined within the region $0 \leq x \leq a$ and whose wave function is $\Psi(x, t) = \sin\left(\frac{\pi x}{a}\right) \exp(-i\omega t)$. Calculate the probability of finding the particle in the interval $\frac{a}{4} \leq x \leq \frac{3a}{4}$.
- Q.4 What is spectral purity? Derive an expression for coherence length and coherence time in term of wavelength and frequency.
- Q.5 Explain, how energy bands are formed in Solids with a suitable example?
- Q.6 The Hall coefficient (RH) of a semiconductor is $3.22 \times 10^{-4} \text{ m}^3 \text{ C}^{-1}$. Its resistivity is $9 \times 10^{-3} \text{ ohm-m}$. Calculate the mobility and carrier concentration of the carriers.
- Q.7 Deduce the Poynting vector and explain the physical significance for various terms involved in the expression.

PART - C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

- Q.1 Draw labelled diagram of Michelson's interferometer and explain its working. How it is used to find the wavelength of light? What is the order of the central fringe?
- Q.2 Derive the Schrödinger time dependent wave equation and also explain the physical significance of wave function.
- Q.3 With the help of neat energy level diagram, explain how population inversion is achieved in He-Ne laser. Explain why increase in diameter of He-Ne tube may reduce lasing frequency?
- Q.4 Derive an expression for the maximum acceptance angle and numerical aperture of an optical fibre. Also, find the fractional refractive index and numerical aperture for an optical fibre with refractive indices of core and cladding as 1.5 and 1.49 respectively.
- Q.5 Deduce the Maxwell's equation for free space and prove that electromagnetic waves are transverse.
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