2E3203

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2E3203

B.Tech. II-Sem. (Main/Back) Examination, May/June - 2025

2FY2-02 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 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).

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory. **(10×2=20)**

1. Discuss Haidinger Fringes.
2. Distinguish between Fresnel's and Fraunhofer's diffraction.
3. What do you mean by Quantum Mechanics?
4. Define wave-particle duality and matter waves.

5. Distinguish between Spatial and Temporal coherence.
6. Define visibility as a measure of coherence and spectral purity.
7. Define population inversion and pumping of laser.
8. What do you mean by intrinsic and extrinsic semiconductors?
9. Write the differential form of Maxwell equations.
10. Give the importance of displacement current.

PART - B

(Analytical / Problem Solving Questions)

Attempt any Five questions. **(5×4=20)**

1. A plane transmission grating produces an angular separation of 0.01 radian between two wavelengths observed at an angle of 30°. If the mean value of the wavelength is 5000A° and the spectrum is observed in the second order, calculate the difference in the two wavelengths.

2. The hall voltage for the sodium metal is 0.001 mV, measured at $I = 100$ mA, $B = 2$ Tesla, the width of the specimen = 0.05 mm and $\sigma = 2.09 \times 10^{7}\ \Omega^{-1}m^{-1}$. (a) calculate the number of carriers per cubic meter in sodium and (b) calculate the mobility of electrons in sodium.

3. When a thin film of mica of refractive index 1.6 is interposed in the path of one of the interfering beams of the Michelson's interferometer, a shift of 50 fringes of sodium light is observed across the field of view. If the thickness of the air film is 0.02 mm. Calculate the wavelength of the light used.

4. Calculate the value of pointing vector and the amplitude of the electric field if a laser beam of 500W is concentrated using a bust on a cross-section area of 10^{-10} M^2.

   Given $E_0 = 9 \times 10^{-12}$ F/M.

5. White light has wavelengths from 0.4 μm to 0.8 μm. Determine its coherence length, coherence time and Q value.

6. Find the probability that a particle trapped in a box L cm wide can be found between 0.45L and 0.55L for the ground and first excited state.

7. A glass clad fiber is made with core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.0005. Calculate: (a) the cladding index (b) the critical internal reflection angle (c) the external critical acceptance angle (d) the numerical aperture.

PART - C

(Descriptive / Analytical / Problem Solving / Design Questions)

Attempt any Three questions. **(3×10=30)**

1. a) Give a difference between the fringes produced with the help of Newton's rings and Michelson's interferometer. **(3)**

   b) Discuss the formation of Newton's rings by (i) reflected light and (ii) transmitted light. Derive an expression for the diameter of n^{th} dark ring in reflected light. **(7)**

2. a) Describe the construction and working of a semiconductor laser. **(5)**

   b) Define acceptance angle and numerical aperture. Derive their expression. **(5)**

3. a) What is poynting vector? How is the Poynting theorem derived from Maxwell equations? Explain Poynting theorem. **(7)**

   b) Show that the gradient of a scalar function at any point is directed normally to the surface in the scalar field over which the value of the scalar function is constant. **(3)**

4. a) Give physical significance of wave function. Derive time dependent Schrodinger wave equation. **(7)**

   b) Define Hall Effect and Hall Coefficient. **(3)**

5. a) Write down Schrodinger's equation for a particle of mass m trapped in three dimensional box. Solve it for energy Eigen values and Eigen function. **(6)**

   b) Explain Fermi Dirac distribution function and Fermi Energy. **(4)**