

Sub Code: AHT 001

ROLL NO.....

B. Tech. I Semester Examination 2022-23

Branch: Common to All Branch

Engineering Physics

Time: 3 Hrs.

MM: 100

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

1. Answer any four parts of the following.

[5×4=20]

- Explain non-reflecting film.
- What is diffraction of light? Distinguish between Fresnel and Fraunhofer class of diffraction.
- What do you understand by double refraction? Explain optic axis and principal section in calcite crystal
- Explain the concept of Maxwell's displacement current and show how it led to the modification of the Ampere's law.
- Discuss Dual nature of matter wave. Explain de-Broglie concept of matter waves and Heisenberg Uncertainty principle.
- Explain direct and indirect band gap in semiconductors.

2. Solve any four of the following numerical problems.

[5×4=20]

- Calculate the thickness of the thinnest film ($\mu=1.4$) in which interference of violet component ($\lambda = 4000 \text{ \AA}$) of incident light can take place by reflection.
- A plane transmission diffraction grating has 40,000 lines in all with grating element $12.5 \times 10^{-5} \text{ cm}$. Calculate the maximum resolving power for which it can be used in the range of wavelength 5000 \AA .
- Calculate the numerical aperture, acceptance angle and critical angle of the optical fibre if the refractive index of the core is 1.50 and refractive index of the cladding is 1.45.
- The maximum value of field vector \vec{E} of EM-wave in vacuum is 10^3 N/C . Find the maximum value of magnetic induction vector.
- Calculate the energy difference between the ground state and the first excited state for an electron in a one-dimensional rigid box of length 10^{-8} cm .
- 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 $0.36 \text{ m}^2/\text{V/s}$.

3. Answer any two parts of the following.

[10×2=20]

- Discuss the phenomenon of interference of light due to thin films and find the condition of maxima and minima. Show that the interference patterns of reflected and transmitted monochromatic source of light are complementary.
- Describe Fraunhofer diffraction due to single slit and deduce the positions of the maxima and minima. Show that the relative intensities of the successive maxima are nearly

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} : \dots\dots\dots$$

- c) Define specific rotation. Describe the construction and working of Laurent's half shade polarimeter. How would you use it to determine the specific rotation of cane sugar solution?

4. Answer any two parts of the following. [10×2=20]

- a) Discuss the construction and working of He-Ne laser and also explain the term population inversion in laser.
- b) Write down Maxwell's equations and using these equations show that light is transverse in nature and electric and magnetic fields both are perpendicular to each other.
- c) What is Hysteresis curve? Explain residual magnetism and coercive force. Prove that energy dissipated per cycle per c.c of magnetization is μ_0 times of I-H curve.

5. Answer any two parts of the following. [10×2=20]

- a) What is Compton Effect? Derive an expression for Compton shift. Explain the presence of unmodified radiations in it.
- b) Solve the Schrodinger wave equation for a particle in a box and also find an expression for wave function and energy for it.
- c) Explain construction and discuss I-V Characteristics of Photodiode and solar cell.
