[This question paper contains 4 printed pages.]

Your Roll No.....8016

Sr. No. of Question Paper : 4787 **E**

Unique Paper Code : 32511603

Name of the Paper : Photonics

Name of the Course : **B.Sc. (H) Electronics (Core)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.

1. (a) Why is Compensating glass plate needed in Michelson's interferometer?

(b) Distinguish between Fresnel and Fraunhoffer type of diffraction.

(c) Considering the physics of generating light is the same in LED and semiconductor laser, give difference in construction of the two.

P.T.O.

(d) Define Malus Law of Polarization.

(e) Differentiate between step index fiber and graded index fiber. (5×3)

2. (a) What are coherent sources? How can these be obtained?

(b) Describe the construction and working of a Michelson interferometer. Show with necessary theory how this interferometer can be used to measure wavelength of monochromatic light.

(c) For a sodium lamp, the distance traversed by the mirror of a Michelson interferometer between two successive disappearances is 0.289 mm. Calculate the difference in the wavelengths of the D_1 and D_2 lines. Given λ = 5890Å. (4+8+3)

3. (a) Describe a method for the measurement of wavelength of light using Newton's rings. Deduce the necessary formula.

(b) In the Newton's rings arrangement, the diameter of the 5th and 15th rings are 0.336 cm and 0.590 cm respectively. Find the radius of curvature of the plano-convex lens if the wavelength of light used is 5890 Å.

(c) Discuss the phenomenon responsible for the different colors seen on the surface of soap bubble created in air. (8+4+3)

4. (a) Derive an expression for the intensity distribution in single slit Fraunhofer diffraction pattern. Also give the positions of maxima and minima.

(b) Consider the case when slit width $b=8.8 \times 10^{-3}$ cm, separation between the slits $d=7.0 \times 10^{-2}$ cm and $\lambda=6.328 \times 10^{-5}$ cm. How many interference minima will occur between the two diffraction minima on either side of the central maximum?

(c) Calculate the thickness of half-wave plate for light of wavelength 5000 Å, the refractive indices for ordinary and extraordinary rays being 1.544 and 1.553 respectively. (7+5+3)

5. (a) What is a Hologram? Explain the basic principle involved in recording and reconstruction of Hologram.

(b) Derive Einstein Coefficients A and B for an atomic system.

(c) Give the principle of Liquid Crystal Display. What are the advantages of LCD over LED displays? (5+6+4)

P.T.O.

6. (a) Consider a symmetric slab waveguide defined by the refractive index variation

$$n = n_1 \text{ for } |x| < d$$
$$= n_2 \text{ for } |x| > d$$

Derive the eigen value equation for the TE modes.

(b) Calculate minimum entrance angle for optical fiber with following specifications: n_1=1.48, n_2=1.46, and core radius is 50 μm.

(c) What is the difference between single mode fiber and multi-mode fiber? Describe what pulse dispersion is. (8+3+4)

7. (a) A left circularly polarized beam (λ_0=5893 Å) is incident on a quartz crystal (with its optic axis cut parallel to the surface) of thickness 0.025 mm. What will be the state of polarization of the emergent beam? (Assume n_0=1.54425, n_e=1.55336).

(b) What do you understand by double refraction? What are ordinary and extraordinary rays in a uniaxial crystal?

(c) What is Brewster angle? What would be its value for air-glass interface, if the refractive index of glass is 1.55? (7+5+3)