**Your Roll No.** : 150855801)

**Sl. No. of Q. Paper** : 6536     **HC**

Unique Paper Code : 32511603

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

Name of the Paper : Photonics

Semester : VI

*Time : 3 Hours*     *Maximum Marks : 75*

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **FIVE** questions in all.

(c) Question **NO.1** is compulsory.

(d) **Use** of Scientific calculator is allowed.

1. (a) Explain Brewster's law. What would be its value for ait-glass interface, if refractive index of glass is 1.55 ?

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

(c) Find the acceptance cone of the optical fiber with $n_2 = 1.45$ and $\Delta = 0.01$

(d) What is Charged Couple Device (CCD) ? Give any **two** applications.

P.T.O.

(e) Green light of wavelength 5100 A⁰ from narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen is 200 cm away is 2 cm, find the slit separation. $3 \times 5 = 15$

2. (a) In Michelson Interferometer, explain under what conditions will it give circular fringes ? Show how it may be used to measure the wavelength of light ? 7

(b) Light beam from external source falls obliquely on a thin film of an optical medium. Find the expression for the effective path difference between a part of the ray reflected externally at the first surface and the part of the ray which suffers one reflection internally at the other face. 5

(c) Show that a grating with 5000 lines per cm cannot give a spectrum in the fourth or higher order for light of wavelength 5890A⁰. 3

3. (a) What is Threshold Population Inversion ? Find the expression for the threshold population inversion density required for the oscillation of the LASER. 8

(b) Give the principle of Liquid Crystal Display. What are the advantages of LCD over LED displays ? 5

(c) Define Quantum efficiency. 2

**4.** (a) Discuss the phenomenon of superposition of two rectangular simple harmonic vibrations of same period and show how it can be used for the production of linearly, circularly and elliptically polarized light.

7

(b) Explain the phenomenon of double refraction in uniaxial crystals when light is incident normally on it for optic axis perpendicular to the plane of incidence and parallel to the refracting surface.

5

(c) The refractive indices of Quartz for ordinary and extraordinary rays of light of wavelength 5896A° are 1.54 and 1.55 respectively. What should be the thickness of Quarter wave plate ?

3

**5.** (a) What is Hologram ? Explain basic principle involved in recording and reconstruction of Hologram. How it is different from photograph ?

8

(b) What are three basic components of LASER ? What is the significance of each ?

4

(c) In Young's double slit experiment the separation of slits is 0.19 mm and fringe spacing of 0.31 mm, at a distance of one meter from slits. Find the wavelength of light.

3

3

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

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

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

Derive the eigen value equation for the TE modes. 8

(b) Calculate minimum entrance angle for optical fiber with following specifications :

$n_1 = 1.48$, $n_2 = 1.46$, and core radius is 50 $\mu$m

3

(c) What is the difference between single mode fiber and multimode fiber ?

4

**7.** (a) Explain with necessary theory how circular rings are obtained in Newton's Ring method ? Also explain how it is used for measuring wavelength of light ? 7

(b) What is meant by resolving power of the optical instruments ? Explain Rayleigh's criterion for resolution and obtain an expression for the resolving power of Telescope. 5

(c) Deduce the missing order for double slit diffraction pattern, if the slit width is 0.16 mm and the slits are 0.8 mm apart. 3

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