This question paper contains **4** printed pages]

**Roll No.** | | | | | | | | | | |

S. No. of Question Paper : **6481**

Unique Paper Code : **251604** **D**

Name of the Paper : **Optics and Optical Electronics (ELHT 603)**

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

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Attempt *Five* questions in all.

Question No. **1** is compulsory.

Each question is of **15** marks.

1. Attempt any *five* parts :

   (*a*) Write the wave equation for plane electromagnetic wave as well as spherical electromagnetic wave, in homogenous medium.

   (*b*) In a typical Michelson interferometer arrangement, a total of 1000 fringes are formed. What is the order of centermost fringe ? What is the use of compensating glass in this interferometer ?

P.T.O.

(*c*) Draw the intensity distribution corresponding to a 5 slit Fraunhofer diffraction pattern, indicating the Principal maxima, secondary maxima and number of minima between two consecutive Principal maxima.

(*d*) Define Malus law. If a linearly polarised (LP) light is passed through a rotating polarizer, and its output intensity noted as a function of angle of rotation of polarizer, then draw, how the plot of output intensity variation *vs.* angle will look like.

(*e*) Write *three* differences between LED and Photo Diode (PD) emphasizing on :

(*i*) Principle used

(*ii*) Band structure

(*iii*) Material used

(*f*) What is the difference between p-n, p-i-n, and avalanche photo diodes ? Which one is used for fiber optics communication and why ? 3×5=15

2. (*a*) A soap bubble is created in air. Different colours are seen on its surface. In this regard, discuss :

(*i*) phenomenon responsible for it.

(*ii*) derive cosine law, *i.e.*, the optical path difference between two successive waves emanating from the film. 5

(*iii*) total phase difference between the two successive waves emanating from the film. 4

(*b*) If the radius of curvature of the convex lens used in Newton ring is 100 cm. then find the radius of first three dark rings for $\lambda = 0.6$ μm. 5

3. (*a*) Fresnel coefficient of reflection for a parallel polarized wave is as follows :

$$r = \frac{\tan(\theta_1 - \theta_2)}{\tan(\theta_1 + \theta_2)}$$

where $\theta_1$, $\theta_2$ are the angles of incidence and reflection respectively. Starting with this information, discuss when will we get a phase change of π upon reflection. Also discuss the condition when coefficient of reflection becomes zero. 7

(*b*) Light of $\lambda = 0.5$ μm is incident normally on a slit of width 0.2 mm. The screen is at a distance 3 m from the slit. Calculate the total width of central maxima. 8

4. (*a*) Derive an expression for intensity distribution in two slit Fraunhofer diffraction pattern. Also plot the variation of intensity on the screen. 8

(*b*) A left circularly polarized beam ($\lambda = 0.5893$ μm) is incident normally on a calcite crystal (with its optic axis cut parallel to the surface) of thickness 0.005141 mm. What will be the state of polarization of the emergent beam ? 7

P.T.O.

5. (*a*) Write *three* differences between chromatic and monochromatic aberrations. 6

(*b*) For a step index fiber, $n_1$, = 1.465 and $n_2$ = 1.45. Find numerical aperture (N.A.) of this fiber. 4

(*c*) Discuss *three* main components of a laser system. 5

6. (*a*) Write the wavelengths of emission of the following laser systems :

(*i*) HeNe laser

(*ii*) Ruby laser

(*iii*) $CO_2$ laser

(*iv*) Nd-YAG laser 4

(*b*) Obtain Einstein coefficients A and B for an atomic system. 6

(*c*) Write a short note on semiconductor lasers. 5