B.Sc. Semester-VI Examination, 2022-23

ELECTRONICS [Honours]

Course ID : 61712 Course Code : SH/ELC/602/C-14(T)

Course Title : Photonics

Time : 1 Hour 15 Minutes Full Marks : 25

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **three** of the following questions: 1×3=3

   a) What will happen to Biprism fringes if angle of Biprism is increased?

   b) What do you mean by coherence?

   c) What is optical rotation?

   d) What is diffraction of light?

   e) Can a sound wave show the phenomenon of polarization?

   f) What are polaroids?

2. Answer any **three** of the following questions: 2×3=6

   a) Why do radio waves diffract around buildings, although light waves do not?

   b) Define refractive index of ordinary and extra ordinary rays.

   c) State and explain Malus's law.

   d) The refractive index for water is 1.33. Calculate the polarizing angle for water.

   e) Differentiate between prismatic and grating spectra.

   f) Why a thick film shows no colors in reflected white light?

3. Answer any **two** of the following questions: 5×2=10

   a) What are Fresnel's half-period zones? Why is it so called? Show that the amplitude at a point infront due to a large wavefront is just half that due to the first half-period zone acting alone. 1+1+3=5

   b) In a two slit Interference pattern with $\lambda = 6000\,\mathring{A}$, the 0th order and the 10th order maxima fall at 12.34 mm and 14.73 mm,

respectively. If λ is changed to $5000\,\mathring{A}$, deduce the positions of 0th order and the 20th order fringes, other arrangements remaining the same. 5

c) Explain the formation of Newton's rings in reflected monochromatic light. Hence, prove that in reflected light, diameters of dark rings are proportional to the square root of natural numbers. 2+3=5

d) How many orders will be observed by a grating having 4000 lines per cm if it is illuminated by visible light in the range $4000\,\text{Å}$ to $7000\,\text{Å}$? 5

4. Answer any **one** of the following: 6×1=6

a) Explain how light is guided by an optical fibre. Define acceptance angle and numerical aperture. How are they related to the refractive indices of the core and the cladding? 2+2+2=6

b) Calculate the displacement of the fringes when a thin transparent lamina is introduced in the path of one of the interfering beams in Biprism. Show how this method is used for finding the thickness of a mica plate. 5+1=6

c) What do you mean by quarter-wave plate and half-wave plate? If a quarter-wave plate and a half-wave plate be given to you, how would you distinguish them from each other? 2+4=6

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