

B.Sc. 6th Semester (Honours) Examination, 2021

Subject: Electronics (H)

Course ID: 61712

Course Code: SH/ELC/602/C-14(TH)

Course Title: Photonics

Full Marks: 25

Time: 1 Hr 15 Min

*(The figures in the right hand side margin indicate marks. Answer all the questions.
Candidates are required to give their answers in their own words as far as possible)*

1. Answer *any three* of the following: 1×3= 3
 - (a) What is temporal coherence?
 - (b) What is total internal reflection?
 - (c) Why an extended source of light is essential to observe colours in thin films?
 - (d) What do you mean by resolving power of an optical instrument?
 - (e) What is holography?
 - (f) What is anti-reflecting film?

2. Answer *any three* of the following: 2×3=6
 - (a) 'There is no violation of the law of conservation of energy in the phenomenon of interference' - Explain.
 - (b) What are uniaxial and biaxial crystals? Give one example of each.
 - (c) Mention the difference between interference and diffraction of light.
 - (d) How can you convert a left handed circularly polarized light into right handed circularly polarized light?
 - (e) What do mean by 'fringes of equal thickness' and 'fringes of equal inclination'?
 - (f) What do you mean by single-mode and multi-mode fibers?

3. Answer *any two* of the following: 5×2=10
 - (a) Find an expression for the intensity of Fraunhofer diffraction pattern due to a single slit. State the condition for maxima and minima. Give a graphical plot of the intensity distribution. 2+2+1=5
 - (b) Describe the construction and working of Nicol's prism. What do you mean by parallel and crossed Nicols? 3+2=5
 - (c) What is quarter wave plate? How can it be used to produce circularly polarized and elliptically polarized light? 1+2+2=5
 - (d) With the help of a neat diagram, explain the construction and working of an LED? What are the materials used for constructing LED? 4+1=5

4. Answer *any one* of the following:

6×1=6

(a) Explain with necessary theory how you can determine the refractive index of a liquid by means of Newton's rings. If on introducing a liquid between the lens and the plate, the diameter of 7th dark ring is found to decrease by 0.54 mm, find the refractive index of the liquid inserted if radius of curvature of the lens is 1 m and wavelength of light used is 600 nm.

4+2=6

(b) Define acceptance angle and numerical aperture of an optical fibre. How are they related to the refractive indices of the core and the cladding?

2+4=6

(c) Describe the state of polarization of the wave represented by

$$\vec{E}(z,t) = \hat{i} E_0 \cos\left(\omega t - kz + \frac{\pi}{2}\right) + \hat{j} E_0 \cos(\omega t - kz).$$