

Sl. No. of Ques. Paper : 1494

F-7

Unique Paper Code : 2511702

Name of Paper : Photonics (EL-DC-I-702)

Name of Course : B.Tech. Electronics

Semester : VII

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.

1. Attempt any five questions:

- (a) Find an expression for resultant intensity at a point due to interference between two light waves of equal intensity I having phase difference δ .
- (b) What is the effective index of refraction in an optical waveguide?
- (c) What should be minimum number of lines in a grating, which will just resolve two yellow lines in the second order spectrum?
- (d) What is population inversion? How is it achieved?
- (e) If a plane polarised beam is incident on quarter wave plate, what is the state of polarization of emergent beam? 5×3

2. (a) Describe the construction and working of Michelson interferometer. How can this interferometer be used to find wavelength of monochromatic light? 8
- (b) In Newton's rings arrangement, the diameters of the 5th and 15th rings are 0.336 cm and 0.590 cm respectively. Find the radius of the curvature of the plano-convex lens if the wavelength of light used is 5890 Å. 4
- (c) What are non-reflecting film coatings? Explain the phenomena involved. 3

3. (a) Derive an expression for the intensity distribution in two slit Fraunhofer diffraction pattern. Also plot the variation of intensity on the screen. 8
- (b) Consider a plane wave incident normally on a long narrow slit of width 0.02 cm. The Fraunhofer diffraction pattern is observed on the focal plane of a lens whose focal length is 20 cm. Assuming $\lambda = 6000 \text{ Å}$, determine the positions of 1st and 2nd minima. 4
- (c) What is Rayleigh criterion for the resolution of two spectral lines? 3

4. (a) What do you understand by elliptically polarized light, how can it be produced? How would you distinguish between partially polarized and elliptically polarized light? 7
- (b) Explain the phenomena of double refraction in a calcite crystal. Compare the properties of O and E rays. 5
- (c) The refractive indices of quartz for ordinary and extraordinary rays of light of wavelength 5896 Å are 1.54 and 1.55, respectively. What should be the thickness of a quarter wave plate? 3

5. (a) What are Einstein's A and B coefficients? Derive expressions for both of them. 7
 (b) What do you understand by holography? Explain the production of a hologram and its importance. 5
 (c) Calculate the cavity lifetime (t_c) in the case of He-Ne laser with the help of following data:
 $d = 40$ cm, $n_0 = 1$, $R_1 = 0.999$, $R_2 = 0.980$, $\alpha_1 = 1$, $c = 3 \times 10^{10}$ cm/s
 where symbols have their usual meaning. 3
6. (a) Explain TE mode in symmetric step index waveguide. On what factors does the number of modes supported in a waveguide depend? 8
 (b) For a typical optical fiber, $n_2 = 1.458$ and $\Delta = 0.01$. Find N.A. and thus the angle of acceptance of the light incident on the fiber. 3
 (c) What do you understand by dispersion in an optical fibre? 4
7. Write short notes on any *two* of the following:
 (a) Light Emitting Diode
 (b) Semiconductor Laser
 (c) Liquid Crystal Display. 7.5×2