[This question paper contains 4 printed pages]

Your Roll No. : ....

Sl. No. of Q. Paper : 6134   F-9

Unique Paper Code : 2511702

Name of the Course : **B.Tech.Electronics**

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

Semester : VII

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 **FIVE** questions in **all**. Question **NO.1** is compulsory.

1. Attempt any **five** questions: 5×3=15

   (a) Two coherent sources whose intensity ratio is 64: I, produce interference fringes. Deduce the ratio of maximum and minimum intensity.

   (b) Two Nicol prisms are oriented with their principal planes making an angle of 60°. What percentage of initial unpolarised light will pass through the system ?

P.T.O.

(c) What is Numerical aperture?

(d) What should be the band gap range for visible region LED). Which material can be used ?

(e) What do you understand by missing order with reference to diffraction ?

2. (a) What are Newton's rings and how are they formed? Explain Newton's ring method for measuring the wavelength of light. Why are Newton's rings circular ?   7

(b) Discuss the phenomenon responsible for different colours seen on the surface of soap bubble created in air. Derive cosine law, i.e., the optical path difference between two successive waves emanating from the film.   5

(c) Why is a compensating glass plate used in Michelson interferometer ?

3. (a) Derive an expression for the intensity distribution in single slit Fraunhofer diffraction pattern. Also give the positions of maxima and minima.   7

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(b) In a double slit Fraunhofer pattern with slit width $b = 8.8 \times 10^{-3}$ cm, separation between the slits $d = 7.0 \times 10^{-2}$ cm and wavelength of light is $6328 A^0$. How many interference minima will occur between the two diffraction minima on either side of the central maxima ?   5

(c) What is the highest order spectrum, which may be seen with monochromatic light of wavelength $5000 A^0$ by means of a diffraction grating with 5000 lines/cm.

   3

4. (a) What do you understand by plane polarized, circularly polarized and elliptically polarized light ? Explain two methods of producing plane polarized light.   7

(b) What is a Quarter wave plate ? Deduce its thickness for a given wavelength in terms of its refractive indices.   4

(c) If the plane of vibration of the incident beam makes an angle of 30^0 with the optic axis, compare the intensities of extraordinary and ordinary light.   4

5. (a) Derive an expression for threshold population inversion required for the action of a laser system.   7

(b) Explain the construction and working of semiconductor laser diode. 5

(c) What is lineshape function ? What is its significance ? 3

6. (a) What is pulse dispersion in an optical fibre ? How can it be reduced ? 5

(b) What do you understand by modes in a step index dielectric waveguide.

For a single mode dielectric waveguide, what should be the thickness of the dielectric film if wavelength of light used is $1.5\,\mu m$, n_1 1.5 and $n_2 = 1.48$. How many modes it will support if wavelength is reduced to $0.6\,\mu m$. 7

(c) Show that phase velocity of bound modes in an optical fibre lies between phase velocity of two bulk materials. 3

7. Write short note on any **two** of the following : 7.5×2=⬤

(a) He-Ne Laser

(b) Holography

(c) Uniaxial doubly refracting crystal

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