Sl-No. 07 9-P : 5676 26/5

Unique Paper Code	:	251604
Name of the Paper	:	Optics & Optoelectronics
Name of the Course	:	B.Sc. (H) Electronics ~~VI Semester~~
Semester	:	VI
Duration	:	3 Hours
Maximum Marks	:	75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt FIVE Questions in all
3. Question 1 is compulsory.
4. Use of Scientific Calculator is allowed

Q.1

a) Explain the role of compensating plate in Michelson Interferometer. Why is it essential for white light? 3

b) If the light intensity increases by 25% after a round trip, through a gain medium of 0.3m long, calculate the small signal gain coefficient. 3

c) What is Rayleigh's criteria of resolution? On what factors does the resolving power of a grating depend? 3

d) Calculate the thickness of quarter-wave plate for light of wavelength 5896 Å, ~~The refractive indices for~~ ordinary and extraordinary ~~rays being~~ 1.54 and 1.55 respectively. 3 refractive indices are

e) How ~~we can~~ can we obtain a three dimensional image of an object. Give the underlying principle. 3

Q.2

a) Explain with necessary theory the Newton's Ring method of measuring the wavelength of light. 5

b) When a thin sheet of transparent material of thickness 6.3×10^{-4} cm is introduced in path of one of the interfering beams, the central fringe shifts to a position occupied by the sixth fringe. If wavelength of light used is 5460Å°, find the refractive index of the sheet. 3

c) For a Fabry Perot Interferometer, derive the expression for coefficient of Finess and also determine the FWHM. 7

Q.3

a) Describe and explain the Fraunhofer Diffraction due to a plain transmission grating. What particular spectra would be absent if the width of transparencies is same as opacities? 7

b) Show that if a white light source is used, then 2nd order and 3rd order spectra will overlap in a diffraction grating of 15000 lines/inch. 5

c) Derive the expression for the width of the principal maxima of the transmission grating. 3

Q.4

a) Describe two methods of producing plane polarized light. How can plane polarized light be converted into elliptically and circularly polarized light? 7

b) A left circularly polarized beam (λ=0.5893μm) 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? (Assume $n_o = 1.65836$, $n_e = 1.48641$) 4

c) What is Brewster's Law? A ray of light is incident on surface of a glass plate of refracting index 1.5 at the polarizing angle. What is the angle of refraction? 4

Q.5

a) What is meant by chromatic aberration and achromatic doublet? Deduce the condition for achromatic combination of two lenses separated by a distance "d". 7

b) Draw a ray diagram showing image formation in Huygen's eye piece. 5

c) What do you understand by Quantum efficiency and Responsivity? 3

Q.6

a) What is threshold population Inversion? Derive the expression for the threshold population inversion density required for the oscillation of the Laser. 6

b) In a typical He-Ne Laser, with following parameters, 6

Wavelength = 6328 A°

Reflectivities of the mirror is $R_1 = R_2 = 0.98$

Length of the Resonator d = 10 cm

Spontaneous lifetime = 10^{-7} Sec

Line Broadening ($\Delta\omega$) = 10^9 Hz

Assuming the medium to be air (n_o =1) and average loss per unit length (α_1) due to all loss mechanism is Zero.

Calculate passive Cavity life time t_c , and $(N_2 - N_1)_{th}$

c) For a Laser system derive a relation between the two Einstein's coefficients. 3

Q.7

a) How can Coherent sources be obtained in practice? Explain how the wavelength of light can be determined using Fresnel Biprism. 7

b) Distinguish between a positive and negative crystal. 4

c) For a typical optical fiber, $n_2 = 1.458$ and $\Delta = 0.01$. Find the N.A and thus the angle of acceptance of the light incident on the fiber. 4