LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FIFTH SEMESTER – **NOVEMBER 2024**

UPH 5503 – OPTICS

Date: 14-11-2024 Dept. No. Max. : 100 Marks

Time: 09:00 am-12:00 pm

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**MCQ**	
a)	The determinant of refraction matrix is (a) 0 (b) 1 (c) -1 (d) >1	
b)	The dispersive power is independent of (a) Angle of prism (b) Angular dispersion (c) Angle of incident (d) Both (a) and (c)	
c)	Which of the following is the path difference for destructive interference? (a) n (λ+ 1) (b) nλ (c) (2n+1) λ/2 (d) (2n-1) λ/2	
d)	When ordinary light is made incident on a quarter wave plate, the emergent light is (a) unpolarised (b) circularly polarised (c) elliptically polarised (d) linearly polarised	
e)	A laser beam is used for locating distant objects because (a) It has high intensity (b) It is monochromatic (c) It is not observed (d) It has small angular spread	
2.	**Fill in the blanks**	
a)	The failure of lens to bring all rays from a point object to focus at the same point is the cause for both----------	
b)	In a system matrix the constants a, b, c and d are known as----------	
c)	A plane in which vibration of polarised light are confined is called----------	
d)	The colours seen in the reflected white light from thin oil film are due to----------	
e)	Nd: YAG laser is a ----------level solid state laser.	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**True or False**	
a)	Chromatic aberration cannot be removed completely.	
b)	The interference fringes which are produced by Lloyd's mirror, the central fringe is bright	

	whereas in case of biprism, it is dark.
c)	Observation of Fraunhoffer diffraction phenomenon does not require any lenses.

d)	The polarised light ray which does not obey Snell's law of refraction is known as an ordinary ray.	
e)	Population inversion is required for producing stimulated emission	
4.	**Match the following**	
a)	Plano- convex lenses	– Coherent source
b)	Double refraction	– Semiconductor diode laser
c)	Interference	– diopter
d)	Power of lens	– Uniaxial crystal
e)	S. N Hall	– Spherical aberration

SECTION B - K3 (CO2)

Answer any TWO of the following in 100 words each. (2 x 10 = 20)

5.	What is a spherical aberration? How can this be minimized in the case of (i) an ordinary lens and (ii) two thin lenses of same medium when placed at a distance apart.
6.	Discuss the diffraction pattern formed by a straight edge. How does this pattern differ from a straight wire?
7.	Explain the phenomenon of interference for the transmitted light beam from an air film placed between two plane plates. What are the factors which determine the sharpness of these fringes?
8.	What is a quarter wave plate? How would you distinguish between (i) circularly and unpolarized light (ii) partially polarised and elliptically polarised light.

SECTION C – K4 (CO3)

Answer any TWO of the following in 100 words each. (2 x 10 = 20)

9.	Describe an experimental arrangement for obtaining achromatic fringes, with necessary diagram.
10.	Explain the theory of a plane transmission grating and show how would you use it to find the wavelength of light?
11.	Elaborate the phenomenon of double refraction in uniaxial crystal. How is double refraction explained by Huygens's theory?
12.	For atomic transitions, derive Einstein's relations and hence deduce the expression for the ratio of spontaneous emission rate to the stimulated emission rate.

SECTION D – K5 (CO4)

Answer any ONE of the following in 250 words (1 x 20 = 20)

13.	a) Explain the construction and working of a Fresnel biprism. b) Obtain an expression for resolving power of a telescope.
14.	i) Describe the vibrational modes of CO_2 molecule. ii) With a neat sketch, explain the construction, principle and working of CO_2Laser.

SECTION E – K6 (CO5)

Answer any ONE of the following in 250 words (1 x 20 = 20)

15.	Discuss the phenomenon of Fraunhoffer diffraction at a single slit and show that the relative intensities of successive maxima are nearly $1:\frac{4}{9\pi^2}:\frac{4}{25\pi^2}:\frac{4}{49\pi^2}:\ldots$
16.	Define specific rotation. Describe the construction and working of the Laurentz half shade polarimeter.

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