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

Answer ANY FOUR of the following **4 x 10 = 40 Marks**

1. Analyse the effect of translation and refraction on a light ray passing through a system comprising a translation followed by a refraction at a spherical surface.
2. Derive the lens formula for a thick lens using the matrix method. Compare it with the thin lens formula and discuss the conditions under which the thin lens approximation is valid.
3. Derive the condition for the minima in the Fraunhofer diffraction pattern produced by a single slit of width. Explain how the angular positions of these minima depend on the wavelength of light and the slit width.
4. What is optical activity? Explain Fresnel's theory of optical activity and how it leads to the specific rotation of plane-polarized light in chiral substances.
5. Explain the phenomenon of double refraction in uniaxial crystals. Describe the working principle of a Nicol prism and how it is used to produce polarized light.
6. Differentiate between homo junction and hetero junction semiconductor lasers. Discuss the advantages of hetero junction lasers over homo junction lasers in terms of performance and applications.
7. Describe the conditions required for constructive and destructive interference in thin films due to reflected and transmitted light.
8. Using the matrix approach, derive the overall system matrix for two thin lenses separated by a distance.

SECTION B

Answer ANY THREE of the following **3 x 20 = 60 Marks**

9. Define the dispersive power of a prism. Derive the expression for dispersive power in terms of the refractive indices for different wavelengths. Explain how a combination of prisms can be arranged to produce dispersion without deviation.
10. Compare and contrast Huygen's eyepiece with Ramsden's eyepiece. Discuss the advantages of using Ramsden's eyepiece in optical instruments.
11. Explain the working principle of Michelson's interferometer. How can it be used to determine the wavelength of light and the thickness of a thin transparent sheet? Include relevant equations in your explanation.
12. Derive the condition for the principal maxima in a diffraction grating. Explain Rayleigh's criterion for the resolution power of a telescope or grating and discuss its significance in spectroscopy.
13. State Brewster's law and derive the expression for the Brewster angle. Explain how this principle is utilized to obtain polarized light in optical applications.

14. Describe the principle of total internal reflection in optical fibres. Discuss the characteristics of single-mode and multimode optical fibres, including their applications and limitations.

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