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322305

December 2023

B.Sc. (H) Chemistry – III SEMESTER

Waves & Optics (OPHY–301)

Time : 3 Hours] [Maximum Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any **four** questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of non-programmable simple calculator is allowed.*

PART–A

1. (a) Write difference between longitudinal and transverse waves. (1.5)

   (b) Define the plane progressive waves. (1.5)

   (c) Why is the diffraction phenomenon so common in sound but not in light? (1.5)

   (d) Distinguish between Uniaxial and biaxial crystals. (1.5)

(e) What types of diffraction bands are produced in a single slit? (1.5)

(f) What is grating? Define grating element. (1.5)

(g) Define the Haidinger and Fizeau fringes. (1.5)

(h) Sodium light of wavelength 5890 Å passes through two narrow slits 2 mm apart. The interference pattern is seen at a distance of 1.25 m away from the centre of the slits. Determine the fringe width. (1.5)

(i) What are ordinary and extra-ordinary rays? (1.5)

(j) What is the relation between phase difference and path difference? (1.5)

PART–B

2. (a) Explain phase velocity and group velocity. Derive the relation between phase velocity and group velocity. (10)

(b) Discuss the interference produced in wedge-shaped film and find the conditions of maxima and minima with fringe width. (5)

3. (a) What do you understand by polarization of light? Explain the types of polarization in details. (10)

(b) Define the sound waves. Explain the production of sound waves with its properties. (5)

4. (a) Discuss the formation of Newton's rings by (i) reflected light (ii) transmitted light. Derive an expression for radius of n^{th} dark ring in reflected light. (12)

(b) In a Newton's ring experiment, the diameters of 4^{th} and 12^{th} dark rings are 0.40 cm and 0.70 cm respectively. Deduce the diameter of 20^{th} dark ring. (3)

5. (a) Describe the principle, construction and working of Michelson's interferometer. Explain how you will use if to find the wavelength of monochromatic light. (10)

(b) What are coherent sources? Give the conditions to produce good interference. (5)

6. (a) What is a zone plate and how it is constructed? Derive an expression for its focal length and compare its performance with that of a converging lens. (10)

(b) Explain Stokes treatment of Reflection. (5)

7. (a) Explain the Fraunhofer diffraction for double slit. (10)

(b) Define simple harmonic motion (SHM) and derive the expression for it. (5)

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