

B.Sc. Second Year CBCS Pattern Semester-IV  
**USPHT08 - Physics Paper-II : Optical Physics**

P. Pages : 3

Time : Three Hours



**GUG/W/23/12017**

Max. Marks : 50

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- Notes : 1. All questions are compulsory.  
2. Draw neat labelled diagrams wherever necessary.

**Either:**

1. a) i) Define interference of light. What are the conditions for constructive and destructive interference of light? 3
- ii) Explain interference in thin film. Obtain the conditions for maxima and minima for interference in thin film due to transmitted rays of light. 5
- iii) A parallel beam of light of wavelength  $5890 \text{ \AA}$  is incident on a glass plate having refractive index 1.5. The angle of refraction in the glass plate is  $60^\circ$ . Calculate smallest thickness 't' of glass plate which will appear dark by reflected light. 2

**OR**

- b) a) What is wavefront? Explain different types of wavefront. 2½
- b) Explain the complimentary nature of interference pattern due to reflected and transmitted light in thin film. 2½
- c) Derive the expression for fringe width of interference pattern at wedge shaped thin film. 2½
- d) A bi-prism is placed at a distance of 5cm in front of narrow slit illuminated by sodium light of wavelength  $5890 \text{ \AA}$ . The distance between the two virtual sources is found to be 0.05cm. find the width of the fringes observed in an eyepiece placed at a distance 75 cm. From the bi- prism. 2½

**Either:**

2. a) i) Explain the experimental arrangement to obtain Newton's rings. Show that the diameters of bright rings are proportional to the square root of odd natural numbers. 6
- ii) Derive the expression to determine the wavelength of monochromatic light using Newton's rings. 2
- iii) In a Newton's ring experiment the diameter of the 5<sup>th</sup> ring was 0.336 cm. and diameter of 15<sup>th</sup> ring was 0.59 cm. If the radius of curvature of planoconvex lens is equal to 100 cm. Find the wavelength of light used. 2

**OR**

- b) a) Draw the experimental arrangement of Michelson's interferometer and explain its construction. 2½
- b) How do you determine refractive index of the thin film using Michelson's interferometer? 2½
- c) Discuss the application of Newton's rings to determine refractive index of a liquid. 2½
- d) When the movable mirror of Michelson interferometer is moved by 58.90m, a shift of 200 fringes is observed. What is the wavelength of light used? 2½

**Either:**

3. a) i) Define diffraction. 1
- ii) Explain Fraunhofer diffraction at single slit and obtain expression for position of central maxima, secondary maxima and minima. 6
- iii) In an arrangement for Fraunhofer diffraction we use a slit of width 0.2 mm and first minimum is at 5mm on either side of central maxima. If the distance between the lens and the screen is 2m, calculate the wavelength of light. 3

**OR**

- b) a) Explain Fresnel's half period zones and show that the width of the zone decreases from first to the outer zone. 2½
- b) What is zone plate? How it is constructed? 2½
- c) Explain the determination of wavelength of light by using plane transmission grating. 2½
- d) A plane diffraction grating has 15000 lines per inch. Find the wavelength of a monochromatic light used if the first order principal maxima is obtained at an angle 20°. 2½

**Either:**

4. a) i) What is polarization of light? 1
- ii) Explain construction and working of Nicol prism. 5
- iii) How Nicol prism is used as analyser? 2
- iv) Calculate the thickness of doubly refracting crystal to have a path difference of  $\frac{\lambda}{2}$  between ordinary ray and extraordinary ray when  $\lambda = 6000 \text{ \AA}$ ,  $\mu_o = 1.65$  and  $\mu_e = 1.48$ . 2
- b) a) Obtain an expression for thickness of quarter waveplate. 2½
- b) State and prove Brewster's law. 2½

- c) Explain Nicol prism used as analyser of plane polarized light. 2½
- d) Calculate the thickness of doubly refracting crystal required to introduce a path difference of  $\frac{\lambda}{2}$  between the o-ray and e-ray. When  $\lambda = 6000 \text{ \AA}$ . 2½

5. Solve **any ten** of the following.

- a) What is coherent source of light? 1
- b) Define wavefront. 1
- c) What is wedge shape thin film? 1
- d) Why the center of Newton's rings dark in reflected light? 1
- e) What happen if we replace mono-chromatic light with white light in Newton's ring experiment? 1
- f) What are applications on Michelson's interferometer? 1
- g) What is zone plate? 1
- h) What is grating element? 1
- i) Distinguish between interference and diffraction. 1
- j) What is optical axis? 1
- k) What is double refraction? 1
- l) What is phase retardation plate? 1

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