

B.Sc. S.Y. (CBCS Pattern) Semester - IV  
**USPHT08 - Physics Paper-II (Optical Physics)**

P. Pages : 3

Time : Three Hours



**GUG/S/23/12017**

Max. Marks : 50

- Notes :
1. All questions are compulsory and carry equal marks.
  2. Draw well labelled diagram wherever necessary.

**Either**

1. a) i) State the condition for obtaining steady interference pattern. 2
- ii) Explain the phenomenon of interference in thin film and obtain the condition for constructive and destructive 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 thin glass plate of refractive index 1.5 to that angle of refraction into the glass plate in  $60^\circ$ . Calculate smallest thickness of glass plate which will appear dark. 3

**OR**

- b) 1) Derive an expression for fringe width for interference fringes at wedge shaped film. 2½
- 2) Describe an experiment to determine the wavelength of monochromatic light with Biprism. 2½
- 3) What is the need of extended source of light for observing colours in thin film. 2½
- 4) Two narrow and parallel slits 0.1 cm apart are illuminated with a monochromatic light of wavelength 589.3nm. The interference pattern is observed at a distance of 25 cm from the slits. Calculate the fringe width. 2½

**Either**

2. a) i) Explain the experimental arrangement to obtain Newton's rings. Show that the diameter of bright rings are directly proportional to the square roots of odd natural numbers. 6
- ii) How can you determine the unknown wavelength of monochromatic light by using Newton's ring. 2
- iii) In the Newton's ring experiment using reflected light, the diameter of 5<sup>th</sup> ring is 0.336cm and that of the 15<sup>th</sup> ring 0.59cm. If the radius of curvature of lens surface in contact with plane glass is 100 cm, calculate wavelength of light used. 2

**OR**

- b) 1) What is the role of compensating glass plate in Michelson's interferometer. 2½
- 2) Explain how Michelson interferometer can be used to find the refractive index of thin transparent film. 2½

- 3) Explain the term, visibility of fringes. 2½
- 4) In the Michelson's interferometer, the position of mirror  $M_1$  for two consecutive maximum visibility were 0.6939 mm and 0.9884 mm. If the mean wavelengths of sodium light is  $5893\text{\AA}$ . Calculate the difference between the wavelengths for  $D_1$  and  $D_2$  lines of sodium. 2½

**Either**

3. a) i) Explain Fraunhofer diffraction due to narrow slit obtain an expression for the intensity at various points on the screen. 6
- ii) Explain the difference between single slit and double slit diffraction. 2
- iii) In Fraunhofer diffraction pattern due to a single slit a screen is placed 2m away from the lens to obtain the pattern. If the slit width 0.2mm and the first minima lie 5mm on either sides of the central maximum. Find the wavelength of light. 2

**OR**

- b) 1) Distinguish between Fresnel and Fraunhofer diffraction. 2½
- 2) What is zone plate? Describe the construction of Zone plate. 2½
- 3) State the difference between a zone plate and convex lens. 2½
- 4) Find the radius of first two zones of a zone plate behaving like a convex lens of focal length 0.2m for a light of wavelength  $5000\text{\AA}$ . 2½

**Either**

4. a) i) What is polarization ? Define the term plane of polarization and plane of vibration. 3
- ii) Explain construction and working of Nicol prism to obtain polarized light. 5
- iii) The refractive index of ordinary and extraordinary ray are 1.640 and 1.650 respectively. The thickness of the half wave plate is  $1.2 \times 10^{-3}\text{cm}$ . Calculate the wavelength of light used. 2

**OR**

- b) 1) How Nicol prism used as analyser of plane polarized light. 2½
- 2) Explain how quarter wave plate can be used to produce elliptically polarized light. 2½
- 3) State and prove Brewster's law. 2½
- 4) A ray of light is incident on glass plate of refractive index 1.732 at a polarizing angle. Find the angle of incidence and angle of refraction. 2½

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

- |   |   |
|---|---|
| a) Define wavefront.  | 1 |
| b) What is the relation between path difference and phase difference?                                   | 1 |
| c) What are coherent sources?   | 1 |
| d) Why the centre of Newton's rings appears dark in reflected light.                                    | 1 |
| e) What is interferometer?  | 1 |
| f) What will happen, if the plane glass plate is replaced by plane mirror in Newton's rings experiment? | 1 |
| g) What is diffraction of light?  | 1 |
| h) What is plane transmission grating?  | 1 |
| i) What is grating element?   | 1 |
| j) What do you mean by polarization of light?   | 1 |
| k) Write the relation between refractive index and angle of polarization.                               | 1 |
| l) What is quarter wave plate?  | 1 |

\*\*\*\*\*

