Bachelor level/ B.Sc / 5th Semester   Full Marks : 100
Time: 3 hrs   Pass Marks : 50
Subject : Optics (PHY 451)

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Group – A

1. **Answer in short any EIGHT questions**   [2x8 = 16]
   a. What are the common defects in the images produced by a single lens? How can these defects be removed?
   b. Define Abbe's sine conditions.
   c. What is refractive index? Write about the anti-reflecting coatings.
   d. The central fringe produced byLloyod's single mirror is black why?
   e. Write any three properties of hologram.
   f. When a beam of light is polarized, does its intensity vary?
   g. Define dispersion of light and angular dispersion of light.
   h. Can we obtain interference pattern if two coherent sources are separated by a distance less than a wavelength of light?
   i. What is the shape of interference fringes obtained with Michelson's interferometer?
   j. What is a Nicol prism? How can it be used as a polarizer or as an analyzer?

Group – B

2. **Answer any SIX questions**   [6x6= 36]
   a. What is an eyepiece? Explain with a neat diagram the construction and working of Ramsden eyepiece and compare it with a Huygens eyepieces.
   b. What is interference of light? How will you determine the wavelength of light using Fresnel' biprism?
   c. What is the fundamental principle of hologram? How it is produced and how is the image reconstruction from it?
   d. Derive an expression $\frac{\lambda}{d\lambda} = t \frac{d\mu}{d\lambda}$ for resolving power of prism.
   e. State and derive Brewster's law. What does the law become when the rays of light travel from denser to rarer medium?
   f. What is the plane diffraction grating? Derive and express for half angular width of principle maxima in a diffraction grating.
   g. Discuss the phenomena of diffraction at a circular aperture.

Group – C

3. What do understand by plane, elliptically and circularly polarized lights? Explain with necessary theory, how to obtain these polarized lights?   [3+6]

4. What is zone plate? Derive an expression for its focal length. Show that a zone plate has multiple foci.[9]

OR

Describe the construction of Michelson's interferometer and explain its working. Discuss the important applications of interferometer.

5. Calculate the minimum plate separation in a Fabry-Perot interferometer to obtain a free spectral range of $0.05A^o$ in the wavelength region $5000A^o$. Calculate also the smallest resolvable wavelength difference for a reflectivity of 0.95.   [6]

6. A zone plate has focal length 50 cm at a wavelength 6000A°. What will be its focal length at $\lambda = 5000A°$.   [6]

7. Interference fringes are produced by monochromatic light falling normally on a wedge shaped film of cellophane of refractive index. 1.40.if the angle of the wedge is 20 seconds of an arc and the distance between successive fringes is 0.25 cm, calculate the wavelength of light.   [6]

OR

When light is incident at an angle of 60° to the normal, the reflected light is plane polarized. What is the refractive index of the transparent reflecting medium? What is the angle of refraction corresponding to the angle of incidence of 60°?

8. Find the specific rotation of a given sample of sugar solution if the plane of polarization is turned through 26.4°. The length of the tube containing 20% sugar solution is 20cm.   [6]

9. Quartz has refractive indices 1.553 and 1.544. Calculate the thickness of quarter wave plate for sodium light of wavelength 5890A°.   [6]

THE END