

**IV Semester B.Sc. Examination, May/June 2007**  
**(Semester Scheme)**  
**PHYSICS – IV**  
**Acoustics, Optics and Lasers**

Time : 3 Hours

Max. Marks : 60

## PART – A

Answer **any five** of the following questions. **Each** question carries **6** marks :

1. a) What are sound waves ?  
 b) Obtain an expression for the velocity of sound waves in a rod. (1+5)
2. Describe with necessary theory, the Foucault's rotating mirror method of determining the velocity of light. 6
3. a) Explain the concept of Huygen's principle and construction of wavefront.  
 b) What are coherent sources ? How they are obtained using a biprism ? (3+3)
4. What are Newton's rings ? Give the theory of Newton's rings. (1+5)
5. a) Explain the construction of a zone plate.  
 b) Compare a zone plate with a convex lens. (3+3)
6. a) What is resolving power ?  
 b) Obtain an expression for the resolving power of a grating. (2+4)
7. a) Distinguish between elliptically polarised and circularly polarised light.  
 b) Explain the terms "optical activity" and "specific rotation" of a substance. (4+2)
8. Explain the construction and working of Ruby Laser. 6

## PART – B

Answer **any four** of the following questions. **Each** question carries **5** marks :

9. Plane waves of sound of effective pressure 100 Pa travelling in water incident on a sand bottom. The density of sand is  $2000 \text{ kg m}^{-3}$  and speed of sound in sand is  $2000 \text{ ms}^{-1}$ . If the density of water is  $1000 \text{ kg m}^{-3}$  and velocity of sound in water is  $1480 \text{ ms}^{-1}$ , calculate
  - a) The effective pressure of reflected wave back into water and
  - b) The effective pressure of the transmitted wave into the sand.

10. In a biprism experiment interference fringes of width 0.2 mm are observed at 1 m from the slit. The distance between the coherent sources is 3 mm. Calculate the wavelength of light. On placing a thin transparent sheet of refractive index 1.5 in the path of one of the interfering beams the central bright fringe was found to be shifted through a distance equal to width of 10 fringes. Calculate the thickness of transparent sheet.
11. Using sodium light of wavelength  $5893 \text{ \AA}$ , interference fringes are formed from a thin air wedge. When viewed normally 10 fringes are observed in a distance of 1 cm. Calculate the angle of wedge.
12. A narrow slit illuminated with monochromatic light of wavelength  $5893 \text{ \AA}$  is placed at a distance of 0.1 m from a straight edge. If the distance between the straight edge and the screen is 1.9 m, Calculate the distance between the first and fourth dark bands.
13. Light of wavelength  $5000 \text{ \AA}$  is incident normally on a plane transmission grating of width 3 cm and 15000 lines. Find the angle of diffraction in the first order.
14. Plane polarised light passes through a quartz plate with its axis parallel to the faces. Calculate the least thickness of the plate for which the emergent beam will be
  - a) Plane polarised and
  - b) Circularly polarised given  $n_E = 1.553$ ,  $n_O = 1.544$  and  $\lambda = 5000 \text{ \AA}$ .

### PART – C

Answer **any five** of the following questions. **Each** question carries **2** marks :

15. a) If the Kundt's tube is filled with  $\text{CO}_2$  instead of air, what happens to the length of each loop formed in it ? Explain.
  - b) Can sound waves be polarised ? Explain.
  - c) Bubbles of colourless soap solution appear coloured in sunlight. Why ?
  - d) Is the phenomenon of interference of light in accordance with the law of conservation of energy ? Explain.
  - e) It is easy to observe diffraction effect in sound than in light. Justify.
  - f) Does the value of polarising angle depend on colour of light ? Explain.
  - g) Optic axis in a doubly refracting crystal is a direction and not a particular line. Explain.
  - h) If a hologram is broken into fragments, can these fragments give rise to reconstruction of images ? Explain.
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10. In a biprism experiment interference fringes of width 0.2 mm are observed at 1 m from the slit. The distance between the coherent sources is 3 mm. Calculate the wavelength of light. On placing a thin transparent sheet of refractive index 1.5 in the path of one of the interfering beams the central bright fringe was found to be shifted through a distance equal to width of 10 fringes. Calculate the thickness of transparent sheet.
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