2022

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer all questions and fill in the blanks as required. [1 × 8

(a) The achromatic condition for two lenses of focal lengths f_1 and f_2 separated by distance d is _____.

(b) Electromagnetic wave is Transverse or Longitudinal ?

(c) On reflection from a denser medium, path difference introduced is _____.

(d) Fringe width of Young's double slit experiment is directly proportional to the which factor of wave ?

(e) How is the shape of fringes in Michelson interferometer, when two mirrors are exactly perpendicular to each other ?

(f) In single slit Fraunhofer diffraction, the width of central maximum is greatest for which color ?

(g) Can diffraction occur for virtual images ?

(h) What is the phase difference between wavelets from successive half period zone ?

GROUP - B

2. Answer any eight of the following within two or three sentences each. [1½ × 8

(a) What is Fermat's principle of stationary wave ?

(b) Why eye-piece is used in telescope or microscope ?

(c) When the principal points coincide with the nodal points ?

(d) What is the pressure equation of a longitudinal wave ?

(e) Write the differential equation describing wave motion.

(f) State Stroke's law in term of phase change on reflection.

(g) Why the central ring of Newton's ring is dark ?

(h) What happens to fringes when white light is used in Young's double slit experiment ?

(i) What is the expression for resoling power of a telescope ?

(j) Express the focal length of zone plate.

GROUP - C

3. Answer any eight of the following within 75 words each. [2 × 8

(a) What is the role of a compensating plate in the Michelson interferometer ?

(b) Write the differences between Ramseden and Huygen's eye-piece.

(c) Write the differences between principal points and focal points.

(d) Write Cauchy's formula to find refractive index of light in dispersion.

(e) Write the differences between temporal and spatial coherence.

(f) Distinguish between longitudinal and transverse wave.

(g) Explain the differences between Fresnel and Fraunhofer diffraction.

(h) What are Hadinger and Fizeau fringes ?

(i) Compare between Michelson and Fabry Perot interferometer.

(j) Write the comparison between zone plate and convex lens.

GROUP - D

Answer any four questions within 500 words each. [6 × 4

4. Find an expression for the focal length in terms of u and v, using matrix method for a thin lens.

5. Give the construction and working of Huygen's eye-piece with neat diagram.

6. What is a Lissajous figure ? Discuss the formation of Lissajous figures when two SHMs are having frequencies in the ratio 1 : 2.

7. Derive total energy and intensity of progressive wave.

8. Explain the principle and working of Michelson interferometer.

9. Describe Young's double slit experiment of interference of light. Find an expression for fringe width.

10. What is a zone plate ? Derive an expression for its focal length.