Roll No. .....

(011/17-I)

5198

B. Sc. EXAMINATION

(Third Semester)

PHYSICS

PH-302

Wave and Optics-I

Time : Three Hours *Maximum Marks :* 40

Note : Section I is compulsory. Select *one* question from each Section other than Section I.

Section I

1. (a) Why the central point in Lloyd's mirror interference pattern is dark ? 2

   (b) What is necessity of an etalon in standardisation of a meter ? 2

   (c) Is it possible to observe diffraction of light waves using a rectangular obstacle of 1m×1m ? Justify the answer. 2

(d) What is relation between limit of resolution and resolving power ? 2

Section II

2. (a) Explain in detail how fringes are produced with Lloyd's mirror. How are the two coherent sources are produced ? 3

(b) Describe the method to find the distance between two coherent sources in a Fresnel's Biprism. 2

(c) A thin film of reflexive 1.40 for light of 5461 Å is inserted in path of one of the interfering beams. The central fringe shifts through 4 fringes. Find the thickness of the film. 3

3. (a) Describe the construction of a Fresnel's Biprism. Describe the theory to find the wavelength of light. 3

(b) Explain how a phase change of π takes place when a ray of light is reflected from the surface of a denser medium. 3

(c) Explain, why two coherent sources are essential to observe interference. 2

Section III

4. (a) Explain the formation of Newton's rings. Explain, how this phenomenon is used to determine the wavelength of light. Derive the formula. 4

(b) Describe, how colours are produced in thin film ? What is necessity of an extended source of light in observing colours ? 4

5. (a) Describe the construction of working of a Michelson's interferometer. Discuss its use to determine the wavelength of light. 3

(b) Describe construction of an etalon. 2

(c) With a light of $\lambda = 5490\text{Å}$ of the diameter of a bright ring be 0.65 cm and that of 10th bright Newton ring is 0.95 cm. Calculate the radius of curvature of the convex surface of the lens. 3

Section IV

6. (a) Give the theory, working and construction of a zone plate. Show that it behaves like a convex lens with multiple foci. 4

(b) What are half period zones and why so called ? 2

(c) What is difference between Fresnel's class and Fraunhoffer's class of diffraction ? 2

7. (a) Discuss in detail Fresnel's diffraction' at a circular aperture. 5

(b) A monochromatic beam of light on passing through a slit of width 1.6 mm falls on a screen held close to the slit. When screen is 50 cm away from the slit middle of the path of light becomes dark. Calculate the frequency of light used. 3

Section V

8. (a) Discuss theory of Fraunhoffer's diffraction of a large no. N of slits. 4

   (b) How many orders will be visible if frequency of incident light be 6×10^{14} Hz and the no. of lines on grating be 7620 to an inch ? 2

   (c) Derive an expression for dispersive power of a plane transmission grating. 2

9. (a) Describe Rayleigh's criterion for Resolution. Derive an expression for resolving power of a grating. 3

   (b) Give differences between Prism and Grating Spectra. 2

   (c) Sodium light consists of two lines of λ_1 = 5890 Å and λ_2 = 5896 Å. Find the minimum no. of lines on the grating to resolve this doublet in the first order. 3