

West Bengal State University
B.A./B.Sc./B.Com (Honours, Major, General) Examinations, 2015
Part - II

PHYSICS - HONOURS
PAPER - IV-A

Duration : 2 Hours]

[Full Marks : 50

Answer Question No. 1 and any *four* from the rest,
 taking at least *one* from each Group.

1. Answer any *five* of the following : 5 × 2 = 10
- a) Construct the translation matrix under paraxial approximation.
 - b) What is the necessity of having two lenses in an eyepiece ?
 - c) Can two real sources of light act as coherent sources ? Explain.
 - d) What do you mean by a normal spectrum ?
 - e) On what factors does the dispersive power of a grating depend ?
 - f) Does the function $\Psi (x, t) = a (x - vt)$, where a is a constant, represent a travelling wave ? Justify.
 - g) What is negative crystal ? Give example.
 - h) Calculate the coherence length for CO_2 laser whose line width is 1×10^{-5} nm at IR emission wavelength of $10.6 \mu\text{m}$.

Group - A

2.
 - a) State and explain Fermat's principle of least time.
 - b) Using Fermat's principle, derive the laws of reflection of light at a spherical surface.
 - c) Define unit points of a lens system.
 - d) When do principal and nodal points coincide ? 2 + 4 + 2 + 2

3. a) What are lateral and longitudinal spherical aberrations ? What measures may be taken to minimise spherical aberration ? 2 + 2
- b) What kind of achromatism is required in telescopic system ? 2
- c) An achromatic converging combination of focal length 30 cm is formed with a convex lens of crown glass and a concave lens of flint glass placed in contact with each other. Calculate their focal lengths if dispersive power of crown glass is 0.03 and that of flint glass is 0.05. 4
4. a) Find the position of the cardinal points of a Ramsden's eyepiece. Show it on a diagram. 4 + 2
- b) Obtain the system matrix for a system of two thin lenses of focal lengths f_1 and f_2 separated by a distance d in air. 4

Group - B

5. a) Apply Huygens' principle of wave propagation to deduce the laws of reflection from a plane reflector. 4
- b) In an experiment with Fresnel biprism fringes for light of wavelength 5×10^{-5} cm are observed 0.2 mm apart at a distance of 175 cm from the prism. The prism is made of glass of refractive index 1.5 and is 25 cm from the illuminated slit. Calculate the angle at the vertex of the biprism. 3
- c) Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit widths are 0.16 mm and they are 0.88 mm apart. 3
6. a) What is meant by elliptically polarized light ? Show that plane and circularly polarized light are special cases of elliptically polarized light. 2 + 2

- b) Calculate the thickness of half wave plate for sodium light ($\lambda = 5893 \text{ \AA}$), given that $\mu_0 = 1.54$ and ratio of ordinary and extraordinary components is 1.007. Is the crystal positive ? 2 + 1
- c) Explain clearly the difference between interference and diffraction. 3
7. a) Explain the working of a quarter wave plate. How is it used to produce circularly polarised light ? 2 + 2
- b) What is double refraction ? 2
- c) In a Newton's ring experiment the diameter of the 10th ring changes from 1.4 cm to 1.27 cm, when a drop of liquid is introduced between the lens and glass plate. Calculate the refractive index of the liquid. 2
- d) What is double refraction ? 2
-