TKN/KS/16/5826

Bachelor of Science (B.Sc.) Semester-III (C.B.S.) Examination

PHYSICS

Paper—II

(Physical Optics & Electromagnetic Waves)

Time—Three Hours] [Maximum Marks—50

N.B. :— (1) **ALL** questions are compulsory.

(2) Draw neat diagrams wherever necessary.

EITHER

1. (A) Describe the experimental arrangement to obtain Newton's rings. Show that the diameters of dark rings due to reflected light in Newton's ring experiment are proportional to square root of natural numbers. 5

(B) (i) Explain how can unknown wavelength of monochromatic light be determined using Michelson interferometer. 3

(ii) In the Michelson interferometer, the initial and final position of micrometer screw are 10.7347 mm and 10.7047 mm respectively, when 100 fringes passed from the field of view. Find the wavelength of light used. 2

OR

(C) Explain the complementary nature of fringes due to reflected and transmitted light in thin films. 2½

(D) In a Newton's ring experiment diameter of 4^{th} dark ring and 12^{th} dark ring are 0.4 cm and 0.7 cm respectively. If the radius of curvature of plano-convex lens is 200 cm. Calculate the wavelength of light used. 2½

(E) How Fabry-Perot interferometer is used to determine the difference between two closely situated wave lengths ? 2½

(F) What are the advantages of Fabry-Perot interferometer over Michelson interferometer ? 2½

EITHER

2. (A) (i) Explain the construction of Fresnel half period zones and hence obtain an expression for area of half period zone. 3

(ii) The area of a plane wavefront from a monochromatic source of wavelength 6000 Å, is 10 cm^2. Find the area of half period zone and the number of half period zones on the wavefront with respect to a point P situated on a straight line passing through centre and normal to the wavefront. The distance of P from the wavefront is 10 cm. 2

(B) Explain with necessary theory the phenomenon of Fraunhofer's diffraction at a single slit. Find the expression for the width of central maximum. 5

OR

(C) Distinguish between Fresnel and Fraunhofer diffraction. 2½

(D) Obtain an expression for resolving power of grating. 2½

(E) What is the radius of first zone of a zone plate of focal length 0.2 m for the light of wavelength 5000 Å ? 2½

(F) State and explain Rayleigh's criterion of resolution. 2½

EITHER

3. (A) (i) Explain double refraction and state assumptions of Huygen's theory of double refraction. 3

(ii) Find the thickness of a half wave plate for given quantities, λ = 5000 Å, μ_e = 1.536 and μ_o = 1.545. 2

(B) What do you mean by unpolarised and polarised light ? Explain how plane, circularly and elliptically polarised light can be detected. 5

OR

(C) State and prove Brewster's law. 2½

(D) Derive an expression for the minimum thickness of quarter wave plate. 2½

(E) Show that $\frac{d_h}{d_q} = 2$ for positive crystal. Where d_h and d_q are thickness of half wave and quarter wave plate respectively. 2½

(F) Write a short note on Rochön prism. 2½

EITHER

4. (A) (i) Derive an equation of continuity for time varying field. 3

(ii) Determine the solar constant if the average distance between sun and earth is 1.5×10^{11} m and power radiated by sun is 3.8×10^{26} Watt. 2

(B) State the characteristics of electromagnetic waves and show that the electromagnetic waves are transverse in nature. 5

OR

(C) Explain the concept of displacement current. 2½

(D) Discuss the origin of electromagnetic waves. 2½

(E) State and derive Maxwell's equation $\vec{\nabla} \cdot \vec{D} = \rho$. 2½

(F) Find the value of the intensity of the magnetic field in air at a distance 100 cm from a radiating source of power 10 kW. 2½

5. Attempt any **TEN** (**1** mark each) :

(i) What are Haidinger's fringes ?

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

(iii) Calculate the visibility of fringes for a reflection 80% in Fabry-Perot interferometer.

(iv) What is zone plate ?

(v) A light of wavelength 5000 Å is incident normally on a grating having 2500 lines per cm. How many orders will be visible ?

(vi) What is Airy's disc in the diffraction pattern produced by circular aperture ?

(vii) Write any two optical phenomena to produce linearly polarised light.

(viii) Distinguish between positive and negative crystals.

(ix) If the angle between a polariser and analyser is 60º, what will be the intensity of light transmitted having original intensity of incident light I_o ?

(x) State the different types of media.

(xi) State Poynting theorem.

(xii) Define characteristic impedance. 1×10