

2023

Time - 3 hours

Full Marks - 60

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

*Candidates are required to answer
in their own words as far as practicable.*

GROUP – A

1. Answer all questions and fill in blanks as required. [1 × 8]
- (a) The Poynting vector is directed _____ along the direction of propagation of electromagnetic wave.
- (b) $\vec{\nabla} \cdot \vec{B} = 0$ is also known as _____ law in magnetism.
- (c) Name the optical device used for producing and analysing polarised light.
- (d) The electric and magnetic energy densities are _____.
- (e) The reflectance for metals is very _____.
- (f) For perfect dielectric, the value of conductivity is _____.
- (g) In positive crystal, _____ ray travels slower.
- (h) What is specific rotation ?

GROUP – B

2. Answer any eight of the following questions within two to three sentences each.

[1½ × 8

- (a) What is isotropic medium ?
- (b) Define wave impedance.
- (c) What do you mean by skin depth ?
- (d) What is Coulomb gauge ?
- (e) What is plasma frequency ?
- (f) Define electrical conductivity of ionized gases.
- (g) Define critical angle.
- (h) What is transmission co-efficient ?
- (i) What do you mean by double reflection ?
- (j) What is optical rotation ?

GROUP – C

3. Answer any eight of the following questions within 75 words each.

[2 × 8

- (a) Define displacement current.
- (b) Give relation between refractive index and dielectric constant.

- (c) Give the significance of displacement current.
- (d) Give examples of two vector potential.
- (e) What is Gauge transformation ?
- (f) Give physical concept of electromagnetic field energy density.
- (g) How would you distinguish between circularly polarised light and unpolarised light ?
- (h) Why is Brewster's angle known as polarising angle ?
- (i) What are the types of polarised wave ?
- (j) State the factors on which optical rotation depends.

GROUP – D

4. Answer any four of the following questions within 500 words each.
- (a) Prove Maxwell's equation of electromagnetic wave. [6]
 - (b) Show that $R + T = 1$ where R is reflection coefficient, T is transmission coefficient. [6]
 - (c) Explain Fresnel's theory of optical rotation. [6]
 - (d) State and prove Poynting theorem. [6]
 - (e) What is Babinet's compensator ? Give uses. [6]

[4]

- (f) How elliptically polarised light is produced and detected ? [6]
- (g) Discuss the propagation of electromagnetic waves in ionised medium and obtain the expression for plasma frequency and skin depth. [6]