

Total number of printed pages-02

3(Sem-8/FYUGP)BNC(A)/DSCI

2025

PHYSICS

(Discipline Specific Core)

**Paper Name:** Electromagnetic Theory

Paper Code: **PHY-DSC-244**

Full Marks: 45

Time: Two Hours

(The figures in the margin indicate full marks for the questions)

Answer *either* in English *or* in Assamese

1. **Answer the following questions:** **1x4=4**
  - (a) Write the expression for Coulomb gauge.
  - (b) State the S.I. unit of skin depth.
  - (c) What is double refraction ?
  - (d) Define specific rotation.
  
2. **Answer any three from the following questions:** **2x3=6**
  - (a) Differentiate between conduction current and displacement current ?
  - (b) Define Brewster's angle. Why it is called polarizing angle ?
  - (c) What do you mean by positive and negative crystals. Give one example each.
  - (d) Give reasons as to why graded index optical fibre is better than a step index fibre.

**3. Answer any three from the following questions: 5x3=15**

- (a) Deduce inhomogeneous wave equations in terms of scalar and vector potentials.
- (b) Derive the wave equation for electromagnetic wave propagating through a non-conductor. Hence get the expression for velocity of such waves.
- (c) Derive the expression of reflection and transmission coefficient of electromagnetic wave at the boundary between two dielectric media for normal incidence.
- (d) Discuss how Nicol prism can be used for the production and analysis of plane polarized light.
- (e) Discuss Fresnel theory of optical rotation.

**4. Answer any two from the following questions: 10x2=20**

- (a) State and derive Poynting's theorem. Explain the physical meaning of each term on it. 1+6+3=10
- (b) Describe the concept of Laurent's half shade device used in a polarimeter. The angle of rotation of plane of polarisation in a certain substance is  $20^\circ$  per cm. Find the difference in refractive indices for right circularly polarised light in the substance for light of wavelength  $5896 \text{ \AA}$ . 5+5=10
- (c) Derive an expression for numerical aperture of step index fibre. Determine the numerical aperture of a step-index fibre when the core and cladding refractive indices are respectively 1.5 and 1.4. Find the acceptance angle if the fibre is in air. 6+4=10

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