B.Sc. Semester-II

PHYSICS

Course No: 201 (Non-CBCS)

Time Allowed: 3hours Max. Marks: 80

Note: Attempt five questions, selecting at least one from each unit.
All questions carry equal marks.

UNIT-I

1. (a) Define the term divergence of a vector field. Derive an expression for divergence of a vector in Cartesian coordinates. (12)
   (b) Explain the terms:
   (i) Solenoidal vector field (ii) Irrotational vector field (04)

2. (a) State and prove Stokes theorem. (12)
   (b) Prove that $\nabla.(\nabla x\mathbf{A}) = 0$, where **A** is a vector (4)

UNIT-II

3. (a) Show that electric field at a point is equal to negative gradient of potential at that point. (08)
   (b) Derive Poisson's and Laplace's equation for an electric field. Discuss the significance of Laplace's equation. (08)

4. (a) Derive an expression for energy stored per unit volume in a dielectric medium. (12)
   (b) Explain boundary condition for **E** at the interface between two homogenous dielectrics. (04)

UNIT-III

5. (a) State and prove Ampere's circuital law both in integral and differential form. (12)
   (b) Show that $\nabla.\mathbf{B} = 0$ (04)

6. (a) What do you understand by magnetic susceptibility and magnetic permeability? Derive relation between them. (04)
   (b) Derive an expression for magnetic vector potential. (12)

UNIT-IV

7. (a) Derive relation between self and mutual inductance of two coils. (12)
   (b) A solenoid is 0.5m long and has radius 0.01m. If it has 500 turns and is wound on a material of relative permeability 800, calculate the coefficient of self-induction of the solenoid. (04)

8. State and prove Poynting Theorem. (16)

UNIT-V

9. (a) Using Maxwell's equations, derive wave equations satisfied by **E** and **B** in vacuum. (08)
   (b) Prove that electromagnetic waves are transverse in nature. (08)

10. (a) Derive the laws of reflection and refra7ction of e.m. waves in a dielectric medium. (12)
    (b) Explain the term Skin depth. (04)