[This question paper contains 4 printed pages.]

214 *Your Roll No.* .....

B.Sc. Prog. / II **C**

PH-201 – PHYSICS

(Electricity, Magnetism and Electromagnetic Theory)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **five** *questions in all.*
Question No. **1** *is compulsory.*

1. Attempt any **five** :

(a) If u is a scaler field at a point and $\vec{V}$ is a vector field at that point, prove that

$$\vec{\nabla} \times (u\vec{V}) = (\vec{\nabla} u) \times \vec{V} + u(\vec{\nabla} \times \vec{V})$$

(b) What is continuity equation ? Derive it and discuss what does it signify ?

(c) Obtain the relation $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$ where $\vec{D}$, $\vec{E}$ and $\vec{P}$ are electric displacement, electric field intensity and electric polarisation vector respectively.

P.T.O.

(d) Calculator the magnetic field along the axis of along solenoid having 300 turns per meter when current is 10 amperes.

(e) Prove that the charge sensitivity of a ballistic galvanometer is $\frac{2\pi}{T}$ times in current sensitivity.

(f) Show that the divergence of magnetic field vector $\vec{B}$ is zero everywhere.

(g) Define the terms critical angle, numerical aperture and acceptance angle for optical fibre. (3×5)

2. (a) State and prove Gauss theorem related to vector analysis.

(b) Find curl $(\vec{a}\cdot\vec{r})\vec{a}$ where $\vec{a}$ is a constant vector and $\vec{r}$ is a position vector.

(c) Prove that vector $\vec{A} = \frac{\vec{r}}{r}$ is irrotational. (7,4,4)

3. (a) Show that for a conservative field line integral for a closed path is zero.

(b) Deduce the relation $\vec{E} = -\text{grad } V$ between electric field and electric potential.

(c) The potential function at a point is given by $V = x(3y^2 - x^2 + z)$. Find the components of electrostatic field at that point. (5,5,5)

4. (a) Prove $\vec{\nabla} \times \vec{B} = \mu \vec{J}$ where μ_0 is magnetic permeability of free space and $\vec{B}$ and $\vec{J}$ are magnetic field and current density vectors.

(b) Explain what you understand by the term magnetic vector potential ($\vec{A}$). Prove the relation

$$\vec{B} = \text{curl}\,\vec{A}.$$

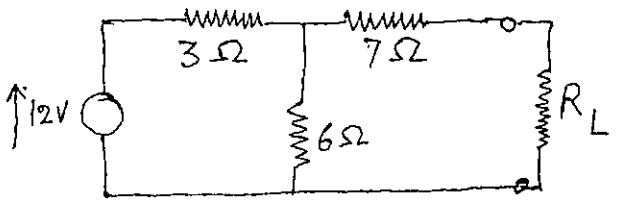
What is meant by solenoidal nature of magnetic field vector $\vec{B}$? (7,8)

5. (a) Write Maxwell's electromagnetic field equations for a dielectric medium and obtain the wave equation for the electric and magnetic fields.

(b) Prove that electromagnetic waves are transverse in nature. (8.7)

6. (a) Describe with relevant theory Anderson's bridge method for finding the self inductance of a coil.

(b) Convert the linear network shown below in to Thevenin's equivalent network. (9,6)



7. Write short notes on any **two** :

(a) Biot-Savart law in magnetostatics

(b) Stokes theorem

(c) Polarisation of electromagnetic waves

(d) Ballistic galvanometer (2×7.5)