Roll No. .....

3001

B. Tech. (ECE) 1st Semester Examination – February, 2022

INTRODUCTION TO ELECTROMAGNETIC THEORY

Paper : BSC-PHY-101-G

Time : Three Hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all and each question carry equal marks. Select only ***one*** question from each unit but 1st question is ***compulsory***.

1. Attempt any ***six*** questions :

(a) Define electric polarization and dielectric constant.

(b) State Biot-Savart's law.

(c) If charge particles of equal value 'q' are placed at each corner of a square of side 'a' in vacuum then find out total electric energy of system.

(d) Define Eddy current and explain its application as electromagnetic breaking.

(e) What do you mean by displacement current and write its expression ?

(f) State Stokes theorem and explain its physical significance.

(g) Define electric dipole and electric dipole moment.

(h) Find out the value of divergence of a position vector $(\vec{r} = x\hat{i} + y\hat{j} + z\hat{k})$ *i.e.* $\vec{\nabla} \cdot \vec{r}$. $(2.5 \times 6 = 15)$

UNIT – I

2. (a) Derive equation of electric energy density in term of electric field intensity. 7

(b) Find out electric field intensity and electric potential at axial line of short electric dipole. 8

3. (a) Derive Poisson and Laplace's equations. 7

(b) Define gauss law and find out electric field intensity at distance 'r' from straight uniform charge wire of infinity length and linear charge density 'λ'. 8

UNIT – II

4. (a) Derive the equation of magnetic vector potential. 7

   (b) Show that $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$ and $\vec{\nabla} \cdot \vec{B} = 0$. 8

5. (a) Derive magnetic field at axial and equatorial line of a bar magnet. 7

   (b) Define magnetic flux density ($\vec{B}$), magnetizing field intensity ($\vec{H}$), intensity of magnetization ($\vec{I}$), magnetic susceptibility (χ_m) and relative permeability (μ_r). Derive the relation between relative permeability (μ_r) and magnetic susceptibility (χ_m). 8

UNIT – III

6. (a) Derive the equation of magnetic energy stored in a magnetic field i.e., $U_m = \frac{1}{2\mu_0} \int B^2 dV$. 7

   (b) State Poynting theorem and derive equation of Poynting vector ($\vec{S}$). 8

7. (a) Derive equation of continuity and show that modified Ampere's law satisfy the equation of continuity. 7

   (b) State Faraday laws in EMI and derive its differential equation. Find out inducede.m.f.in a circular conducting wire of area (A) which is rotating about its diameter with uniform angular speed (ω) in uniform magnetic field (B). 8

P. T. O.

UNIT – IV

8. (a) Derive speed of electromagnetic wave in vacuum. 7

(b) Write properties of electromagnetic waves and show that electromagnetic wave is transverse in nature. 8

9. (a) Show that ratio of electric field intensity to magnetic field intensity is equivalent to speed of electromagnetic wave i.e., $E/B = C$. 7

(b) Prove that pressure exerted by EM wave incident perpendicularly on the highly absorbing surface is ratio of intensity of wave to speed of the wave i.e., $P = I/C$. 8
