

Roll No.

3001

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

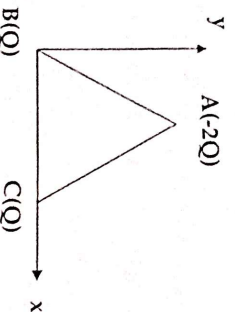
Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Show that potential function $U = x^2 + y^2 - 2z^2$ satisfies Laplace's equation.
- (b) Using Equation $\nabla \cdot \vec{D} = \rho$, Prove that :
$$\vec{F} = \frac{1}{4\pi \epsilon_0} \frac{Qq}{r^2}$$
- (c) Write characteristics of a material to be permanent magnet.

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- (d) What are polar and non-polar dielectrics ? Discuss their behavior in an applied electric field.
- (e) Charges Q , Q and $-2Q$ are placed on the vertices of equilateral ΔABC of sides of length "a" as shown in figure. Find monopole and dipole moment of this system ?



- (f) Define magnetic susceptibility and permeability. Derive the relation between them. $6 \times 2.5 = 15$

UNIT - I

2. (a) Find the potential of a uniformly charged spherical shell of radius R. 8
 (b) Define Gauss Law. Derive Gauss Law in differential form. 7
3. (a) Discuss Boundary condition on electric field and potential. Show how ∇V inherits its discontinuity from \vec{E} . 10
 (b) Find an expression for the energy of a continuous charge distribution. 5

UNIT - II

4. Derive an expression for the torque acting on a current loop when placed in magnetic field. 15

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5. (a) Define surface-bound currents and volume-bound currents. Derive an expression for the field of magnetized object. 10
 (b) Explain ferromagnetism on the basis of Domain-Theory. 5

UNIT - III

6. Derive Maxwell equations for free space. Explain physical significance of each equation. 15
7. Deduce an expression for emf induced in a rectangular conducting coil. What type of current will be produced if push-pull motion is done rapidly ? Explain. 15

UNIT - IV

8. Show that for normal incidence on medium-vacuum interface sum of reflection and transmission coefficient is unity. 15
9. Write characteristics of electromagnetic waves. Derive the expression for wave impedance. Show that field vectors E and H are in same phase during propagation. 15

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