Roll No ....

EX - 302

B.E. III Semester

Examination, December 2012

Electro-Magnetic Theory

Time : Three Hours

Maximum Marks : 70/100

Note: Total number of questions is 10. Attempt one question (including all parts) from each unit. Assume missing data, if any, suitably.

Unit - I

1. a) State and explain Divergence theorem and give its physical significance.

   b) If $D = y^2z^3a_x + 2xyz^3a_y + 3xy^2z^2a_z$ pC/m² in free space (i) Find the total electric flux passing through the surface $x = 3, 0 \le y \le 2, 0 \le z \le 1$ in a direction away from the origin, (ii) Find $|E|$ at $P(3,2,1)$, and (iii) Find the total charge contained in an incremental sphere having a radius of $2\ \mu m$ centered at $P(3,2,1)$.

OR

2. a) Explain method of images with its applications.

   b) Discuss Gauss Law and write down its properties. Explain Gauss Law in point form with its significance.

Unit - II

3. a) Explain Laplace's equations with its physical significance.

   b) A point charge of 6 nC is located at the origin in free space. Find V_p if point P is located at (0.2, -0.4, 0.4) and : (i) V=0 at infinity; (ii) V=0 at (1,0,0); (iii) v=20 Volts at (-0.5,1,-1).

OR

4. a) Derive the conditions at a boundary between two dielectrics having dielectric constants of ε_1 and ε_2.

   b) Find the relative permittivity of the dielectric material used in a parallel plate capacitor if : (i) C = 40 nF, d = 0.1 mm, and S = 0.15 m²; (ii) d=0.2mm, E = 500 kV/m, and $\rho_s = 10\mu C/m^2$; (iii) D = 50$\mu C/m^2$ and the energy density is 20 J/m³.

Unit - III

5. a) Write and explain Ampere's circuital law with its applications. Write down point form of Ampere's circuital law.

   b) Using the Ampere's circuital law, to find the H and B inside a long straight nonmagnetic conductor of radius 8 mm carrying a uniform current density of 100 kA/m². Show that $\nabla \times H = J$.

OR

6. a) Using Biot-Savart Law, derive an expression for inductance per unit length of a long coaxial cable with radii of inner and outer conductors as 'a' and 'b' (b>a) respectively.

b) Derive the formula for force between two long and parallel current carrying conductors.

Unit - IV

7. a) Explain vector magnetic potential and its properties.

   b) Derive Maxwell's equations in harmonically varying field. Give its significance.

OR

8. a) Write down and explain Maxwell's equations in point form and integral form.

   b) Explain and derive the formula for transformer and motional EMF. .

Unit - V

9. a) State Poynting's theorem. How it is derived from Maxwell' Curl equation?

   b) What is meant by Polarization of a wave? When is a wave linearly polarized? When is a wave circularly polarized?

OR

10. a) Explain the phenomena of polarization of wave.

    b) Write a short note on uniform plane wave in dielectrics.

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