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EC–402(GS)

B. E. (Fourth Semester) EXAMINATION, June, 2012

(Grading System)

(Electronics & Communication Engg. Branch)

ELECTROMAGNETIC THEORY

[EC–402(GS)]

Time : Three Hours

Maximum Marks : 70

Minimum Pass Marks : 22 (D Grade)

Note : Attempt all questions. All questions carry equal marks.

1. (a) Point charges Q_1 and Q_2 are respectively located at $(4, 0, -3)$ and $(2, 0, 1)$. If $Q_2 = 4$ nC, find Q_1 such that (i) The $\overline{E}$ at $(5, 0, 6)$ has no z component. (ii) The force on the test charge at $(5, 0, 6)$ has no x component.

   (b) State and prove Stokes theorem.

Or

2. (a) A circular ring of radius 'a' carries a uniform charge ρ_l c/m and is placed on X-Y plane with axis same as z-axis. What are the values of E and H ?

   (b) Using Gauss law find the expression for $\overline{D}$ for uniformly charged sphere.

3. (a) Define Electric dipole and Dipole moment. Derive relations for potential and electric field intensity due to a dipole.

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(b) Use Poisson's equations to find V in the region between two concentric right cylinders containing a uniform charge density ρ.

Or

4. Derive solution of Laplace's equation for the following :
   (i) Cartesian solution in one-dimension (field between two parallel plates)
   (ii) Cylindrical co-ordinates (field between co-axial capacitors)

5. Derive the expressions for magnetic scalar and vector potentials.

Or

6. (a) If plane $z = 0$, carries uniform current $\bar{k} = k_y \hat{a}_y$, obtain the expression for $\overline{H}$ using Ampere's law.
   (b) The X-Y plane serves as an interface between two different media. Derive the magnetic boundary conditions for the two media if :

$$\overline{H}_1 = -20\hat{a}_x + 6\hat{a}_y + 4a_z$$

in the region $y - x - 2 \leq 0$ where $\mu_1 = 5\mu_0$. Calculate $\overline{H}_2$ in the region $y - x - 2 \geq 0$ where $\mu_2 = 2\mu_0$.

7. (a) Derive the expression for displacement current. Explain how it is different than conduction current.
   (b) Derive the Maxwell's equation in differential and integral forms for harmonically varying field.

Or

8. Determine the self-inductance of a coaxial cable of inner radius a and outer radius b.

9. (a) State and prove Poynting vector theorem. Also give the expression for average and complex Poynting vector.

   (b) Explain the term polarisation. Derive the expression for elliptical and circular polarisation.

Or

10. Explain and derive the expression for reflection of plane waves for oblique incidence in free space. Explain both horizontal and vertical polarization.

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