Code: R7 210205

R7

B.Tech II Year I Semester (R07) Supplementary Examinations, May 2012

ELECTROMAGNETIC FIELDS

(Common to EEE and E.Con.E)

Time: 3 hours Max Marks: 80

Answer any FIVE questions

All questions carry equal marks

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1 (a) State and explain coulomb's law in electrostatics.
(b) Two points $Q_1 = 2x10^{-4}$ C, located at (1, 2, 4) and $Q_2 = 2x10^{-4}$ C located at (1, 2, 3) and $Q_3 = -4 \times 10^{-4}$ C located at (2, 0, 6) are situated. Find the vector force F_2 on charge Q_2.

2 (a) Show that the torque on a physical dipole $\overline{P}$ c-m. in a uniform electric field $\overline{E}$ is given by
$\overline{T} = \overline{P} \times \overline{E}$.
(b) Find the potential 'V' at the point (2,3,4) for the field of two co-axial conducting cylinders, given V= 60 V at P = 3 m and V = 10 V at P = 5 m.

3 (a) State and prove the boundary conditions at the dielectric surface.
(b) A condenser in built of two parallel plates each 50 cm^2 in area separated in air by 1mm. If 100 μ J of energy are required to increase the distance between the plates to 3 mm, calculate the initial and final voltages across the plates. Assume perfect insulation.

4 (a) Derive Maxwell second equation div (B) = 0.
(b) A uniform solenoid 100 mm in diameter and 400 mm long has 100 turns of wire and a current of I = 3 A. Find the magnetic field on the axis of the solenoid (i) at the centre (ii) at one end (iii) half way from the centre to one end.

5 (a) Derive the Maxwell's third equation $\nabla \times H = J$.
(b) A steady current of 20 A flow in a filament in the a_z direction on the Z – axis. Also, $3a_3$ (A/m) flow on the infinite cylinder at P = 2 m and $-2.5a_z$ (A/m) be at P = 3 m. Sketch HØ V_s P, 0<P< 5 m.

Contd. in Page 2

Code: R7 210205

R7

6 (a) Define a magnetic dipole. What is the magnetic moment? Describe how a differential current loop behaves like a magnetic dipole.

(b) Evaluate the inductance of a solenoid of 2800 turn wound uniformly over a length 0.6 m on a cylindrical paper tube 4 cm in diameter. The medium in air.

7 (a) Derive the self-inductance of a solenoid.

(b) An iron ring has a mean circumference of 125 cm cross- sectional area of 10 cm^2. It is wound with 500 turns of wire when it carrier 1.5 A, the flux produced in 1 m wb. What is the relative permeability of the iron material and what is the inductance of the system? If a length of 1 mm is removed from the ring, what is the new value of inductance of the system?

8 (a) State and explain the faraday's laws of electromagnetic induction and derive the expression for induced emf.

(b) Find the conduction and displacement current densities in a material having conductivity of 10^{-3} s/m and E_r = 2.5, if the electric field in material in, E = 5.8 x 10^{-6} sin (9 x10^9 t) v/m.

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