

Code: R7210205

R07

B.Tech II Year I Semester (R07) Supplementary Examinations, May 2013

**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 prove Gauss law and explain its application through example.  
(b) Let  $D = 2y^2z^2i_x + 3xy^2z^2i_y + 2xyzi_z$  pC/m<sup>2</sup> in free space, find
  - (i) Electric flux passing through the surface  $x = 2$ ,  $0 \leq y \leq 2$ ,  $0 \leq z \leq 2$  in a direction away from the origin.
  - (ii) Total charge contained in an incremental sphere of radius  $1 \mu\text{m}$  centered at P (2, 2, 2).
- 2 (a) Show that the electric potential due to electric dipole satisfies Laplace's equation.  
(b) Develop an expression for potential difference at any point between spherical shells in terms of applied potential using Laplace's equation.
- 3 (a) Discuss about the classification of materials as conductors, insulators and dielectrics.  
(b) The polarization P of a homogeneous isotropic dielectric material is  $3i_x$  nC/m<sup>2</sup>, considering electric susceptibility  $\chi_e$  is 6 find the electric field.
- 4 (a) Using Biot-savart law derive an expression for inductance per unit length of long co-axial cable.  
(b) A coil of 500 turns is wound on a closed iron ring of radius 10 cm and cross section area of 5 cm<sup>2</sup> find the self inductance of the coil if  $\mu_r = 800$  for iron.
- 5 (a) Two infinite surface sheet currents are located at  $z = 0$  and  $z = h$  with current densities  $Ki_y$  and  $-Ki_y$  respectively. Find the field at any point in space.  
(b) Given magnetic flux density of  $\frac{3}{r} \sin^2 \phi i_z$  find the flux across the plane of  $z = 0$  and radius 5 cm.
- 6 (a) Derive an expression for magnetic field at a point due to two long straight parallel wires carrying equal and opposite currents.  
(b) A conductor carries a current of 5 amps along the x-direction find the force it if it is subjected to a flux density of 1 Wb/m<sup>2</sup> along z-direction.
- 7 (a) Explain the concept of scalar magnetic potential and hence define magneto motive force.  
(b) Find the magnetic vector potential due to a infinite plane current sheet of uniform density 'K'?
- 8 (a) Which Maxwell's equation support the statements 'no isolated magnetic poles exist' prove it through justification.  
(b) For a time varying voltage applied across a capacitor prove that the displacement current through the capacitor is equal to conduction current.

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