Code No: R5210205 **R5**

II B.Tech I Semester(R05) Supplementary Examinations, May/June 2010
ELECTROMAGNETIC FIELDS
(Common to Electrical & Electronic Engineering and Electronics & Control Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the term: "potential difference V(A) - V(B) between points A and B in a static electric field". Give an energy interpretation to potential difference.
   (b) What are the equipotential surfaces for an infinite straight line of uniform charge density? Explain.
   (c) Potential for a certain region is given by $V(x, y, z) = \frac{300}{x}$ volts; where x is in meters. Find the electric field at the point P:(x= 1 m). [6+6+4]

2. (a) i. Define capacitance. Express its units in 2 different ways.
      ii. As per the usual definition, show that a capacitance is always positive.
      iii. Sometimes, capacitance of a single conductor is referred to. What does this mean?
   (b) i. Two large parallel conducting plates are separated by a distance d m in air. Find the capacitance per unit area.
      ii. A conducting sheet of thickness s m (s<d) is now introduced between the plates, parallel to them but not touching them. Find the new capacitance per unit area between the outer plates. [6+6+4]

3. (a) Define polarization. Explain how a dielectric acquires polarization.
   (b) A long straight line of uniform charge density λ C/m is surrounded by an insulating medium out to a radius R m. Find $\overline{D}$. Also find the electric field in the region outside the insulation. Explain why the electric field cannot be found in the insulation region. [8+8]

4. (a) A steady current of I A extends along the z-axis from $\frac{-\ell}{2}\,m$ to $\frac{\ell}{2}\,m$ in free space. Find the magnetic field $\overline{B}$ at a point on the y-axis y m from the origin, using Biot-Savart's law.
   (b) Extend the result of (a) to an infinite straight line of steady current. Express the result in cylindrical co ordinates. [10+6]

5. (a) How Amperes current law differs from Biot - Savart Law.
   (b) Evaluate the closed line integral of $\overline{H}$ from (5,4,1) to (5,6,1) to (0,6,1) to (0,4,1) to (5,4,1) using straight line segments, if $\overline{H} = 0.1y^3\ a_x + 0.4x\ a_z$ A/m. [6+10]

6. (a) 'A current carrying conductor kept in magnetic field experience a force' justify the statement.
   (b) A cylindrical conducting shell of radius ρ = 4 mm and negligible thickness forms the inner conductor of a co-axial line. The outer conductor is a co-axial conducting cylinder of 20 mm radius and negligible thickness. The cylinders carry equal and opposite total currents of 100 A. What is the magnitude of force per unit length acting to split the outer cylinder apart longitudinally? [8+8]

7. (a) Obtain the expression for coefficient of coupling between two coils.
   (b) A coil of 10 mH is magnetically coupled to another coil of 600 μH. The coefficient of coupling between two coils is 0.15. Calculate the inductance if these two coils are connected in parallel addition and parallel opposition. [8+8]

8. (a) Obtain the expression for Displacement current density.
   (b) Find the displacement current density next to your radio, in air, where the local FM station provides a carrier having H = 0.2 cos [210(3 * 10^8t - x)] a_z A/m. [8+8]

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