2007 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

II B.TECH I SEMESTER REGULAR EXAMINATIONS
ELECTROMAGNETIC FIELDS
(Common To Electrical & Electronic Engineering And Electronics & Controlengineering)

NOVEMBER 2007

Time: 3 hours
Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define the term: "Potential difference V(A) - V(B), between points A and B in a static electric field". Explain the concept of reference point and comment on its location.

(b) What are the equipotential surfaces for an infinite straight line of uniform charge density? Explain.

(c) A uniformly charged spherical surface of radius 0.5 m is in free space. If the potential at the surface is 100 V (reference at infinity), what is the surface charge density?
[6+6+4]

2. (a) Show that the torque on a physical dipole p C-m in a uniform electric field E is given by T = $P \times E$. Extend the result to a pure dipole.

(b) A concentric spherical conductor arrangement If the capacitance of the arrangement is 0.1 nF, and a is 10 cm, find b.
[8+8]

3. (a) Define polarization. Explain how a dielectric acquires polarization.

(b) A long straight line of uniform charge density ? C/m is surrounded by an insulating medium out to a radius R m. Find 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) State Biot - Savart's law for the magnetic field B due to a steady line current element in free space. Hence obtain the magnetic field due to a steady volume current configuration.

(b) For the current elements located in free space as shown in figure 4b, find the magnetic field B at the point P.

5. A solid non-magnetic conductor of cross section ? = 2 cm, carries a total current of 60 A, in the az direction. The conductor is inhomogeneous having a conductivity that varies with ? as s = 105 (1 + 2.5 * 105?2) Siemens/m. Find the total flux crossing through the radial plane defined by ? = 0, 0 < z < 1m and 0 < ? < 1 cm.
[16]

6. (a) What is Ampere's force law? Derive the expression.

(b) Two long parallel wires separated 2 meters apart carry currents of 50 A and 100 A

respectively in the same direction. Determine the magnitude and direction of the force between them per unit length. [10+6]

7. (a) Explain the self and mutual inductance. Obtain the expression for same.

(b) A coil of 1 mH is magnetically coupled to another coil of 500 µH. The coefficient of coupling between two coils is 0.015. Calculate the inductance, if these two coils are connected in series addition and series opposition.
[10+6]

8. A co-axial capacitor has the parameters a=5 mm, b = 30mm, I = 20 cm, er =8, and s = 10 - 6 Siemens/m. If the conduction current density in the capacitor is (2/?) sin 106t a? A/m2, find

(a) The total conduction current through the capacitor.
(b) The Maximum value of the displacement current density.
(c) The total displacement current.