Code No: A109210205 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
ELECTRO MAGNETIC FIELDS
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the concept of diplacement current.
   (b) Find the frequency at which conduction current density and displacement current density are equal in
      i. Distilled water, for which $\in_r = 18$ and $\sigma = 2.0 \times 10^{-4} mho/m$
      ii. Sea water for which $\in_r =$ / and $\sigma = 4.0 mho/m$. [7+8]

2. (a) State and explain Ampere's Circuital law.
   (b) Derive an expression for $\bar{H}$ due to an infinitely long current carrying conductor. [8+7]

3. Let the magnetic potential be $V_m = (2x^2 + 4x - 2y^2)$ A in a certain region of free space. Find the vector force exerted on a straight wire segment in this region if it extended from the origin to
   (a) P_A (1, 0, 0) and carries 5A in the $\bar{a}_x$ direction
   (b) P_B (0, 0, 1) and carries 5A in the $\bar{a}_z$ direction. [8+7]

4. (a) A parallel plate capacitor consists of two square metal plates with 500 mm side and separated by 10 mm. A slab of sulphur ($\varepsilon_r = 4$) of 6 mm thick is placed on the lower plate and air gap of 4mm. Find the capacitance of the capacitor.
   (b) A Spherical condensor has a capacity of 54 PF. It consists of two concentric spheres differing in radii by 4 cm and having air as dielectric. Find their radii. [7+8]

5. The flux density $\bar{D} = \frac{r}{3}\bar{a}_r$ nC/m^2 is in the free space.
   (a) Find $\bar{E}$ at r = 0.2m?
   (b) Find the total electric flux leaving the sphere of r = 0.2m?
   (c) Find the total charge within the sphere of r = 0.3m? [15]

6. (a) Calculate the inductance of a solenoid 8cm in length, 2cm in radius having $\mu_r = 100$ and carrying 800 turns of wire.
   (b) Calculate the inductance of a toroid formed by surface $\rho = 3$cm and $\rho = 5$cm, z = 0 and z = 1.5cm wrapped with 5000 turns of wire and filled with a magnetic material with $\mu_r = 6$. [7+8]

7. Obtain an expression for magnetic field intensity on the axis of a circular loop of radius 'R' carrying a current of I amps. Also get the value at centre of the current loop. [15]

8. In spherical co-ordinated V = 0 at r = 0.1m and V = 100v at r = 2m. Assuming free space between these concentric spherical shells, find $\bar{E}$ and $\bar{D}$. [15]

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Code No: A109210205 **R09** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
ELECTRO MAGNETIC FIELDS
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and explain Faraday's laws of electromagnetic induction.
   (b) Distinguish clearly the dynamically induced emf and statically induced emf. Explain with neat sketches. [7+8]
2. (a) Derive Lorentz force equation.
   (b) A point charge Q = -2.4 C has velocity $\bar{V} = (5\bar{a}_x + 4\bar{a}_y - 3\bar{a}_z)$ m/s. Find the magnitude of the force exerted on the charge if,
      i. $\bar{E} = -9\bar{a}_x + 5\bar{a}_y - 10\bar{a}_z$ V/M
      ii. $\bar{B} = -2\bar{a}_x + 4\bar{a}_y + 3\bar{a}_z$ wb/ m^2. [7+8]
3. (a) Using Ampere's Circuital law, find the magnetic field intensity in the case of a closely wound torroidal coil.
   (b) A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry currents of +100 and -100 amps respectively. Determine the flux density at the surface of each conductor and also in space exactly midway between A and B. [7+8]
4. Two identical charges of 500μc each are spaced equally around a circle of diameter 2m. Find the force on a charge of -10μc located on the axis 2m from the plane of the circle. [15]
5. (a) Derive expression for torque on an electric dipole in an electric field.
   (b) Point charges of +3μc and -3μc are located at (0, 0, 1)mm and (0, 0, -1)mm respectively in free space.
      i. Find dipole moment $\bar{p}$?
      ii. Find $\bar{E}$ in Spherical components at P(r = 2, $\theta = 40^0$, $\phi = 50^0$)? [7+8]
6. Derive an expression for capacitance between two concentric spheres with two dielectrics with relative permittivities ε_{r1} and ε_{r2}. [15]
7. (a) Derive an expression for mutual inductance between straight long wire and a square loop wire in the same plane.
   (b) Derive an expression for energy stored in a magnetic field. [7+8]
8. A conductor is bent in the form of a regular polygon of 'n' sides inscribed in a circle of radius 'r'. Show that the expression for magnetic flux density $\bar{B}$ at the centre for a current of I amp is $\bar{B} = \frac{\mu_0 NI}{2\pi r} \tan\frac{\pi}{n}$. [15]

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Code No: A109210205 **R09** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
ELECTRO MAGNETIC FIELDS
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the concept of electric field intensity.
   (b) Derive an expression for electric field intensity at any point due to number of point charges. [8+7]
2. The long straight parallel wires in air, two meter apart, carry currents I_1 and I_2 in same direction. The field intensity H at midway is 7.5 AT/M. If the force on each wire per unit lenght is 2.5×10^{-4} N determine values of I_1 and I_2. [15]
3. (a) A coaxial capacitor with inner radius 5mm, outer radius 6mm and a length of 500 mm has a dielectirc for which $\in_r$= 6.7 and an applied voltage 250 sin 377t volts. Determine the displacement current i_D and compare with conduction current i_c.
   (b) State and prove Poynting theorem. [8+7]
4. Derive the expression for capacitance of a parallel plate capacitor with single dielectric. Also derive the expression for the capacitance of a parallel plate capacitor with two dielectric. [15]
5. Explain Oestard's experiment in detail with neat sketch of experimental setup. [15]
6. (a) What is a dipole? Derive expression for Torque experienced by a dipole in uniform electric field.
   (b) Verify that the potential field given below satisfies the Laplace's equation. V = $4x^2$ - $6y^2$ + $2z^2$. [7+8]
7. Derive Neuman's formula for mutual inductance considering two loops carrying currents I_1 and I_2. [15]
8. A circular conductor has an internal magnetic field $\bar{H} = \frac{1}{\rho}[\frac{1}{a^2}\sin(a\rho) - \frac{\rho}{a}\cos(a\rho)]\bar{a}\phi$ A/m. find the current density in the conductor. [15]

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Code No: A109210205 **R09** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
ELECTRO MAGNETIC FIELDS
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State Lenz's law and prove it.
   (b) In a given lossy dielectric medium, conduction current density $J_c = 0.02 \sin 10^9$ t (A/m^2). Find the displacement current density if $\sigma = 10^3$ v/m and $\in_r = 6.5$. [7+8]

2. (a) State and explain Ampere's circuital law.
   (b) A single-phase circuit comprises two parallel conductors A and B, each 1 cm diamter and spaced 2m apart. The conductor carry current of +50 and -50 amps. respectively. Determine the field intensity at the surface of each conductor and also in space exactly midway between A and B. [7+8]

3. (a) Define potential and potential difference.
   (b) A potential distribution is given by V = $5y^2$ + 10x. Determine the electric field intensity $\bar{E}$. What is the vector value at points
      i. (0, 0, 0)
      ii. (10, 2, 0) [7+8]

4. (a) Calculate the magnetic flux density due to a coil carrying 60 amperes and area 20 cm^2 on the axis of the coil at a distance 6 m from the centre.
   (b) A solenoid of radius 8 cm and length 16 cm is wound uniformly with 200 turns of wire and carries a current of 6A. Calculate the flux density at the point on the axis at a distance 8 cm from the middle of the coil. [7+8]

5. (a) How a differential current loop work as a magnetic dipole?
   (b) A galvanometer has a rectangular coil suspended in a radial magnetic field so that the magnetic field always acts across the plane of the coil. If the coil is 10mm × 10 mm side and has 1000 turns, and if the magnet provides a constant flux density of 0.7 tesla find the torque exented on the coil for a current of 10 mA. [7+8]

6. (a) A toroidal one is composed of material with $\mu_r = 25$. the boundary surfaces are z_1= 0, z_2= 0.025, ρ_1= 0.025m and ρ_2= 0.04m. The core is wound symmentrically with 12000 turns of wire such that H is in the $-\bar{a}_e$ direction. Find the inductance.
   (b) Two mutually coupled coils are connected in series. L_1 = 0.5 H, L_2 = 0.6 H, m = 0.1 H. A DC current of 2 amps is parallel through this system in such a way that the current increase at a uniform rule of 1 amp per sec. What is the voltage developed across the end points if,

i. The coils are connected in a magnetically adding conditions.

ii. The coils are connected in a magnetically opposing condition. [8+7]

7. Solve Laplace's equation for the potential field in the homogeneous region between two concentric conducting spheres with radii a and b, b > a, if V = 0 at r = b, and V = V_0 at r = a. Find the capacitance between them. [15]

8. A Co-axial cable is required to transmit electric power. The potential difference between the inner and outer conductors is to be filled mainly with nitrogen gas under pressure whose dielectric strenght is 25×10^{-6} V/m. The radius of the outer conductors is double that of inner conductors.

   (a) Determine the capacitance of the cable.

   (b) Determine energy stored in the electric filed of this cable when potential difference is 2×10^5. [8+7]

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