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

II B.Tech I Semester Examinations,MAY 2011
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) Show that the torque acting on a dipole of moment $\bar{p}$ due to an electric field $\bar{E}$ is $\overline{p} \times \overline{E}$.
   (b) Compute the torque for a dipole consisting of $1\mu c$ charges in an electric field $\overline{E} = 10^3(z\overline{a_x} - \overline{a_y} - \overline{a_z})$ separated by 1 mm and located on the z-axis at the origin. [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) Explain scalar magnetic potential and give its limitations.
   (b) Explain the importance of vector magnetic potential. [7+8]

4. (a) A conducting cylinder of radius 7cm and height 15 cm rotates at 600 rev/min in a radial field $\bar{B}$=0.2 $\bar{a}_r$ Telsla .Sliding contacts at the top and bottom connenc to a voltmeter as shown in figure 1. Find the induced voltage.

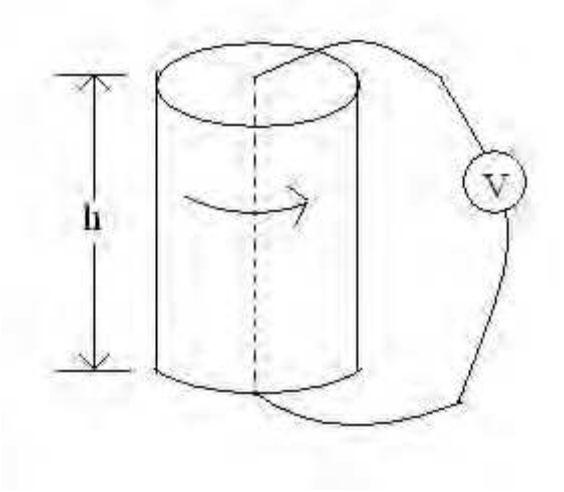

Figure 1:

   (b) Distinguish statically induced emf and dynamically induced emf. [8+7]

5. (a) Derive the conditions at a boundary between two perfect dielectrics.

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(b) Given $\bar{J} = 10^3 \sin\theta\, \bar{\partial}_r\, A/m^2$ spherical co-ordinates, find the current crossing the spherical shell of r = 0.02m, where r = radius of shell. [7+8]

6. (a) State and explain Gauss's law.

   (b) Derive an expression for potential difference between two concentric spheres of radii 'a' and 'b' (b > a), if the outer sphere of the inner sphere is charged with Q_c. Apply Gauss's law. [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. Filamentary currents of -25 $\bar{a}_z$ and 25 $\bar{a}_z$ amperes are located in the x = 0 plane in free space at y = -1 and y = 1m respectively. a third filamentary current of $10^{-3}\bar{a}_x$ amperes is located at x = k, y = 0. Find the vector force on a 1m length of 1mA filament? [15]

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

II B.Tech I Semester Examinations,MAY 2011
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. Derive an expression for $\bar{H}$ due to infinite sheet of current. [15]

2. (a) Derive expression for inductance of a toroid.
   (b) A toroid 600 turns wound on a core of circular cross-section 6 cm^2, a mean diameter of 38 cm. The core material has permeability 1000. Calculate the inductance of the coil. [7+8]

3. (a) Distinguish between conductors and dielectrics.
   (b) A 2 μF capacitor is charged by connecting across a 100 V d.c supply. It is now disconnected and then it is connected across another 2 μF capacitor. Assuming no leakage, determine the potential difference between the plates of each capacitor and energy stored. [15]

4. A conductor 15m long lies along Z-direction with a current of 6A in $\bar{a}_z$ direction. Find the force experience by the condenctor if $\bar{B} = 0.09\ \bar{a}_x$. [15]

5. (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]

6. Given $\bar{D} = 5x^2\,\bar{\partial}_x + 10z\,\bar{\partial}_z(c/m^2)$, find the net outward flux crossing the surface of a cube 2m on an edge centred at the origin and the edges of the cube are paralled to the axes. [15]

7. (a) A circular loop conductor shown in the figure 2 lies in the z=0 plane, has a radius of 0.1m and a resistance of 5Ω. Give $\bar{B} = 0.2 \sin 10^3 t\ \bar{a}_z$(T). Determine the current.
   (b) An area of $0.65m^2$ in the z=0 plane is enclosed by a filamentry conductor. Find the induced voltage given that $\bar{B} = 0.05 \cos 10^3 t\ \frac{\bar{a}_y + \bar{a}_z}{\sqrt{2}}$(T). [15]

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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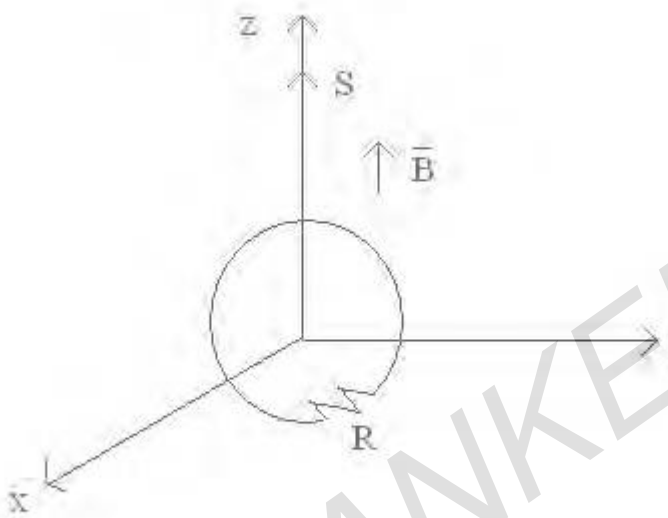

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Code No: A109210205 **R09** **Set No. 1**

II B.Tech I Semester Examinations,MAY 2011
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) Derive an expression for magnetic field intensity due to a current carryiing wire of infinite lenght, at a radial distance 'R' m.
   (b) Calculate the magnetic field intensity $\bar{H}$
      i. At the centre of coil of 4 turns and 10 cm in diameter.
      ii. In the interior of the solenoid of length 50 cm uniformly wound with 500 turns. The current in each turn is 2.5 A. [7+8]
2. (a) Define electric field intensity.
   (b) Figure 3 shows two charges at points A and B in free space. Find the electric field at point P due to there charges? [15]
3. (a) Obtain the conditions at a boundary between two dielectrics.
   (b) At boundary between glass ($\varepsilon_r = 4$) and air, the lines of electric field make an angle of 40^0 with normal to the boundary. If electric flux density in the air is $0.25\mu c/m^3$, determine the orientation and magnitude of electric flux density in the glass. [8+7]

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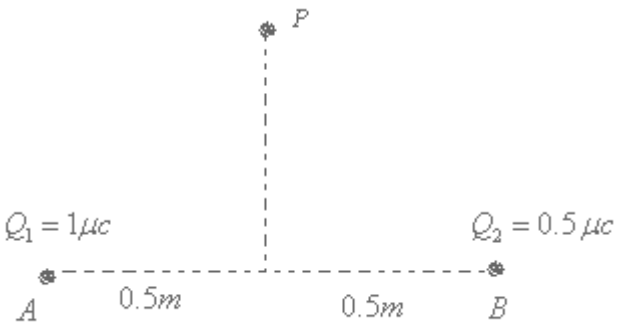

Figure 3:

4. (a) Define statically induced emf and dynamically induced emf.

   (b) A rectangular loop shown in the figure 4 moves towards the origin at a velocity V = -250$\bar{a}_y$ m/s in a field $\bar{B}$=0.8e$^{-0.5y}\bar{a}_z$ Telsa. Find the current at the intent the coil sides are at y =0.5m and 0.6m if R=2.5Ω. [15]

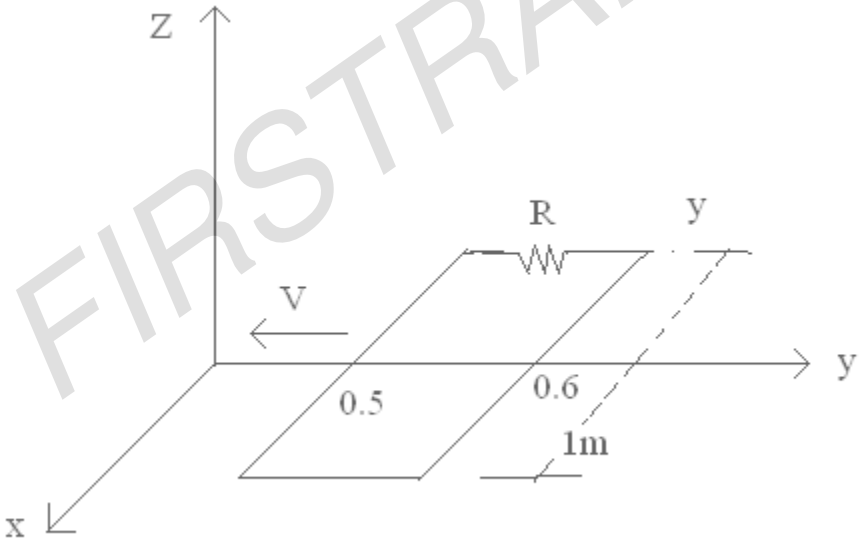

Figure 4:

5. (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]

6. A conductor of lenght 4m, carrying a current of 10A in the $\bar{a}_y$ direction lies along the y - axis between $y = \pm 2$. If the field is $\bar{B} = 0.05\ \bar{a}_x$ T, find the work done in

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moving the conductor parallel to itself at constant speed, to x = y = 2m. Derive the formula used. [15]

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) A circular loop located on $x^2 + y^2 = 9$ carries a current of 12A. Determine H at (0,0,6) and (0, 0, -6). Take the direction of current in anti-clockwise direction.

   (b) Using ampere's circuital law, find $\bar{H}$ and $\bar{B}$ inside a long straight non mangentic conductor of 'y' radius 8mm carrying a current density of 50 KA/m^2. [7+8]

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

II B.Tech I Semester Examinations,MAY 2011
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) Show that the electric field intensity is negative gradient of potential.
   (b) The absolute potential (electric) for some region is assumed to be $\phi = \frac{3000}{x} + \frac{2000}{x^2} + \frac{1000}{x^3}$ for all values of x, y, z where ϕ is in volts and x is in meters. What is the electric field intensity at x = 1m? [7+8]

2. (a) Moist rod has conductivity $10^{-3} mho/m$ and e $_r$= 2.5. Find $\bar{J}_C$ and $\bar{J}_D$ where $E = 6 \times 10^{-6} \sin 9 \times 10^9 t(v/m)$.
   (b) Explain what is meant by displacement current deduce equation of continuity of current $div\left(\bar{J} + \frac{\delta \bar{D}}{\delta t}\right) = 0$. [7+8]

3. (a) Derive lorentz force equation.
   (b) A negative point charge Q = -40 nc is moving with a velocity of $6 \times 10^6 m/s$ in a direction specified by the unit vector $\bar{a} = -0.48\bar{a}_x - 0.6\bar{a}_y + 0.64\bar{a}_z$. Find the magnetic vector force extarted on the moving particle by the fuild
      i. $\bar{B} = 2\bar{a}_x - 3\bar{a}_y + 5\bar{a}_z$ mwb/ m^2
      ii. $\bar{E} = 2\bar{a}_x - 3\bar{a}_y + 5\bar{a}_z$ KV/m. [8+7]

4. (a) Derive expression for torque on an electric dipole in an electric field.
   (b) Point charges of $+3\mu$c 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]

5. A toroid has the dimensions 15 $\times 10^{-3}$ m mean radius and 2 $\times 10^{-2}$ m radius of cross section and 3 $\times 10^{-2}$ m radius of circular cross- section and is wound with 100 turns of wire. The toroid material is iron with an effective relative permeability of 1400 when the current is 0.7 amp. Calculate the total flux
   (a) With no air-gap
   (b) With an air-gap of 10^{-3}m. [7+8]

6. (a) Find an expression for the flux density at any point 'P' on the axis of a finite solenoid when carrying a steady current of I amps.
   (b) What is the flux density at the centre of square loop of 10 turns carrying a current of 10 amperes. The loop is in air and as 2 meter on each side. [7+8]

7. (a) Derive the integral form of continuity equation and also write its meaning.

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(b) Two parallel conducting plates 3 cm apart and situated in air are connected to a source of constant potential difference of 72 KV. Find the electric field intensity between the plates. Is it with in permissible value ? If a mica sheet of $\varepsilon_r = 4$ of thickness 1 cm is introduced between the plates, determine the field intensities in air and mica. Given the dielectric strenghts of air and mica as 30 and 1000 kv/cm respectively. [7+8]

8. A circular loop located on $x^2 + y^2 - 9, z = 0$ carries a current of 10 A. Determine H at (0,0,5) and (0,0,-5). Taken the direction of current in anti-clockwise direction. [15]

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