Code No: RR210204 **Set No.1**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTROMAGNETIC FIELDS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Four concentrated charges $Q_1 = 0.3\,\mu$ c, $Q_2 = 0.2\,\mu$ c, $Q_3 = -0.3\,\mu$c, $Q_4 = 0.2\,\mu$ c are located at the vertices of a plane rectangle. The length of rectangle is 5 cm and breadth of the rectangle is 2 cm. Find the magnitude and direction of resultant force on Q_1.

2. A parallel plate capacitor has a plate area of 1.5 Sq.m. and a plate separation of 5 mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3 mm with a relative permittivity of 6 and the second has a thickness of 2 mm with relative permittivity 4. Find the capacitance . Derive the formula uses.

3. (a) What are Boundary conditions for Potential?
   (b) Show that the electric field intensities on the two sides of a boundary and normal to the boundary will be uncharged, If the relative permitivity of the two sides of boundary is charged to unity and a surface density of charge $\rho_s = \frac{\in_{r1} - \in_{r2}}{\in_{r1}} = \in_0 E_2 = \frac{\in_{r2} - \in_{r1}}{\in_{r2}} \in_0 E_1$
   where $\in_{r1}$ and $\in_{r2}$ are the relative permitivities of the two media in which the normal electric field is E_1 and E_2 respectively.

4. State and prove Ampere's circuital law. Discuss few applications for the same.

5. What is Magnetic moment? Derive an expression for torque on a current loop.

6. A solenoid of 500 turns has a length of 50 cm and radius of 10 cm. A steel rod of circular cross section is fitted in the solenoid co-axially and tightly. Relative permeability of steel is 3000. A d.c. Current of 10 Amps is passed through the solenoid. Compute inductance of the system, energy stored in the system and mean flux density inside the solenoid.

7. Explain the Faradays disc generator and derive an expression for finding the unknown magnetic field.

8. (a) State and Prove the Poynting theorem for conducting medium.
   (b) A plane-traveling wave in free space has an average pointing vector of 1.5 $watts/m^2$. Calculate the average density.

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Code No: RR210204 **Set No.2**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTROMAGNETIC FIELDS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is the value of the E field at the surface of a flat conducting sheet which has placed on it a surface charge density of $\rho_s = 10^{-2}$ C/m^2.

2. (a) 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 within permissible value? If a mica sheet ($\epsilon_r = 4$) of thickness 1 cm is introduced between the plates determine the field intensities in air and mica. Given the dielectric strength of air and mica as 30 and 1000 kv/cm respectively.
   (b) Derive and expression for the potential difference at any point between spherical shells in terms of applied potential using Laplace equation.

3. (a) Derive the integral form of continuity equation and also write its meaning.
   (b) What is the Capacitance of a Capacitor consisting of two parallel plates 30 cm by 30 cm, Separated by 5 mm in air. What is the energy stored by the capacitor if it is charged to a potential difference of 500 volts.

4. State and prove Ampere's circuital law. Discuss few applications for the same.

5. The rectangular coil shown in figure 1 is in a field $\bar{B}$= 0.05 $\frac{\bar{a}_x + \bar{a}_y}{V_2}$Tesla. Find the torque about the Z-axis when the coil is in the position shown and carries a current of 5 amps.

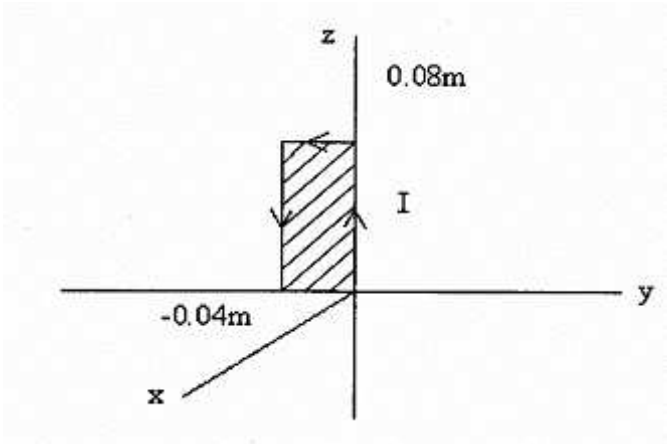

Figure 1:

6. 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 2Amps is passed through this system in such a way that the current increases at a uniform rate of 1 Amp. per sec. What is the voltage developed across the end points if

   (a) the coils are connected in a magnetically aiding condition

   (b) the coils are connected in a magnetically opposing condition.

   Derive formula used.

7. (a) Explain what is meant by the term displacement current. Deduce equation of continuity of current div ($\mathbf{J}$+d$\mathbf{D}$/dt)=0.

   (b) Find the displacement current density within a parallel plate Capacitor where $\epsilon = 100\epsilon_0$, a=$0.01m^2$, d=0.05 mm and the capacitor Voltage is 100 sin 200 πt volts?

8. Assuming Maxwell's equations, show that the quantity given by the expression $\oint(\overline{E} \times \overline{H})\,\overline{ds}$ is equal to the total power flowing out the volume enclosed by the closed surface $\bar{S}$ surrounding the volume.

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II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTROMAGNETIC FIELDS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) State and explain coulomb's law.
   (b) Two small identical conducting spheres have charge of 2nC and - 0.5nC respectively. when they are placed 4 cm apart what is the force between them. If they are brought into contact and then separated by 4 cms what is the force between them?

2. (a) A co axial cable with inner and outer conductor radii 'a' and 'b' respectively have the respective voltage Va and Vb by using laplaces equation, find E at all points.
   (b) The construction of a paper capacitor is as follows: Aluminum foil of $100-cm^2$ area is placed on both sides of paper of thickness 0.03 mm. If the dielectric constant of paper is given as 3, and its dielectric breakdown strength is 200 kV/cm , what is the rating of the capacitor?

3. (a) State and prove the conditions at the boundary between two dielectrics.
   (b) Determine the resistance of a insulation in length 'L' of co-axial cable as inner and outer radii are 'a' and 'b' respectively.

4. Two narrow circular coils A and B have a common axis and are placed 10 cms apart. Coil A has 10 turns of radius 5cm with a current of 1A passing through it. Coil B has a single turn radius 7.5 cms. If the magnetic field at the centre of coil A is to be zero, what current should be passed through coil B.

5. A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry current of +100 and -100 Amps. respectively. Determine the filed intensity at the surface of each conductor and also in space exactly midway between A and B.

6. Prove that in the case of two mutually coupled coils $M = K\sqrt{L_1\, L_2}$ with usual notations.

7. (a) Explain what is meant by the term displacement current. Deduce equation of continuity of current div ($\mathbf{J}$+d$\mathbf{D}$/dt)=0.
   (b) Find the displacement current density within a parallel plate Capacitor where $\epsilon = 100\epsilon_0$, a=$0.01m^2$, d=0.05 mm and the capacitor Voltage is 100 sin 200 πt volts?

8. Assuming Maxwell's equations, show that the quantity given by the expression $\oint(\overline{E} \times \overline{H})\,\overline{d}s$ is equal to the total power flowing out the volume enclosed by the closed surface $\bar{S}$ surrounding the volume.

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Code No: RR210204 **Set No.4**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTROMAGNETIC FIELDS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) The charge density inside a sphere of radius 'a' is given by $\rho = kr^2$. Find E inside and outside the sphere.
   (b) If a charge of 1 μC is uniformly distributed throughout a spherical volume of radius r =10 mm, what is E everywhere?

2. (a) Find electric potential due to electric dipole.
   (b) The potential difference between two concentric sphere of radii $r_1 0$ and $r_2(r_2 > r_1)$ show that electric field E at the surface of inner sphere is minimum of $2V/r_1$ for $r_1 = r_2/2$.

3. (a) Derive the integral form of continuity equation and also write its meaning.
   (b) What is the Capacitance of a Capacitor consisting of two parallel plates 30 cm by 30 cm, Separated by 5 mm in air. What is the energy stored by the capacitor if it is charged to a potential difference of 500 volts.

4. A conductor is in the form of a Regular polygon of n sides inscribed in a circle of radius R. Show that the expression for **B** at the center for a current is given by $|B| = \left(n\mu_o {}^{I}/_{2\pi R}\right) Tan\, {}^{\pi}/_{n}$

5. A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry current of +100 and -100 Amps. respectively. Determine the filed intensity at the surface of each conductor and also in space exactly midway between A and B.

6. A torroid is made up of two semicircular rings of iron and steel held together tightly. Cross sectional area of each part is 5 sq.cm and mean radius of torroid is 20 cm. Relative permeabilities of steel and iron are respectively 2000 and 500. The exciting coil has 500 turns. Find inductance of the system.

7. Explain the Faradays disc generator and derive an expression for finding the unknown magnetic field.

8. (a) Define skin depth and derive an expression for it.
   (b) The electric field intensity associated with a plane wave traveling in a perfect dielectric medium is given by Ex(Z,t)=$10\cos(2\pi\, 10^7 t - 0.1\pi x) V/m$
      i. Calculate the velocity of propagation.
      ii. Write down an expression for the magnetic field intensity associated with the wave if $\mu = \mu_0$.

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