Code No: R05210205 **R05** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
ELECTROMAGNETIC FIELDS
Common to Electronics And Control Engineering, Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive Poisson's and Laplace's equations.
   (b) The infinite zx-plane carries a uniform surface charge density and is in free space. Find the potential in the region y > 0, by solving Laplace's equation, given that the potential at y = 0 is 100 V; and at y = 1 m it is 0 V. Also find the charge density on the plane. [Hint: For y > 0; the electric field will be only in the y - direction]. [8+8]

2. (a) Explain the terms
      i. Motional EMF
      ii. Static EMF
   (b) A copper wire carries a conduction current of 1 Amp. Determine the displacement current in the wire at 1 MHz. for copper $\varepsilon = \varepsilon_o$ and $\sigma = 5.8 * 10^7$ Siemens/m. [8+8]

3. (a) Obtain the expression for the force experienced by a current carrying conductor kept in magnetic field.
   (b) A current of 6 Amp flows from M (2, 0, 5) to N (5, 0, 5) in a straight solid conductor in free space. An infinite current filament lies along z- axis and carries 50 Amp current in a_z direction. Compute the vector torque on the wire segment using an origin, at (3, 0, 0). [8+8]

4. (a) For a conducting body in the electric field of static charges, explain what will be the
      i. net electric field inside the conductor, and
      ii. volume charge density at any point inside the conductor.
   (b) Obtain, from fundamentals, an expression for the capacitance per unit area of a parallel plate capacitor. If the plates are separated by 1 mm in air, and have a potential difference of 1000 V, what is the energy stored per unit area? [8+8]

5. (a) i. A steady current element $10^{-3}a_z$ A-m is located at the origin in free space. What is the magnetic field $\overline{B}$ due to this element at the point (1,0,0) m (in rectangular coordinates)?
      ii. What is the magnetic field at the point (0,0,1) m?
   (b) Find $\overline{B}$ due to a straight length ℓ m of steady current I A at a distance of y m from the center of the line current. [6+10]

6. Applying Ampere's current law to differential element obtain the Maxwell's equation ∇ X H = J. [16]

7. (a) Define the electric displacement vector $\overline{D}$ in the presence of dielectrics. Obtain the expression for its divergence.

   (b) A conducting sphere of radius 20 cm is surrounded up to a radius of 1 m by a linear dielectric of dielectric constant 2. An external charge of 1 nC is placed on the conductor. Find the bound surface charge densities. [8+8]

8. The region in free space enclosed by planes z = 0, and 3 cm and by cylinders ρ = 5 and7 cm, forms a toroid with a rectangular cross section. A surface current K = 600 a_z A/m flows on the inner surface.

   (a) Determine the H within the solenoid.

   (b) Determine the scalar magnetic potential within the toroid if the scalar magnetic potential is zero at ρ = 6 cm, φ = 0.6 rad, z = 2 cm. [8+8]

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Code No: R05210205 **R05** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
ELECTROMAGNETIC FIELDS
Common to Electronics And Control Engineering, Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the electric displacement vector $\overline{D}$ in the presence of dielectrics. Obtain the expression for its divergence.
   (b) A conducting sphere of radius 20 cm is surrounded up to a radius of 1 m by a linear dielectric of dielectric constant 2. An external charge of 1 nC is placed on the conductor. Find the bound surface charge densities. [8+8]

2. Applying Ampere's current law to differential element obtain the Maxwell's equation ∇ X H = J. [16]

3. The region in free space enclosed by planes z = 0, and 3 cm and by cylinders ρ = 5 and7 cm, forms a toroid with a rectangular cross section. A surface current K = 600 a_z A/m flows on the inner surface.
   (a) Determine the H within the solenoid.
   (b) Determine the scalar magnetic potential within the toroid if the scalar magnetic potential is zero at ρ = 6 cm, φ = 0.6 rad., z = 2 cm. [8+8]

4. (a) i. A steady current element $10^{-3}a_z$ A-m is located at the origin in free space. What is the magnetic field $\overline{B}$ due to this element at the point (1,0,0) m (in rectangular coordinates)?
      ii. What is the magnetic field at the point (0,0,1) m?
   (b) Find $\overline{B}$ due to a straight length ℓ m of steady current I A at a distance of y m from the center of the line current. [6+10]

5. (a) Obtain the expression for the force experienced by a current carrying conductor kept in magnetic field.
   (b) A current of 6 Amp flows from M (2, 0, 5) to N (5, 0, 5) in a straight solid conductor in free space. An infinite current filament lies along z- axis and carries 50 Amp current in a_z direction. Compute the vector torque on the wire segment using an origin, at (3, 0, 0). [8+8]

6. (a) For a conducting body in the electric field of static charges, explain what will be the
      i. net electric field inside the conductor, and
      ii. volume charge density at any point inside the conductor.

(b) Obtain, from fundamentals, an expression for the capacitance per unit area of a parallel plate capacitor. If the plates are separated by 1 mm in air, and have a potential difference of 1000 V, what is the energy stored per unit area? [8+8]

7. (a) Derive Poisson's and Laplace's equations.

(b) The infinite zx-plane carries a uniform surface charge density and is in free space. Find the potential in the region y > 0, by solving Laplace's equation, given that the potential at y = 0 is 100 V; and at y = 1 m it is 0 V. Also find the charge density on the plane. [Hint: For y > 0; the electric field will be only in the y - direction]. [8+8]

8. (a) Explain the terms

i. Motional EMF

ii. Static EMF

(b) A copper wire carries a conduction current of 1 Amp. Determine the displacement current in the wire at 1 MHz. for copper $\varepsilon = \varepsilon_o$ and $\sigma = 5.8 * 10^7$ Siemens/m. [8+8]

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Code No: R05210205 **R05** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
ELECTROMAGNETIC FIELDS
Common to Electronics And Control Engineering, Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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   i. Motional EMF
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   (b) A copper wire carries a conduction current of 1 Amp. Determine the displacement current in the wire at 1 MHz. for copper $\varepsilon = \varepsilon_o$ and $\sigma = 5.8 * 10^7$ Siemens/m. [8+8]

2. The region in free space enclosed by planes z = 0, and 3 cm and by cylinders ρ = 5 and7 cm, forms a toroid with a rectangular cross section. A surface current K = 600 a_z A/m flows on the inner surface.
   (a) Determine the H within the solenoid.
   (b) Determine the scalar magnetic potential within the toroid if the scalar magnetic potential is zero at ρ = 6 cm, φ = 0.6 rad., z = 2 cm. [8+8]

3. Applying Ampere's current law to differential element obtain the Maxwell's equation ∇ X H = J. [16]

4. (a) Obtain the expression for the force experienced by a current carrying conductor kept in magnetic field.
   (b) A current of 6 Amp flows from M (2, 0, 5) to N (5, 0, 5) in a straight solid conductor in free space. An infinite current filament lies along z- axis and carries 50 Amp current in a_z direction. Compute the vector torque on the wire segment using an origin, at (3, 0, 0). [8+8]

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6. (a) Derive Poisson's and Laplace's equations.

(b) The infinite zx-plane carries a uniform surface charge density and is in free space. Find the potential in the region y > 0, by solving Laplace's equation, given that the potential at y = 0 is 100 V; and at y = 1 m it is 0 V. Also find the charge density on the plane. [Hint: For y > 0; the electric field will be only in the y - direction]. [8+8]

7. (a) i. A steady current element $10^{-3}a_z$ A-m is located at the origin in free space. What is the magnetic field $\overline{B}$ due to this element at the point (1,0,0) m (in rectangular coordinates)?

   ii. What is the magnetic field at the point (0,0,1) m?

   (b) Find $\overline{B}$ due to a straight length ℓ m of steady current I A at a distance of y m from the center of the line current. [6+10]

8. (a) Define the electric displacement vector $\overline{D}$ in the presence of dielectrics. Obtain the expression for its divergence.

   (b) A conducting sphere of radius 20 cm is surrounded up to a radius of 1 m by a linear dielectric of dielectric constant 2. An external charge of 1 nC is placed on the conductor. Find the bound surface charge densities. [8+8]

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Code No: R05210205 **R05** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
ELECTROMAGNETIC FIELDS
Common to Electronics And Control Engineering, Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the electric displacement vector $\overline{D}$ in the presence of dielectrics. Obtain the expression for its divergence.
   (b) A conducting sphere of radius 20 cm is surrounded up to a radius of 1 m by a linear dielectric of dielectric constant 2. An external charge of 1 nC is placed on the conductor. Find the bound surface charge densities. [8+8]

2. (a) Explain the terms
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   (b) A copper wire carries a conduction current of 1 Amp. Determine the displacement current in the wire at 1 MHz. for copper $\varepsilon = \varepsilon_o$ and $\sigma = 5.8 * 10^7$ Siemens/m. [8+8]

3. (a) Derive Poisson's and Laplace's equations.
   (b) The infinite zx-plane carries a uniform surface charge density and is in free space. Find the potential in the region y > 0, by solving Laplace's equation, given that the potential at y = 0 is 100 V; and at y = 1 m it is 0 V. Also find the charge density on the plane. [Hint: For y > 0; the electric field will be only in the y - direction]. [8+8]

4. (a) i. A steady current element $10^{-3}a_z$ A-m is located at the origin in free space. What is the magnetic field $\overline{B}$ due to this element at the point (1,0,0) m (in rectangular coordinates)?
      ii. What is the magnetic field at the point (0,0,1) m?
   (b) Find $\overline{B}$ due to a straight length ℓ m of steady current I A at a distance of y m from the center of the line current. [6+10]

5. Applying Ampere's current law to differential element obtain the Maxwell's equation ∇ X H = J. [16]

6. The region in free space enclosed by planes z = 0, and 3 cm and by cylinders ρ = 5 and7 cm, forms a toroid with a rectangular cross section. A surface current K = 600 a_z A/m flows on the inner surface.
   (a) Determine the H within the solenoid.
   (b) Determine the scalar magnetic potential within the toroid if the scalar magnetic potential is zero at ρ = 6 cm, φ = 0.6 rad., z = 2 cm. [8+8]

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8. (a) Obtain the expression for the force experienced by a current carrying conductor kept in magnetic field.
   (b) A current of 6 Amp flows from M (2, 0, 5) to N (5, 0, 5) in a straight solid conductor in free space. An infinite current filament lies along z- axis and carries 50 Amp current in a_z direction. Compute the vector torque on the wire segment using an origin, at (3, 0, 0). [8+8]

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