Code No: RT21025 **R13** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
ELECTRO MAGENETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Discuss about electric potential. (3M)
   b) Write about dielectric constant and dielectric strength. (4M)
   c) Explain about magnetic flux and magnetic flux density. (4M)
   d) Discuss about force on a moving charge. (4M)
   e) What is mutual inductance? Explain. (3M)
   f) Explain the concept of displacement current. (4M)

PART –B

2. a) Derive the expression for electric field intensity due to surface charge placed on x = 0 plane. (8M)
   b) Given $V = 5x^3y^2z$ and $\varepsilon = 2.25\varepsilon_0$, find (8M)
   (i) **E** at point P(-3, 1, 2) (ii) ρ_v at P.

3. a) Derive the boundary conditions for electric fields. (8M)
   b) Derive the expression for capacitance of a coaxial capacitor of inner radius 'a', outer radius of 'b' and length L. (8M)

4. a) State and explain Ampere's circuit law. (8M)
   b) A square conducting loop 3 cm on each side carries a current of 10 A. Calculate the magnetic field intensity at the center of the loop. (8M)

5. a) With necessary equations, Explain about force between two differential current elements. (8M)
   b) A small circular loop of radius 10 cm is centered at the origin and placed on the z = 0 plane. If the loop carries a current of 1 A along $\mathbf{a}_\varphi$, calculate: (8M)
   (i) The magnetic moment of the loop
   (ii) magnetic field intensity at (2, 2, 2)

6 Calculate the self inductance per unit length of an infinitely long solenoid. (16M)

7. a) Explain about all Maxwell equations along with word statements. (8M)
   b) In a medium is characterized by $\mu = \mu_0$, $\varepsilon = \varepsilon_0$ and $\sigma = 0$. If $\mathbf{E} = 20 \sin (10^8 t - \beta z)$ $\mathbf{a}_y$ V/m. calculate β and **H.** (8M)

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Code No: RT21025 **R13** SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
ELECTRO MAGENETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Write about line charge, surface charge and volume charge. (4M)
   b) Calculate the capacitance of a parallel plate capacitor having a mica dielectric $\varepsilon_r = 6$, a plate area of 6.45×10^{-3} m^2 and a separation of 0.254 mm. (4M)
   c) Write about point form of ampere's circuit law. (4M)
   d) Discuss about force on differential current element. (4M)
   e) What is internal inductance and external inductance? Explain. (3M)
   f) Distinguish the terms static fields and time varying fields. (3M)

PART –B

2. a) Derive the Relationship between electric field and electric potential. (8M)
   b) A Charge of -0.3 μC is located at A(25, -30, 15) (in cm) and a second charge of 0.5 μC is at B(-10, 8, 12) cm. Find **E** at (i) the origin (ii) P(15, 20, 50) cm (8M)

3. a) Discuss about behavior of conductors in presence of an electric field. (8M)
   b) The point charges -1 nC, 4 nC and 3 nC are located at (0, 0, 0), (0, 0, 1) and (1, 0, 0) respectively. Find the energy in the system. (8M)

4. a) Derive the expression for magnetic field intensity due to infinite sheet of current. (8M)
   b) A current filament carrying a current 15 A in $\mathbf{a_z}$ direction lies along entire Z-axis. Find **H** in Cartesian coordinates at (i) (2, 0, 4) (ii) (2, -4, 4) (8M)

5. a) With necessary equations, explain the concept of Magnetization in materials. (8M)
   b) Explain how a small current loop can be treated as a magnetic dipole. (8M)

6. Determine the self inductance of a coaxial cable of inner radius 'a' and outer radius 'b'. (16M)

7. a) Discuss about transformer EMF and motional EMF. (8M)
   b) A parallel plate capacitor with plate area of 5 cm^2 and plate separation of 3 mm has a voltage 50 sin 10^3t V applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$. (8M)

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Code No: RT21025 **R13** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
ELECTRO MAGENETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What is Gauss Law? Explain. (3M)
   b) What is meant by boundary condition? How they are useful? Explain. (4M)
   c) Explain the concept of non existence of isolated magnetic pole. (4M)
   d) Explain about Lorentz force equation. (3M)
   e) Write analogy between electric and magnetic circuits. (4M)
   f) Write Maxell equations in point form. (4M)

PART -B

2. a) Derive the expression for electric field intensity due to line charge. (8M)
   b) Two point charges -4μC and 5μC are located at (2, -1, 3) and (0, 4, -2) respectively. Find the potential at (1, 0, 1) assuming zero potential at infinity. (8M)

3. a) Derive the expression for equation of continuity. (8M)
   b) Determine the relaxation time for each of the following media: (8M)
   (i) Hard rubber ($\sigma = 10^{-15}$ S/m, $\varepsilon = 3.1\ \varepsilon_0$)
   (ii) Mica ($\sigma = 10^{-15}$ S/m, $\varepsilon = 6\ \varepsilon_0$)
   (iii) Distilled water ($\sigma = 10^{-4}$ S/m, $\varepsilon = 80\ \varepsilon_0$)

4. a) State and explain Boit-Savart's Law. (8M)
   b) Planes z = 0 and z = 4 carry current $\mathbf{K} = -10\ \mathbf{a_x}$ A/m and $\mathbf{K} = 10\mathbf{a_x}$ A/m, respectively. Determine **H** at (1, 1, 1) and (0, -3, 10). (8M)

5. a) Discuss about Torque on a current loop placed in a magnetic field. (8M)
   b) A charged particle has mass 2 kg and charge 3 C. it starts at point (1, -2, 0) with velocity $4\mathbf{a_x} + 3\mathbf{a_z}$ m/s in an electric field $12\ \mathbf{a_x} + 10\ \mathbf{a_y}$ V/m. At time t = 1s, determine (8M)
   (i) The acceleration of the particle (ii) Its velocity

6. Explain the concept of self inductance and mutual inductance. (16M)

7. a) What is poynting theorem and poynting vector? Explain. (8M)
   b) In a certain material, $\mu = \mu_0$, $\varepsilon = \varepsilon_0\varepsilon_r$ and $\sigma = 0$. If $\mathbf{H} = 10 \sin (10^8 t - 2x)\ \mathbf{a_z}$ A/m. find $\mathbf{J_d}$, **E** and ε_r. (8M)

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Code No: RT21025 **R13** SET - 4

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
ELECTRO MAGENETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) State and explain Coulomb's law. (4M)
   b) Discuss about convection current. (3M)
   c) What is law of conservation of magnetic flux? Explain. (4M)
   d) Define magnetic dipole and dipole moment. (3M)
   e) Explain the concept of flux linkage and inductance. (4M)
   f) Write Maxwell equations for time varying fields. (4M)

PART -B

2. a) Explain the Laplace and Poisson's equations for electrostatic fields. (8M)
   b) Using Gauss Law, derive the expression for the electric field intensity at any point inside and outside of a sphere of radius 'a' due to a uniform spherical charge distribution of volume charge density of 'ρ'. (8M)

3. a) What is meant by electric dipole? Derive the expression for electric field intensity due to electric dipole. (8M)
   b) Two dipoles with dipole moments -5 $\mathbf{a_z}$ nC/m and 9 $\mathbf{a_z}$ nC/m are located at points (0, 0, -2) and (0, 0, 3) respectively. Find the potential at the origin. (8M)

4. a) Derive the expression for magnetic field due to an infinitely long straight filament carrying a direct current I. (8M)
   b) Calculate the value of vector current density in Cartesian coordinates at P(2, 3, 4) if $\mathbf{H} = x^2z\,\mathbf{a_y} - y^2x\,\mathbf{a_z}$ (8M)

5. a) What are the different classifications of materials in terms of magnetic properties? Explain. (8M)
   b) An electron with velocity $\mathbf{u} = (3\mathbf{a_x} + 12\mathbf{a_y} - 4\mathbf{a_z}) \times 10^5$ m/s experiences no net force at a point in magnetic field $\mathbf{B} = 10\,\mathbf{a_x} + 20\,\mathbf{a_y} + 30\,\mathbf{a_z}$ mWb/m^2. Find **E** at that point. (8M)

6. Derive the expression for energy in a magnetostatic field. (16M)

7. a) What is the inconsistency in Ampere's circuit law? Explain. (8M)
   b) A conductor with cross sectional area of 10 cm^2 carries a conduction current $0.2\sin 10^9 t$ mA. Given that $\sigma = 2.5 \times 10^6$ S/m and $\varepsilon_r = 6$, calculate the magnitude of the displacement current density. (8M)

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