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

II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
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) Define the electric field intensity and write the equation for a point charge. (4M)
   b) Write ohm's law in point form. (3M)
   c) Derive expression for Point form of Ampere's circuital law (4M)
   d) Write Lorentz force equation (3M)
   e) Define self and mutual inductance. (4M)
   f) What are differences between the statically and dynamically induced emfs and give the example for each one. (4M)

PART -B

2. a) Derive the expression for the electric field intensity due to a line charge. (8M)
   b) Calculate the force on a unit positive charge at P(x=2m, y=0) due to the charges Q1 at origin and Q2 at (x=1m, y=0) where Q1 = 1000 pico coulombs Q2 = -2000 pico coulombs. (8M)

3. a) Differentiate the convection current density and conduction current density. (8M)
   b) Derive the expression for energy stored in static energy filed. (8M)

4. a) Derive an expression for the magnetic field strength at the center of a square loop of side 'a' m and N turns. (8M)
   b) Develop an expression for the magnetic filed at any point on the line through the centre at a distance 'h' from the centre and perpendicular to the plane of a plane circular loop of radius 'a' and carrying current 'I' amperes. (8M)

5. a) What is a magnetic dipole and explain How does a magnetic dipole differ from an electric dipole. (8M)
   b) Derive the expression for Torque produced on a closed current carrying when placed in a magnetic field. (8M)

6. a) Derive the expressions for self inductance of Solenoid. (8M)
   b) Find the mutual inductance between two toroidal windings which are closely wound on iron core of relative permeability 300. The mean radius of the core is 7cm and radius of its cross-section is 3cm. The winding has 400 and 600 turns for windings 1and 2 respectively. (8M)

7. a) In a material for which $\sigma = 5.5 mho/m$ and $\varepsilon_r = 1$, the electric field intensity is E =200 sin 10^9 t U_x V/m. Determine the conduction and displacement current densities and the frequency at which they have equal magnitude. (8M)
   b) Write Maxwell's equations in (i) point form (ii) integral form. Explain the significance of each equation. (8M)

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II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
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 the Laplace's and Poisson's equations and their physical significance. (3M)
   b) Write behavior of conductors in an electric field. (3M)
   c) Write the statement of Amperes circuital law (4M)
   d) Define the magnetic dipole and magnetic dipole moment. (4M)
   e) Write the expression for force produced between two straight long current carrying wires. (4M)
   f) Write the Maxwell's equations in integral form for time varying fields. (4M)

PART –B

2. a) Explain the behavior of conductors in electric field. (8M)
   b) State and Prove the point form of Gauss's law. (8M)
3. a) A charge of −0.3μC is located at A (25, -30, 15) cm and a second charge of 0.5 μ C is located at B (-10, 8, 12) cm. Find the electric field strength, E at i) The origin and ii) Point P (15, 20, 50) cm (8M)
   b) Four 0.8 nC point charges are located in free space at the corners of a square 4 cm on a side. (i)Find the total potential energy stored.(ii) A fifth 0.8 μC charge is installed at the centre of the square. Again find the total energy stored. (8M)

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4. a) Derive Biot-Savart law and relate it to Amperes law. Show that the divergence magnetic induction is always zero. (8M)

   b) Find H in Cartesian components at P (2, 3, 4) if there is a current filament on the Z axis carrying 8 mA in the a_z direction. (i) Repeat if filament is located at x= -1, y = 2. (ii) Find H if both filaments are present. (8M)

5. a) Derive an expression for force per meter length between two straight long parallel wires situated in space, separated by a distance'd' m carrying a steady current of I amp. in the opposite direction. (8M)

   b) Derive the expression for Torque produced on a closed current carrying when placed in a magnetic field. (8M)

6. A toroid is constructed of a magnetic material having a cross-sectional area of 2.5 cm^2 and an effective length of 8 cm. There is also a short air gap of 0.25 mm length and an effective area of 2.8 cm^2. An mmf of 200 AT is applied to the magnetic circuit. Calculate the total flux in the Toroid if the magnetic material (a) is assumed to have a infinite permeability. (b) is assumed to be linear with $\mu_r = 1000$. (c) is silicon steel. (16M)

7. a) State and explain the faraday's laws in electromagnetic induction in integral form and pointing form. (8M)

   b) State and Explain in statistically induced EMF and dynamically induced EMF (8M)

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

II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
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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 Experimental law of coulomb. (4M)
   b) Define polarization (3M)
   c) Write the differences between the conductors and insulators. (3M)
   d) Write the physical significance of point form of Biot-savarts law. (4M)
   e) Write the Laplace's and poisons equations in magneto statics. (4M)
   f) What are differences between the statically and dynamically induced emfs and give the example for each one. (4M)

PART -B

2. a) State and explain Coulomb's law of electrostatic field in vector form. (8M)
   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. (8M)

3. a) The electric field E in air above a block of paraffin with relative dielectric constant=2.1 is at an angle of 45^0 with respect to the plane surface of the block. Find the angle between E and the surface in the paraffin. (8M)
   b) Derive the continuity equation and write its physical significance. (8M)

4. Derive an expression for magnetic field strength, H, due to a finite filamentary conductor carrying a curent I and placed along Z- axis at a point 'P' on y- axis. Hence deduce the magnetic field strength for the length of the conductor extending from $-\infty$ to $+\infty$ (16M)

5. a) What is a magnetic dipole . How does a magnetic dipole differ from an electric dipole (8M)
   b) Derive the expression for torque on a current loop placed in a magnetic field (8M)

6. a) Derive formula for self-inductance of a solenoid. Use this formula and find self inductance of a solenoid having 400 turns, mean diameter equal to 80 cm and length equal to 5 cm. Assume medium to be air. (8M)
   b) Derive the expression for energy stored in a magnetic field. (8M)

7. a) Write Maxwell's equations in (i) differential form (ii) integral form. Explain the significance of each equation with examples. (8M)
   b) State and Explain in statistically induced EMF and dynamically induced EMF (8M)

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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 the physical significance of divergence and curl of vector field. (4M)
   b) Define polarization. (3M)
   c) Write the statement of Amperes circuital law. (4M)
   d) Enumerate the differences between scalar magnetic potential and vector magnetic potential. (4M)
   e) Define self and mutual inductance. (3M)
   f) Write the Maxwell's equations in integral form for time varying fields. (4M)

PART –B

2. a) State and prove Gauss's law in integral form, considering static charges in free space. (8M)
   b) charge of 0.2 micro coulombs is acted upon by a force of 0.1N, in the presence of another charge of 0.45μc. Determine the distance between the two charges. Take the medium as air. (8M)

3. a) Find electric potential due to electric dipole. (8M)
   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. (8M)

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4. a) Starting from Biot - Savart's law, obtain the expression for the magnetic field $\bar{B}$ due to a steady surface current in free space. (8M)

   b) A steady current of 10 A is established in a long straight hollow aluminum conductor having inner and outer radius of 1.5 cm and 3 cm respectively. Find the value of B as function of radius. (8M)

5. a) Derive the Lorentz force equation. (8M)

   b) A long straight conductor lying along the z-axis carries a current of 20 A in the positive direction of z-axis. If the magnetic flux density is $(3u_x + 7u_y)$ wb/m^2, determine the force per meter length of the conductor. (8M)

6. a) Derive the expression for energy stored in a magnetic field (8M)

   b) A toroidal coil of 400 turns is wound on a steel ring of 20cm mean diameter and 2×10^{-2} m^2 cross-sectional area. An excitation of 5000 Am^{-1} produces a flux density of 1.5 tesla. Calculate the inductance of the coil. If a 20mm long gap is cut in the ring, calculate the current required to maintain the flux density at 1.5 tesla. Also calculate the inductance under these new conditions. Neglect all leakage and fringing. (8M)

7. a) Derive the expressions for statically and dynamically induced emf's (8M)

   b) Define pointing vector and derive the expression for pointing theorem. (8M)

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