Code No: R21029 **R10** SET - 1

II B. Tech I Semester Supplementary Examinations, September - 2014
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) State and explain Gauss law in differential form and also list the limitations of Guess law.
   b) A square sheet defined by $-2 \le x \le 2m$, $-2 \le y \le 2m$ lies in the $z = -2m$ plane. The charge density on the sheet is $\rho_s = (x^2+y^2+z^2)^{3/2}$ nC /m^2. Calculate the electric field intensity at the origin.

2. a) Derive Poisson's and Laplace's equations from the fundamentals.
   b) Derive the expression for torque developed on dipole placed in a magnetic field.

3. a) Derive the condition that exist of the boundary between two perfect dielectrics separated by a sharp boundary.
   b) Using Laplace equations, obtain the expression to the capacity of a parallel plate condenser.

4. Using Biot- Savart's law, derive an expression for inductance per unit length of a long coaxial cable with radii of inner and outer conductors as 'a' and 'b' (b>a) respectively.
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Code No: R21029 **R10** SET - 1

5. a) Derive the Maxwell's third equation and explain its importance.
   b) A square loop 10 cm on a side has 500 turns that are closely and tightly wound and carries a current of 120 A. Determine the magnetic flux density at the centre of the loop.

6. Writer a shot notes on the following:
   a) Lorentz force equation.
   b) Magnetic dipole and dipole moment.

7. a) Derive an inductance of a solenoid.
   b) Calculate the inductance of a solenoid of 2000 terns wound uniformly over a length of 0.5m an a cylindrical paper tube of 0.04m in diameter the medium is air.

8. a) Derive Maxwell's equation based on Ampere's circuit law for a time varying field.
   b) A parallel plate capacitor with plate area of $5cm^2$ and plate separation of 3mm has a voltage $50sin\ 10^3t$ V applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$.

Code No: R21029 **R10** SET - 2

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ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) A circular ring of charge with radius 5m lied in z = 0 plane with centre at origin. If the line charge density is 10 nC/m. Find the pint charge a placed at the origin. Which will produce same E at the point (0, 0, 6) m.
   b) Determine the electric field intensity due to infinite line charge, at a point perpendicular to its plane and at a gives distance from the line charge from first principle.

2. a) Differentiate and explain conductors, insulators and dielectrics.
   b) Derive Poisson's and Laplace equations starting from point form of Gauss Law.
   c) Derive an expression for torque due to a dipole that is present in an electric field.

3. a) Obtain the expression for energy and energy density in an electric field.
   b) Express ohm's law in point form and also describe equation of continuity.

4. a) Currents $I_1 = I_2 = 10A$ flows in opposite directions through two long parallel wires, separated by 15cm. Find the magnitude and direction of the MFI at any point 15cm away from each other.
   b) Show that $\nabla .B = 0$.

5. a) Find the magnetic field intensity at centre of a square of sides equal to 5 m and carrying a current equal to 10 A.
   b) A current sheet $K_1 = \frac{8}{\mu_0}\vec{a}_y$ A/m, at x=0 separates region 1, x < 0 and μ_{r1}=3, from region 2, x > 0 and μr2=1. Given $H_1 = \frac{10}{\mu_0}(\vec{a}_y + \vec{a}_z)$ A/m. Find H_2.

6. Explain the following:
   a. Torque on a current loop placed in a magnetic field.
   b. Force on a straight long conductor carrying a current in a magnetic field.

7. a) Drive the expression for mutual inductance between a straight long wire and a square loop wire in the same place.
   b) Derive the expression for energy density in a magnetic field.

8. Write and explain differential and integral forms of Maxwell's equation and also mention them for fields varying harmonically with time.
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Code No: R21029 **R10** SET - 3

II B. Tech I Semester Supplementary Examinations, September - 2014
ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) Prove that the electric field intensity is the negative gradient of potential.
   b) State and explain Gauss law. What are the limitations of Gauss law?

2. a) Find the potential function and electric field intensity for the region between two concentric right circular cylinders where V=0 at r=0.1 cm and V=750 at r=10 cm. Assume free spacing and neglect fringing.
   b) Two point charges Q_1=4nC and Q_2=-2nC are kept at (2,0,0) and (6,0,0). Express electric field at (4, -1, 2).

3. a) Derive the continuity equation.
   b) What is displacement current? Find the displacement current density with a parallel plate capacitor having dielectric with $\in_r = 8$, area of plates = $0.01m^2$, distance of separation = 0.05 mm and the capacitor voltage is 200 sin 200t.

4. a) Derive the expression for magnetic field intensity at the center of a circular wire.
   b) A circuit carrying a direct current of 8A forms a regular hexagon inscribed in a circle of radius 0f 1.5 m. Calculate the magnetic flux density at the centre of the hexagon. Assume the medium to be free space.

5. a) Discuss the application of Amperes current law for unsymmetrical surfaces.
   b) Find the magnetic field intensity at centre of a square of sides equal to 10 m and carrying a current equal to 75 A.

6. a) Derive the torque expression on a current loop placed is a magnetic field.
   b) Explain magnetic dipole and dipole moment.

7. a) Derive the expression for self Inductance of solenoid
   b) A solenoid of 10 cm in length consists of 1000 turns having the cross section radius of 1 cm. Find the inductance of solenoid. What is the value of current required to maintain a flux of 1 milli-Wb in the toroid. Take $\mu_r = 1500$.

8. a) Explain Faraday's law of electromagnetism.
   b) State and explain Poynting theorem.
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Code No: R21029 **R10** SET - 4

II B. Tech I Semester Supplementary Examinations, September - 2014
ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) State and explain Gauss's law of electromagnetic is the integral form.
   b) Using Gauss's law in integral form, obtain the electric field at all points due to the following volume charge distribution, in cylindrical coordinates.

2. a) In spherical coordinates V=0 for r=0.1 and V=100 for r=2 m. Find the potential function. Use Laplace's equation.
   b) A uniform charge density of ρ_v C/m^2 exists throughout the volume of a sphere of radius '*b*' meters. Using Poisson's equation, find the value of electric filed intensity and potential at any point inside the sphere for which $0 <= r <= b$.

3. a) Explain and derive the boundary conditions for a dielectric-dielectric interface.
   b) A capacitor consists of two infinite parallel conducting plates 10cm apart. The space between conductors consists of two layers, each of 5cm thick. One layer has $\in_r = 10$ and the other layer is an air. If the potential difference of 125V is applied to the capacitor, Find:
   i) Magnitude of $\overline{D}$ and $\overline{E}$ both layers. ii) Energy density.

4. A circular loop of wire of radius 'r' lying in xy plane with its centre at origin carries a current 'I' is the $+\phi$ direction. Using Biot- savart law find H(0, 0, Z) and H(0, 0, 0)

5. a) Derive the expression for point form of Ampere's circuital law.
   b) A current sheet $K_1 = 10\vec{a}_z$ A/m lies in the x=4 m plane and second sheet $K_2 = -8\vec{a}_z$ A/m is at x=-5m. Find $\overline{H}$ in all regions.

6. a) When current carrying wire is placed in a uniform magnetic field show that torque experienced by it is $\overline{T} = \overline{m} \times \overline{B}$.
   b) A current of 10 A flows in each of two conducting wires parallel to each other. The separation between the wires is 2 cm. Find the force per unit length of one of the wires.

7. Derive an expression for mutual inductance between a straight long wire and a square loop wire in the same plane.

8. a) Explain poynting theorem and poynting vector.
   b) Starting from Faraday's law of electromagnetic induction, derive $\nabla \times E = -\frac{\partial \vec{B}}{\partial t}$.
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