MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper-I

ELECTROMAGNETIC FIELDS

II YEAR I SEMESER

EEE

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I **5*14=70M**

1.a) Derive the expression for electric field intensity due to line charge.

b) 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. [7+7]

(OR)

2.a) Explain the Laplace and Poisson's equations for electrostatic fields.

b) Using Gauss law, derive an expression for 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'. [7+7]

SECTION-II

3.a) Derive the expression for energy stored and energy density in static electric field.

b) A parallel plate capacitor consists of two square metal plates of side 500 mm and separated by a 10 mm slab of Teflon with $\epsilon_r = 2$ and 6 mm thickness is placed on the lower plate leaving an air gap of 4mm thick between it and upper plate. If 100 V is applied across the capacitor, find D, in Teflon and air. [7+7]

OR

4.a) State and prove the conditions on the tangential and normal components of electric flux density and electric field intensity, at the boundary between the dielectrics.

b) A square parallel plate capacitor 200 mm on side with a plate spacing of 25 mm is filled with a dielectric slap (ε_r =240 of the same dimensions if 100 V is applied to the capacitor) Find: (i) the polarization P in the dielectric and (ii) the energy stored by the capacitor.

[7+7]

SECTION-III

5.a) State Biot-Savart's law for magnetic field B due to a steady line current in free space.

b) Derive an expression for magnetic field intensity due to infinite sheet of current. [7+7]

OR

6.a) 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

b) Derive an expression for the magnetic field strength at the center of a square loop of side 'a' meters and N turns. [7+7

SECTION-IV

7.a) Derive point form of Ampere's circuital law.

b) Two infinitely long parallel conductors are separated by a distance '*d*'. Find the force per unit length exerted by one of the conductor on the other if the currents in the two conductors are I_1 and I_2. [7+7]

OR

8.a) Derive the expression for inductance of a solenoid.

b) A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 meter apart. The conductors carry currents of +100 and -100 amperes respectively. Determine the magnetic field intensity at the surface of each conductor and also exactly midway between A and B. [7+7]

SECTION-V

9.a) A conductor with cross sectional area of 10 cm^2 carries a conduction current of $0.2 \sin(109t)$ mA. Given that $\sigma = 2.5 \times 10^6$ S/m and $\varepsilon_r = 6$, calculate the magnitude of the displacement current density.

b) Derive the Maxwell's equations in point and integral form for time varying fields. [7+7]

OR

10.a) Explain the concept of displacement current and obtain an expression for the displacement current density.

b) Derive Maxwell's fourth equation, $\nabla \times E = -\frac{\partial B}{\partial t}$. [7+7]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper-II

ELECTROMAGNETIC FIELDS

II YEAR I SEMESER

EEE

Time: 3 hours **Max Marks:70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

5*14=70M

SECTION-I

1.a) Three equal positive charges of 4×10^{-9} coulomb each are located at three corners of a square, side 20cm. determine the electric field intensity at the vacant corner point of the square.

b) State and explain Maxwell's first law. [7+7]

OR

2.a) What is an electric dipole? Obtain expression for torque experienced by an electric dipole in a uniform electric field.

b) Derive the expression for Potential gradient. [7+7]

SECTION-II

3.a) Derive the expression for the energy stored in the charged condenser.

b) The capacitance of a parallel plate condenser is 0.2μF. Potential difference between the plates is 2V. Calculate the energy stored by the charged condenser. [7+7]

OR

4.a) Differentiate static electric and magnetic fields.

b) Derive Equation of continuity. What is its significance? [7+7]

SECTION-III

5.a) Find the Magnetic Field Intensity due to a straight current carrying filament.

b) Find the magnetic field intensity at the centre O of a square loop of sides equal to 5M and carrying 10A of current. [7+7]

OR

6.a) State Ampere's circuital law and prove the same.

b) In the region 0 < r < 0.5m, in cylindrical co-ordinates, the current density is $J = 4.5e^{-2r}\hat{a}_z\left(A/m^2\right)$ and J = 0 elsewhere. Use Amperes law to find H [7+7]

.

SECTION-IV

7.a) Derive an expression for magnetic field strength H, due to a current carrying conductor of finite length placed along the y-axis, at a point P in x-z plane and r distant from the origin.

b) What is scalar magnetic potential? Give its limitations. [7+7]

OR

8.a) A toroid with cross section of radius 2cm has a silicon steel core of mean length 28cm and an air gap of length 1mm. Assume the air-gap area is 10% greater than the adjacent core and find the mmf required to establish an air-gap flux of 1.5 mwb.

b) Explain the concept self and mutual inductances. [7+7]

SECTION-V

9. Write Maxwell's equation for static fields. Explain how they are modified for time varying electric and magnetic fields. [14]

OR

10.a) Generalize Ampere's law for time varying fields.

b) In a material for which $\sigma = 5.0$ s/m and $\in r = 1$, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities and the frequency at which they have equal magnitudes. [7+7]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper-III

ELECTROMAGNETIC FIELDS

II YEAR I SEMESER

EEE

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

5*14=70M

SECTION-I

1.a) Determine the potential a (0,0,4) m caused by a total charge 10^{-8} C distributed uniformly along a disc of radius 4m lying in the z=0 plane and centered at origin.

b) Define work done and electric potential. Show that the electric field intensity is negative gradient of potential. [7+7]

OR

2.a) Find the value of electric field intensity at any point along the axis of a uniformly charged disc.

b) State Gauss law and mention few applications of it. [7+7]

SECTION-II

3.a) What is an electric dipole and dipole moment? Derive an expression for torque experienced by an electric dipole.

b) A parallel plate capacitor has conducting plates of area equal to $0.04m^2$. The plates are separated by a dielectric material whose $\epsilon_r = 2$ with the plate separation of 1cm. Find its capacitance value. [7+7]

OR

4.a) Derive the boundary conditions of two dielectric media.

b) Explain about equation of continuity in electrostatic fields. [7+7]

SECTION-III

5.a) Using ampere's circuital law, find MFI due to an infinite sheet of current.

b) What is the magnetic field, H in Cartesian coordinates due to z- directed current element? Find **J** if I=2A.

OR

6.a) What is meant by Curl? Give its significance.

b)A steady current of I amperes flow in a circular bent in the form of square loop of side 'a'. Find the MFI (H) at the center of the loop.

[7+7]

SECTION-IV

8.a) Find the force between two straight long and parallel current carrying conductors in the same and opposite directions.

b) Explain the concept of scalar and vector magnetic potentials. [7+7]

OR

9.a) Find the inductance of Solenoid.

b) Derive the expression for energy stored and energy density in a magnetic field. [7+7].

SECTION-V

10. Write Maxwell's equations in point form and explain physical significance of the equations. [14]

OR

11.a) State and explain the Faraday's laws in electromagnetic induction.

b)Explain statically and dynamically induced e.m.fs. . [7+7]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper-IV

ELECTROMAGNETIC FIELDS

II YEAR I SEMESER

EEE

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

5*14=70M

SECTION-I

1.a) If V=2x2y+20z-(4/(x2+y2)) Volts, Find ***E*** and ***D*** at P (6,-2.5,3)

b) Derive Laplace and Poisson equation. [7+7]

OR

2.a) A circular disc of radius 'a' m is charged uniformly with a charge density of σ c/ m^2. Find the electric field at a point 'h' m from the disc along its axis.

b) What is an electric dipole? Obtain expression for torque experienced by an electric dipole in a uniform electric field. [7+7]

SECTION-II

3.a) Show the expression of the capacitance for a spherical capacitor consists of 2 concentric spheres of radius 'a'&'b' also obtain the capacitance for an isolated sphere.

b) Find the capacitance of a conducting sphere of 2 cm in diameter, covered with a layer of polyethelene with $\in r$ = 2.26 and 3 cm thick. [7+7]

OR

4.a) Derive an expression for capacitance of co-axial cable.

b) In a material for which σ = 5.0 s/m and $\in$ r = 1, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities.

[7+7]

SECTION-III

5.a) Using Biot-Savart's law, find the magnetic field intensity on the axis of a circular loop with radius R and carrying a steady current I.

b) Find the magnetic field intensity at the centre of square loop of side 5m carrying 10A of current. [7+7]

OR

6.a) State Ampere's circuital law and explain any two applications of Ampere's circuital law.

b) Derive the equation to show that curl of magnetic field intensity in equal to current density. [7+7]

SECTION-IV

7.a) Show that the force between two parallel conductors carrying current in the same direction is attractive.

b) A magnetic field, $B = 3.5 \times 10^{-2}$along the x-axis. If the conductor current is 5 A in the -A_x direction, what force must be applied to hold the conductor in position. [7+7]

OR

8.a) Derive the expression for self inductance of a coaxial cable of inner radius 'a' and outer radius 'b'.

b) Determine the inductance of a solenoid of 2500 turns wound uniformly over a length of 0.25m on a cylindrical paper tube, 4 cm in diameter and the medium is air. [7+7]

SECTION-V

9.a) Write Maxwell's equations in integral form for time varying Fields.

b) Generalize Ampere's law for time varying fields. [7+7]

OR

10.a) State and explain Faraday's laws of electromagnetic induction.

b) In a material for which $\sigma = 5.0$ s/m and $\in r = 1$, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities, and the frequency at which they have equal magnitudes. [7+7]