Code No: 133AP **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, December - 2019
ELECTROMAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) State Coulomb's law. [2]
b) Differentiate between conductors and insulators. [3]
c) What is conduction current? [2]
d) Derive the expression for energy density in a static electric field. [3]
e) State Biot-Savart's Law. [2]
f) Define magnetic field intensity, magnetic flux density. What is the relationship between these two? [3]
g) Define magnetic dipole-moment. [2]
h) List the properties of vector magnetic potential. [3]
i) What is Displacement current? [2]
j) List Maxwell's equations for time varying fields. [3]

PART-B

(50 Marks)

2.a) Using Gauss law, derive the expression for electric field intensity due to an infinite length of line charge.
b) Two 6nC point charges are located at (1,0,0)and (-1,0,0) in free space. i) Find V at P(0,0,z) ii) Find V_{max} iii) Calculate $|\frac{dv}{dz}|$on the z-axis. [6+4]

OR

3.a) Derive the expressions for Electric field intensity and potential due to an electric dipole.
b) An electric dipole located at the origin in free space has a moment **p = 3 a_x – 2 a_y + a_znC-m**. Find V at: i) P(2,3,4) ii) r=2.5, θ=30^0, φ=40^0. [6+4]

4.a) Derive the boundary conditions for a dielectric dielectric interface.
b) A dielectric sphere of ε_r = 5.7 and of radius 10 cm has a point charge 2 μC placed at its centre. Calculate the surface density of polarization charge on the surface of the sphere. [6+4]

OR

5.a) Derive the expressions for the capacitance of a parallel plate capacitor and the energy stored in it.
b) A parallel plate capacitor having a mica dielectric ε_r = 6, plate area of 625 cm^2 and a separation of 2.5 cm, a potential of 100 V_X is applied. Find the energy stored in the capacitor. [6+4]

6.a) Derive the magnetic field intensity due to an infinite length current carrying conductor by using Biot Savart's law.

b) Find **H** at the centre of an equilateral triangle loop of side 4m carrying 5 A of current lying in x=0 plane and the centroid lies along z axis. [6+4]

OR

7.a) Derive the expression for magnetic field intensity due to infinitely long coaxial transmission line. Use ampere circuital law.

b) A current filament carrying 15 A in $\mathbf{a_z}$ direction lies along entire Z-axis. Find magnetic field intensity at: i) A($\sqrt{20}$,0,4) ii) B(-2,4,-4). [6+4]

8.a) Derive an expression for the torque on a current loop placed in a uniform magnetic field and hence define magnetic dipole-moment from this derivation.

b) A small current loop $L_1$with magnetic moment 5 $\mathbf{a_z}$ A/m^2 is located at the origin while another small loop of current L_2 with magnetic moment 3 a_y A/m^2 is located at (4,-3,10). Determine the torque on L_2. [6+4]

OR

9.a) Derive the expressions for the self inductances of a solenoid and a toroid.

b) Two parallel current carrying conductors separated by a distance of 4m carries current of 10 A and 15 A in opposite directions. Find the force on each conductor. Find the field intensity at mid-point between the two conductors. [6+4]

10.a) Derive point form of Ampere circuital law and explain displacement current density from this derivation.

b) A parallel plate capacitor with plate area of 10 cm^2 and a plate separation of 6 mm has a voltage 50 Sin 1000t V applied to its plates. Calculate the displacement current if the relative permittivity of the dielctric between the plates is 6. [6+4]

OR

11.a) State and explain Faraday's laws of electromagnetic induction with some examples.

b) A 30 cm × 40 cm loop rotates at 130 rad/s in a magnetic field 0.06 Wb/m^2 normal to the axis of rotation. If the loop has 50 turns, determine the induced voltage in the loop. [6+4]

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