Code No: **20EE3T03**

R20

II B. TECH I SEMESTER REGULAR EXAMINATIONS, MARCH - 2022
ELECTROMAGNETIC FIELDS
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3 Hours **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Summarize the properties of potential gradient of electrostatic field theory. [7M]

   b) Point charges 1 mC and -2 mC are located at (3, 2, -1) and (-1, -1, 4) respectively. Calculate the electric force on a 10 nC charge located at (0, 3, 1) and the electric field intensity at that point. [7M]

(OR)

2. a) Significance of Gauss's Law in electrostatics fields – Justify your answer with suitable example of its application. [4M]

   b) A circular ring of radius 10 cm carries a uniform charge 10 μC/m and is placed on the xy-plane with axis the same as the z-axis. Find the electric field intensity at (0, 0, 0.6). Also derive the necessary equations. [10M]

UNIT-II

3. a) For given dielectric and dielectric mediums, derive boundary conditions. [7M]

   b) Calculate the total current in outward direction from cube of 4m, with one corner at the origin and edges parallel to the co-ordinates axis if, $J = 2x^2\, a_x + 9y^2x\, a_y + 5xy\, a_z$ A/m^2. [7M]

(OR)

4. a) Demonstrate the electric field inside a dielectric material and also describe the polarization concept in detail. [7M]

   b) A wire of diameter 1mm and conductivity 6×10^7 S/m has 10^{29} free electrons/m^3 when an electric field of 40 mV/m is applied. Determine [7M]

   (i) Charge density of free electrons
   (ii) Current density
   (iii) Current in the wire
   (iv) Velocity of the electrons.
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UNIT-III

5. a) Illustrate the Biot-Savart's law principle and hence derive necessary expression. [7M]

   b) Piece of 5m straight conductor is carrying 90A current. Estimate [7M]

   i) The field intensity at a distance of 3.6m from its centre.

   ii) The flux density

(OR)

6. a) Line integral of H is always equal to net current – Justify with suitable example. [7M]

   b) Determine the magnetic field intensity at the centre of a square of side 'a' meter, if the current through it is 'I' Amperes. [7M]

UNIT-IV

7. a) Prove magnetic dipole moment, $m=IS$ if the current I and surface S in given magnetic field. [7M]

   b) Determine the incremental field intensity at point (1, 3, 10) due to a current element $2\pi a_x - 3a_z$ A is placed at point (4, 0, 0). [7M]

(OR)

8. a) Derive magnetic force due to a current element? [7M]

   b) Derive an expression for the torque acting on a current carrying coil when it is placed in a magnetic field of flux density 'B' Tesla. [7M]

UNIT-V

9. a) Express Maxwell's equations for Moving Loop in Time-varying Field? [7M]

   b) Conducting bar can slide freely over two conducting rails along y-axis. Length of bar is 8cm and placed along x-axis. Calculate the induced emf if the bar is stationed at y=9cm and B=10cos $10^6 t\ a_y$ Wb/m^2. [7M]

(OR)

10. a) Derive the toroid inductance if its mean radius is 'r' with N number turns. [7M]

    b) The toroid coil of 400turns has mean radius of 10cm and radius of toroid ring is 4cm. Determine the inductance of coil by considering relative permeability is 2500. [7M]

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