Hall Ticket No | | | | | | | | | | | Question Paper Code: AEE006

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech III Semester End Examinations (Regular) - December, 2017

Regulation: IARE – R16

ELECTROMAGNETIC FIELD THEORY

(Electrical and Electronics Engineering)

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

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Determine electric field intensity at any point due to an infinite sheet of charge having uniform surface charge density. Verify the result using Gauss's law. **[7M]**

   (b) Obtain the relation between electric field strength and potential. The potential is given as $V = 80x^{0.6}$ V. Assuming free space conditions, find: **[7M]**

   i) E

   ii) Find E if the volume charge density at $\rho = 0.5$ C/m^3

2. (a) State Coulomb's law. Point charges of 50nC each are located at A(1, 0, 0), B(−1, 0, 0), C(0, 1, 0), and D(0,−1, 0) in free space. Find the total force on the charge at A. **[7M]**

   (b) Two point charges located -4 μC and 5 μC are located at (2,-1,3) and (0,4,-2) respectively.Find the potential at (1,0,1) assuming zero potential at infinity. **[7M]**

UNIT – II

3. (a) Find the capacitance of the coaxial cable of inner radius 'a' and outer radius 'b'. **[7M]**

   (b) A parallel plate capacitor has a separation of 1cm. A thin piece of glass with $\varepsilon_r = 6.5$ and thickness 0.2cm is inserted between the plates. The dielectric strength of air is 30 kV/cm and that of glass is 290 kV/cm. If 29 kV is applied across the capacitor find whether glass or air will breakdown. **[7M]**

4. (a) Show that the capacitance of the concentric spheres is $\frac{4\prod\varepsilon}{\frac{1}{a}-\frac{1}{b}}$ where V = 0 at r = b; V = V0 at r = a; b > a. **[7M]**

   (b) Explain **[7M]**

   i) dipole moment and polarization

   ii) point form of Ohm's law

   ii) current and current density

UNIT – III

5. (a) State Biot-Savart's Law. Given points C(5,−2, 3) and P(4,−1, 2); a current element IdL = 10^{-4}[4ax − 3ay + az]Am at C produces a field dH at P. Find dH. **[7M]**

   (b) Assume that there is a region with cylindrical symmetry in which the conductivity is given by $\sigma = 1.5e^{-150\rho}$ kS/m. An electric field of 30 az V/m is present. **[7M]**

   i) Find J

   ii) Find the total current crossing the surface $\rho < \rho_0$, z = 0, all φ.

   iii) Make use of Ampere's circuital law to find H:

6. (a) Within the conductor, H = $10^5\rho^2\mathbf{a}_\varphi$ A/m. Find the value of current density. **[7M]**

   (b) A filamentary conductor on the z axis carries a current of 16A in the a_z direction, a conducting shell at $\rho = 6$ carries a total current of 12 A in the $-a_z$ direction, and another shell at $\rho = 10$ carries a total current of 4A in the $-a_z$ direction. Find H for $0 < \rho < 12$. **[7M]**

UNIT – IV

7. (a) Explain the concept of scalar and vector magnetic potential with necessary expressions. **[7M]**

   (b) A Rectangular loop of wire in free space joins points A(1, 0, 1) to B(3, 0, 1) to C(3, 0, 4) to D(1, 0, 4) to A. The wire carries a current of 6 mA, flowing in the a_z direction from B to C. A filamentary current of 15 A flows along the entire z axis in the a_z direction. Find F on side BC

8. (a) A solenoid of 200 turns wound tightly on a cylindrical tube of length 60cm and of diameter 6cm, given that medium is air. Find the inductance. Derive the formula used. **[7M]**

   (b) Find the force between two parallel current carrying conductors having current in opposite directions. **[7M]**

UNIT – V

9. (a) What is displacement current? Derive the expression for displacement current density from point form of Amperes' circuital law. **[7M]**

   (b) Write short notes on **[7M]**

   i) FDM

   ii) FEM

10. (a) Derive Maxwell's equation from Faraday's law. Also write Maxwell's equations for a general medium for time varying fields. **[7M]**

    (b) Explain statically and dynamically induced emf with necessary equations. **[7M]**