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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Regular) - November, 2018

Regulation: IARE – R16

ELECTROMAGNETIC FIELD THEORY

Time: 3 Hours **(EEE)** **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) Write short note on Gaussian surface and conditions to be satisfied by special Gaussian surfaces. **[7M]**

   (b) State Gauss law. Prove Gauss law for electrostatic fields. **[7M]**

2. (a) Derive an expression for electric field intensity using Electric Dipole. **[7M]**

   (b) Determine whether or not the following potential field satisfy the Laplace equation: **[7M]**
   (i)$V = x^2 - y^2 + z^2$
   (ii) $V = rCos\Phi + z$

UNIT – II

3. (a) Derive the equation of continuity for current with help of principle of conservation of charge. **[7M]**

   (b) A conducting wire of diameter 1mm and conductivity 5x10^7 S/m, has 10^{29} free electrons/m^3 when an electric field of 10mV/m is applied. Determine **[7M]**
   (i) The charge density of free electrons
   (ii) The current density
   (iii) The current in the wire

4. (a) Derive an expression for capacitance of parallel plate capacitor. **[7M]**

   (b) A parallel plate capacitor with area 0.3 m^2 and separation 5.5mm contains three dielectrics with interfaces normal to E and D as follows $\in_{r1} = 3.0$, $d_1 = 1.0mm$ $\in_{r2} = 4.0$, $d_2 = 2.0mm$ $\in_{r3} = 6.0$, $d_3 = 2.5mm$. Find the capacitance. **[7M]**

UNIT – III

5. (a) An infinitely long straight filament carrying a direct current I is placed along z- axis. Apply Biot-Savart's law to calculate the value of magnetic field intensity H at the point (ρ, φ, z). **[7M]**

   (b) Find H, using Biot-Savart's law, at a point on the axis of a circular current loop of radius a. **[7M]**

6. (a) Derive mathematical form of Biot Savarts law with diagram and explain any one application. **[7M]**

   (b) Derive relation between Magnetic flux, Magnetic field intensity and Magnetic flux density. **[7M]**

UNIT – IV

7. (a) Derive an expression for inductance of solenoid. **[7M]**

   (b) A solid conducting filament extends from x = −b to x = b along the line y = 2, z = 0. This filament carries a current of 3A in the a_x direction. An infinite filament on the z-axis carries 5A in the a_z direction. Obtain an expression for the torque exerted on the finite conductor about an origin located at (0, 2, 0) **[7M]**

8. (a) Derive an expression for inductance of Toroid. **[7M]**

   (b) A rectangular coil is composed of 150 turns of a filamentary conductor. Find the mutual inductance in free space between this coil and an infinite straight filament on the z-axis if the four corners of the coil are located at **[7M]**

   (i) (0,1,0), (0,3,0), (0,3,1) and (0,1,1)

   (ii) (1,1,0), (1,3,0), (1,3,1), and (1,1,1)

UNIT – V

9. (a) Discuss in brief about the significance and approach to be used in case of Finite Difference Method for solving problems on EM fields. **[7M]**

   (b) Derive the integral forms of the four Maxwell's equations for time varying fields from the respective point forms. **[7M]**

10. (a) Discuss the application of finite element method to calculate electrostatic and magneto static field. **[7M]**

    (b) Explain the Faradays law of Electromagnetic induction and derive Maxwell equation for faradays law in point and integral form. **[7M]**