Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEB10

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations(Regular) - November, 2019

Regulation: IARE – R18

ELECTROMAGNETIC FIELDS

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) State Coulombs law and obtain expressions for force between the two charges. **[7M]**
   (b) A charge Q_1=-20μC is located at P(-6,4,6), and a charge Q_2=50μC is located at R(5,8,-2), in a free space . Find the force exerted on Q_2 by Q_1 in vector form. **[7M]**

2. (a) State Gauss law. What are applications of Gauss law? **[7M]**
   (b) Calculate the field intensity at a point 2m from the origin, if a positive charge of 10 μC is placed at the origin. **[7M]**

UNIT – II

3. (a) What are boundary conditions for perfect dielectric materials? Elucidate conduction and convection currents. **[7M]**
   (b) A conducting wire of diameter 1mm and conductivity 5x10^7 S/m, has 1029 free electrons/m^3 when an electric field of 10mV/m is applied. Determine
   (i) The charge density of free electrons
   (ii) The current density
   (iii) The current in the wire **[7M]**

4. (a) Obtain the expression for a capacitance of a coaxial cable. **[7M]**
   (b) Find the permitivity and capacitance of a parallel plate capacitor, if the plates are of area 1.5m^2, the distance between the plates is 2mm, potential gradient is 105V/m and flux density on the plates is 2.5 μC/m^2 **[7M]**

UNIT – III

5. (a) With help of Bio-Savart's law find the expression for magnetic field intensity at any point on the axis of a circular current carrying coil. **[7M]**
   (b) A uniform solenoid 100mm in diameter and 400mm long has 100 turns of wire and a current of I=3A . find the magnetic field on the axis of the solenoid
   i) At the center
   ii) At one end
   iii) Half the way. **[7M]**

6. (a) Use Ampere's circuital law to obtain the expression for magnetic field intensity due to infinite sheet of charge. **[7M]**

   (b) Calculate the magnetic flux density at the center of a current carrying loop when the radius of loop is 2cm, loop current in 1A and loop is placed in air. **[7M]**

UNIT – IV

7. (a) Obtain the expression for vector magnetic potential and write are it's properties. **[7M]**

   (b) What is the maximum torque on a square loop of 100 turns in a field of uniform flux density B = 1wb/m^2. The loop has 10cm side and carries a current of 3A. What is the magnetic moment of the loop? **[7M]**

8. (a) Define self inductance and mutual inductance. Obtain self inductance expression for solenoid. **[7M]**

   (b) Two coils A and B with 800 turns and 1200 turns respectively, have a common magnetic circuit. A current of 0.5A in A will produce a flux of 3mwb and 80% of the flux links with coil B. Calculate self inductance of each coil and mutual inductance. **[7M]**

UNIT – V

9. (a) Write and explain differential and integral form of Maxwell's equation for fields varying harmonically with time. **[7M]**

   (b) A conductor of length 100cm moves at right angles to a uniform field of strength 10000 lines per cm^2 , with a velocity of 50 meters/sec. Calculate the emf induced in it. Compute also the value of the induced emf when the conductor moves at an angle of 30 degrees to the direction of the field. **[7M]**

10. (a) Illustrate Faradays law of electromagnetic induction. Deduce the expression for Maxwells form of Faraday's Law. **[7M]**

    (b) In a material for which $\sigma = 5.0(m)^{-1}$ and $\sigma_r = 1$ the electric field intensity is E = 250sin (1010t) V/m. Calculate the conduction and displacement current densities and the frequency at which they have equal magnitudes. **[7M]**