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Question Paper Code:AEEC06

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - FEBRUARY 2023

Regulation:UG20

ELECTROMAGNETIC FIELDS

Time: 3 Hours (ELECTRICAL AND ELECTRONICS ENGINEERING) Max Marks: 70

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Infer the expression for electric field intensity due to an infinite sheet of charge in the XY plane with uniform charge density ρ_s. [BL: Understand| CO: 1|Marks: 7]

   (b) A point charge Q=10nc is located at the origin in cartesian coordinates. Determine the magnitude and direction of electric flux density $\overrightarrow{D}$ at(1,3,4)m. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Write the properties of capacitor. Obtain the expression for the capacitance of a co-axial capacitor using Gauss's law. [BL: Understand| CO: 2|Marks: 7]

   (b) An aluminum conductor is 600m long with a circular cross section and a diameter of 20mm. If a dc voltage of 1.2V is applied between them, find i) The current density ii) The current iii) Power dissipated using the knowledge of circuit theory. Assume σ=3.82x10^7 $\mho$/m for aluminum.
   [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Determine the magnetic field strength due to a solenoid of length 'l' and radius 'a' with N turns carrying a current 'I'. [BL: Understand| CO: 3|Marks: 7]

   (b) Calculate the magnetic flux density due to a coil of 1000 ampere turns and area of 100 cm^2 on the axis of coil at a distance of 10m from the center. [BL: Apply| CO: 3|Marks: 7]

4. (a) Illustrate the expression for magnetic field intensity on the axis of the circular loop carrying a steady current 'I'. [BL: Understand| CO: 3|Marks: 7]

   (b) State Biot-Savart's law. Given points C(5,−2, 3) and P(4,−1, 2); a current element IdL = 10^{-4} $[4\widehat{ax} + 3\widehat{ay} + a\widehat{z}]Am$ at C produces a field dH at P. Find dH.
   [BL: Apply| CO: 3|Marks: 7]

MODULE – IV

5. (a) Derive the torque equation about the Y axis for the two conductors of length 'l' separated by a fixed distance 'w', in the uniform field of flux density. [BL: Understand| CO: 4|Marks: 7]

(b) A point charge Q=-50nc is moving with a velocity of 5x 10^6 m/s in the direction specified by unit vector -0.4$\overrightarrow{a_x}$-0.6$\overrightarrow{a_y}$+0.6$\overrightarrow{a_z}$. Determine the magnitude of the force on a moving charge in the magnetic field of flux density $\overrightarrow{B}$= 2$\overrightarrow{a_x}$-6$\overrightarrow{a_y}$+5$\overrightarrow{a_z}$ mWb/m^2. [BL: Apply| CO: 4|Marks: 7]

6. (a) Find the inductance of a parallel two wire transmission line separated by a distance'd' carrying currents in opposite directions. [BL: Understand| CO: 4|Marks: 7]

(b) Two long parallel conduction carrying 100A. If the conductors are separated by 200mm. Find the force per meter of each conductor if the current flow direction is in opposite direction. [BL: Apply| CO: 4|Marks: 7]

MODULE – V

7. (a) Develop the Maxwell's equations in point form and integral form using Ampere's circuital law and Faraday's law. [BL: Understand| CO: 5|Marks: 7]

(b) Find the conduction and displacement current densities in a material having conductivity of 10^{-3} $\mho$/m and ϵ_r=2.5 if the electric field in the material is E=5.8 x 10^{-6}sin(9 x 10^9t)V/m. [BL: Apply| CO: 5|Marks: 7]

8. (a) From Maxwell's equations, determine the electromagnetic wave equation in dielectric medium (ρ_v=0) for $\overrightarrow{E}$ and $\overrightarrow{H}$ fields. [BL: Understand| CO: 5|Marks: 7]

(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. [BL: Apply| CO: 5|Marks: 7]

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