MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Estd. 2000

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Department of Electrical and Electronics Engineering
Question Bank - Academic Year (2021-22)

Course Code & Course Name : 19EEC01 & Electromagnetic Fields

Name of the Faculty : Ms V.Deepika

Year/Sem/Sec : II/III/A

Unit I: INTRODUCTION
Part-A (2 Marks)

1. What are the sources of electromagnetic fields? (CO1, K1)
2. Transform the Cartesian co-ordinates x=2, y=1 and z=3 into spherical coordinates. (CO1, K2)
3. Given $A=10a_y+3a_z$ and $B=5a_x+4a_y$. Find the angle projection of A and B (CO1,K5)
4. Determine the angle between the vectors $A = 2a_x + 4a_y – a_z$ and $B = 3a_x + 6a_y - 4a_z$ using dot product. (CO1, K5)
5. Identify the physical significance of divergence of vector field? (CO1, K2)
6. Differentiate scalar and vector quantity (CO1, K2)
7. Obtain the Cartesian coordinate system $(r,\theta,z) = 5r^4z^3\sin\theta$ (CO1, K5)
8. Examine that the vector H= (y2 - z2 + 3yz -2x) a_x + (3xz +2xy) a_y + (3xy -2xz +2z) a_z is solenoid (CO1, K4)
9. State Coulomb's law. (CO1, K1)
10. Find the force in newton on charge Q1= 20µC situated at (0, 1, 2) m due to charge Q2=- 300µC situated at (2, 0, 0) m? (CO1, K5)

Part-B (16 Marks)

1. What are the different types of co-ordinate systems used to represent field vectors? and explain any two types. (CO1, K2) (16)
2. (i) Using Divergence theorem, evaluate $\iint_s \bar{F}$ nds Where $\bar{F} = 2xy\,\bar{i} + y^2\,\bar{j} + 4yz\,\bar{k}$ and s is the surface of the cube bounded by x =0, x = 1, y = 0 , y =1 and z = 0, z = 1. (CO1, K5) (8)
   (ii) State and prove divergence theorem (CO1, K1) (8)
3. (i) Write short notes on following Gradient, Divergence, Curl, solenoidal and irrotational (CO1, K1) (6)
   (ii) Derive an expression for electric field due to a line charge distribution (CO1, K2) (10)
4. (a) State and verify divergence theorem for the vector $A = 4x\,\bar{a}_x – 2Y^2\,\bar{a}_y + z^2 a_Z$ c/m^2 taken over the cube bounded by x=0, x=1,y=0,y=1and z=0,z=1 (CO1, K5) (16)
5. (i) State and prove Gauss's Law (CO1, K2) (8)
   (ii) State and prove Stroke's theorem. (CO1, K1) (8)

Unit II: STATIC ELECTRIC FIELD

Part A

1. Outline electric potential and potential difference? (CO2, K2)
2. What is meant by equipotential surface? (CO2, K1)
3. Label uniform and non-uniform Electric field. (CO2, K1)
4. Describe Dipole and Dipole moment (CO2, K2)
5. A parallel plate conductor has the charge of 10^{-3}C on a plate while the potential difference between the plates is 1000V. Calculate the value of capacitance. (CO2, K5)
6. Electric field is conservative field justify? (CO2, K2)
7. Calculate the capacitance of a parallel plate capacitor having an electrode area of 100cm2. The distance between the electrodes is 4mm and the dielectric used has a permittivity of 3.5 and applied potential is 100 Volts. (CO2, K5)
8. Determine the capacitance of a parallel plate capacitor composed of thin foil sheets 50cm2 for a plate separated through a dielectric 0.8 cm thick with permittivity 4.6 (CO2, K5)
9. Find the value of capacitance of a capacitor consisting of two parallel metal plates 30cm x 30cm surface area, separated by 5mm in air (CO2, K1)
10. Write the expression of energy density in electrostatic field. (CO2, K1)

Part B

1. (i) Derive the expression for the capacitance of parallel plate capacitor with two dielectrics of relative permittivity ε_1 and ε_2 respectively imposed between the plates. (CO2, K2) (8)
   (ii) A parallel plate capacitance with d=1m and plate area $0.8m^2$ and a dielectric relative permittivity of 2.8A. A dc volt of 5000V is applied between the plates, find the capacitance and energy stored (CO2, K4) (8)
2. Derive the boundary conditions at the interface between two dielectrics (CO2, K2) (16)
3. (i) A parallel plate capacitance has free space between the plates. Compare the voltage gradient in this case to that in the free space, when a sheet of mica=5.4 fills 20% of the distance between the plates. Assume the same applied voltage in each case. (CO2, K4) (8)
   (ii) Derive the expression for energy stored and energy density in electrostatic fields (CO2,K2) (8)
4. (i) Find the value of capacitance of a capacitor consisting of two parallel metal plates 30cm x 30cm surface area, separated by 5mm in air. What is total energy stored by capacitor if capacitor is charged to a potential difference of 500V? What is the energy density? (CO2, K4) (8)
   (ii) Write the expression for Laplace's and Poisson's equation and derive it for various coordinate systems. (CO2, K2) (8)
5. (i) A capacitor consists of squared two metal sheets each 100 cm^2 in area separated by a dielectric 2mm thick is 2×10^{-4} μF. A potential drop of 20 KV is maintained. Calculate (a) The electric flux (b) The potential gradient (c) The relative permittivity of the material (d) The electric flux density (CO2, K4) (8)
   (ii) Discuss electric field in free space, dielectric and in conductors (CO2, K2) (8)

Unit III: STATIC MAGNETIC FIELD

Part A

1. State Biot-Savart's law (CO3, K1)
2. What is meant Lorentz law of force equation? (CO3, K1)
3. Write the equation of Ampere's circuital law (CO3, K1)
4. Define magnetic scalar potential (CO3, K1)
5. A solenoid with a radius of 2cm is wound with 20 turns per cm length and carries 10mA. Find H at the center if the total length is 10cm (CO3, K5)
6. Give the relation between B and H? (CO3, K2)
7. Distinguish between magnetic scalar and magnetic vector potential (CO3, K2)

8. An inductive coil of 10mH is carrying a current of 10A. What is the energy stored in the magnetic field? (CO3, K5)
9. Define mutual inductance and self-inductance (CO3, K1)
10. Write the equation of Ampere's circuital law (CO3, K1)

Part B

1. (i) Write down the torque equation on closed circuits (CO3, K1) (8)
   (ii) A wire carrying a current of 100A is bent into the form of a circle of diameter 10 cm. Calculate (a) Flux density at the centre of the coil (b) flux density at a point on the axis of the coil and 12 cm from it. (CO3, K5) (8)
2. Derive an expression for magnetic flux density and magnetic flux intensity at any point due to finite length conductor (CO3, K2) (16)
3. Obtain the boundary conditions of magnetic field at the interface between two different medium (16) (CO3, K2)
4. (i) Obtain the expression for energy stored in magnetic field and also derive an expression for magnetic energy density (CO3, K1) (10)
   (ii)Derive an expression for force between two long straight parallel current carrying conductors (6) (CO3, K1)
5. (i) Derive an expression for relationship between E and B (CO3, K1) (8)
   (ii) List out and explain the classification of magnetic materials. (CO3, K1) (8)

Unit IV: TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

Part A

1. What is significance of displacement current density? (CO4, K1)
2. State Ampere's Circuital law (CO4, K1)
3. Write about the different types of emfs produced in conductor placed in a magnetic field (CO4, K1)
4. Distinguish between transformer emf and motional emf. (CO4, K2)
5. What is displacement current? (CO4, K1)
6. Define reluctance. (CO4, K1)
7. State Faraday's law of electromagnetic induction (CO4, K1)
8. Write the expression for total current density (CO4, K1)
9. Define permeance. (CO4, K1)
10. A conductor of 1m length is dragged with a velocity of 100 m/sec perpendicular to a field of 1 T, what is the value of emf induced? (CO4, K5)

PART B

1. Derive the Maxwell's equation in point form and integral form using ampere's circuital law (16) (CO4, K2)
2. (i) Compare field theory and circuit theory (CO4, K2) (8)
   (ii) Derive an expression for relationship between E and B (CO4, K1) (8)
3. (i) Derive the Maxwell's equation in point form and integral form using faraday's law (8) (CO4, K2)
   (ii) Explain briefly about Faraday's disc generator. (CO4, K1) (8)
4. Derive the Maxwell's equation in point form and integral form using electric and magnetic gauss's law (CO4, K2) (16)
5. State and prove boundary conditions by the application of Maxwell's equation. (CO4, K2) (16)

Unit V: ELECTROMAGNETIC WAVES

Part A

1. What is lossy dielectric medium? (CO5, K1)
2. State Poynting Theorem (CO5, K1)
3. Characterize the term Wave (CO5, K1)
4. What is characteristics impedance? (CO5, K1)
5. Define skin depth. (CO5, K1)
6. Calculate the characteristics impedance of free space (CO5, K2)
7. Infer Non uniform plane waves? (CO5, K1)
8. Mention the properties of uniform plane wave (CO5, K1)
9. Define propagation constant (CO5, K1)
10. Infer uniform plane waves? (CO5, K1)

Part B

11. What is poynting vector? Derive poynting theorem from Maxwell's curl equations for the general case. (CO5, K6) (16)
12. Derive electromagnetic wave equations for electric field. (CO5, K4) (16)
13. Derive electromagnetic wave equations for magnetic field. (CO5, K4) (16)
14. Describe the concept of electromagnetic wave propagation in a free space, Good conductor and Good dielectrics. (CO5, K1) (16)
15. Write a short notes on Skin depth, Propagation constant, Attenuation and phase constant (CO5, K1) (16)

Course Faculty **HoD**