

Code No: 07A3EC04

R07**Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

ELECTROMAGNETIC FIELDSCommon to Electronics And Control Engineering, Electrical And
Electronics Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. If the magnetic field intensity $\vec{H} = (x^2\vec{a}_x + 2yz\vec{a}_y - x^2\vec{a}_z)$ A/M. Find the current density at (2, 3, 4). [16]
2. (a) Moist rod has conductivity 10^{-3} mho/m and $\epsilon_r = 2.5$. Find \vec{J}_C and \vec{J}_D where $E = 6 \times 10^{-6} \sin 9 \times 10^9 t$ (v/m).
(b) Explain what is meant by displacement current deduce equation of continuity of current $\text{div} \left(\vec{J} + \frac{\delta \vec{D}}{\delta t} \right) = 0$. [8+8]
3. (a) State and explain Gauss's law.
(b) Given $\vec{D} = 2xy\vec{\partial}_x + z\vec{\partial}_y + yz^2\vec{\partial}_z$, find $\nabla \cdot \vec{D}$ at p(2, -1, 3). [8+8]
4. (a) Derive an expression for force between two straight long parallel conductors carrying currents in the same direction
(b) A current element 2m in length lies along the y-axis direction centered at the origin. The current is 5 amps in the \vec{a}_y direction. If it experiences a force $1.5 \left(\frac{\vec{a}_x + \vec{a}_z}{\sqrt{2}} \right)$ N due to a uniform field \vec{B} , determine \vec{B} . [8+8]
5. (a) What is a dipole? Derive expression for Torque experienced by a dipole in uniform electric field.
(b) Verify that the potential field given below satisfies the Laplace's equation.
 $V = 4x^2 - 6y^2 + 2z^2$. [8+8]
6. Derive Neuman's formula for mutual inductance considering two loops carrying currents I_1 and I_2 . [16]
7. Derive the expression for capacitance of a parallel plate capacitor with single dielectric. Also derive the expression for the capacitance of a parallel plate capacitor with two dielectric. [16]
8. Find the expression for the magnetic flux density \vec{B} at a distance 'h' above the centre of a rectangular loop of wire 'b' m on one side and 'a' m on the other side. The loop carries a current of I amps. [16]

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1. (a) State and explain Gauss's law.
 (b) Given $\bar{D} = 2xy\bar{\partial}_x + z\bar{\partial}_y + yz^2\bar{\partial}_z$, find $\nabla \cdot \bar{D}$ at p(2, -1, 3). [8+8]
2. (a) What is a dipole? Derive expression for Torque experienced by a dipole in uniform electric field.
 (b) Verify that the potential field given below satisfies the Laplace's equation.
 $V = 4x^2 - 6y^2 + 2z^2$. [8+8]
3. (a) Moist rod has conductivity 10^{-3} mho/m and $\epsilon_r = 2.5$. Find \bar{J}_C and \bar{J}_D where $E = 6 \times 10^{-6} \sin 9 \times 10^9 t (\text{v/m})$.
 (b) Explain what is meant by displacement current deduce equation of continuity of current $\text{div} \left(\bar{J} + \frac{\delta \bar{D}}{\delta t} \right) = 0$. [8+8]
4. Derive the expression for capacitance of a parallel plate capacitor with single dielectric. Also derive the expression for the capacitance of a parallel plate capacitor with two dielectric. [16]
5. If the magnetic field intensity $\bar{H} = (x^2\bar{a}_x + 2yz\bar{a}_y - x^2\bar{a}_z)$ A/M. Find the current density at (2, 3, 4). [16]
6. Derive Neuman's formula for mutual inductance considering two loops carrying currents I_1 and I_2 . [16]
7. Find the expression for the magnetic flux density \bar{B} at a distance 'h' above the centre of a rectangular loop of wire 'b' m on one side and 'a' m on the other side. The loop carries a current of I amps. [16]
8. (a) Derive an expression for force between two straight long parallel conductors carrying currents in the same direction
 (b) A current element 2m in length lies along the y-axis direction centered at the origin. The current is 5 amps in the \bar{a}_y direction. If it experiences a force $1.5 \left(\frac{\bar{a}_x + \bar{a}_z}{\sqrt{2}} \right)$ N due to a uniform field \bar{B} , determine \bar{B} . [8+8]

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