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Total No. of Pages : 02

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B.Tech.(EE)/(Electrical & Electronics Engg.) (2012 Onwards) /
(Electronics & Electrical Engg.) (2012 to 2017)
(Sem.-4)

ELECTROMAGNETIC FIELDS

Subject Code : BTEE-403

M.Code : 57106

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A**1. Write briefly :**

- a) Find the gradient of a scalar field f , where

$$f(x,y,z) = x^2y + e^z, \text{ where } e = 2.71828$$

What is the magnitude and direction of the gradient at the point P(2,3,4)?

- b) State 'Green's Theorem'.
- c) What is a magnetic dipole? Explain.
- d) Predict the nature of the vector field $A = yz\hat{a}_x + zx\hat{a}_y + xy\hat{a}_z$.
- e) Does $\mathbf{A} \cdot \mathbf{B} = \mathbf{A} \cdot \mathbf{C}$ implies that $\mathbf{B} = \mathbf{C}$? Justify your answer.
- f) If $\mathbf{E}$ is zero at any point, does it result into zero electric potential at that point?
- g) What is a Vector Magnetic Potential?
- h) What is the significance of displacement current?
- i) Why mobile phone does not work properly in the lift of the building once its door gets closed?
- j) Why is Transverse Electromagnetic Wave so called?

SECTION-B

2. State and prove Poynting's Theorem.
3. State Biot Savart's law. Derive its point form. Hence, use this law to obtain magnetic field due to a wire of infinite length and carrying current I at a point distant r from the wire.
4. Transform the vector $3\hat{a}_x + 4\hat{a}_y - \hat{a}_z$ into cylindrical coordinate system at point $P(2,2,4)$.
5. A uniform plane wave of frequency 16GHz is traveling in a medium with conductivity as 24 S/m, $\epsilon_r = 45$ and $\mu_r = 1$. Obtain the loss tangent and predict the nature of the medium. Also, calculate the different characteristics associated with the wave.
6. State and prove boundary conditions associated with magnetic fields.

SECTION-C

7. a) The dielectric constant of water is 78. Find :
 - i) The Brewster angle for parallel polarization, and the corresponding angle of transmission.
 - ii) The reflection and transmission coefficients when a plane wave with perpendicular polarization is incident from air on water surface at incidence angle equal to Brewster angle.
- b) Obtain the expression of capacitance of a cylindrical capacitor using Laplace's equation.
8. State and prove Maxwell's equation in differential and integral forms.
9. Write short notes on the following :
 - a) Helmholtz Theorem
 - b) Stoke's Theorem
 - c) Spherical Coordinate System

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.