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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (EE) (PT) (Sem.-2)
ELECTROMAGNETIC FIELDS
Subject Code : BTEE-403
M.Code : 71538

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

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

- (a) Write the mathematical expression of Laplacian Operator in Cartesian form.
- (b) If $B = x^2y \mathbf{i} + (x-y)\mathbf{k}$. Find Curl A? Where $\mathbf{i}$ and $\mathbf{k}$ are unit vectors?
- (c) Calculate the electrostatic force between two protons in a nucleus of iron with which they repel each other. Assume Separation of $4 \times 10^{-15}\text{m}$ between protons.
- (d) Derive the expression for total energy density in static electric fields.
- (e) Identify the wave polarization of $E = 25 \sin(\omega t + 4x)(\mathbf{a}_y + j\mathbf{a}_z)$.
- (f) Differentiate between critical angle and Brewster angle.
- (g) An EM wave in free space has $E(y,t) = 25 \sin(10^8 t - y) \mathbf{a}_z$. Find direction of Propagation.
- (h) Define Magnetic Vector Potential.
- (i) Write down Mathematical expression for Continuity Equation.
- (j) The wave velocity in free space is $3 \times 10^8 \text{ m/s}$. Find the velocity of wave in the medium having dielectric constant 9.

SECTION-B

2. (a) State and Prove Stoke's Theorem.
(b) A Vector V is called irrotational if $\text{Curl } V=0$. Determine constant a , b & c so that $V = i(x + 2y + az) + j(bx - 3y - z) + k(4x + cy + 2z)$ is irrotational.
3. (a) Derive the expression for Laplace and Poisson's Equation.
(b) A parallel plate capacitor consists of two sheets of copper foil, each of area 0.1 m^2 , separated by a 2.0mm thick sheet of plastic having relative permittivity of 2.1 . Find the Capacitance.
4. (a) Explain Ampere's Law of force?
(b) Calculate the axial magnetic field due to a current I flowing through a circular loop of radius r at a distance d from the center along the axis.
5. Derive the Expression of the Wave equations for free space.

SECTION-C

6. Write down Maxwell's Equations for time-varying fields in both differential and integral forms. Also write the word statements of these equations from the mathematical statements in integral form.
7. The electric field E and magnetic field H in a source free, homogenous, isotropic region are given as $E = 100 (jx + 2y - jz) e^{j\omega t}$ and $H = (-x + jy + z) e^{j\omega t}$.
Estimate the average power flow density and its direction in the region where x, y, z are the unit vectors.
8. (a) Derive the relation between reflection coefficient and transmission coefficient at normal incidence in perfect dielectric.
(b) When a plane wave travelling in a free space is incident normally on a medium having dielectric constant is 4 . Find the fraction of power transmitted in the medium.
9. Derive the expression for the Transformation between the Cartesian, Cylindrical and Spherical Coordinate Systems.

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.