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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. Given vectors $A = 2a_x + 4a_y + 10a_z$ and $A = 4a_x + 8a_y - 5a_z$, find the angle between A and B.

b. If the magnetic flux density of a point in a region is 200 sin(120 π t) a_z,mWb/$_m^2$, What is the curl of magnetic field intensity?

c. If the vector function $F = (3_y - K_1 z)\, a_x + (K_2 x - 2z)\, a_y - (K_3 y + z)\, a_z$ is irrotational, then find the values of K_1, K2 and K_3 respectively.

d. State Gauss's Law.

e. State Stoke's theorem.

f. For a uniformly charged sphere of radius R and charge density σ, find the ratio of magnitude of electric field at a distance R/2 and 2R from the centre.

g. Define magnetic flux density.

h. A uniform plane wave in air incident at 60° angle on a lossless dielectric material with dielectric constant ε_r. The transmitted wave propagates in a 30° direction with respect to normal. Find the value of ε_r.

i. An electric field is produced by point charges 1μC and 4μC located at (–2, 1, 5) and (1, 3,–1), respectively. Find the energy stored in the field.

j. State Laplace equation and what is its significance?

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SECTION-B

2. Derive the expression for magnetic field intensity due to infinitely long straight conductor carrying a current I amps along Z-axis.

3. In a nonmagnetic medium $E = 4 \sin(2\pi \times 10^7 t - 0.8z) a_x$ V/m. Find the total power crossing 100 cm^2 of plane $2z + y = 5$

4. The electric field of an electromagnetic wave propagating in the z-direction is given by the equation $E = \sin(\omega t - \beta z)\, a_x + \sin(\omega t - \beta z + \pi/2)\, a_y$ Prove that the wave is left hand circularly polarised.

5. A medium is divided into regions about $x = 0$ plane as shown in fig. 1. An electromagnetic wave with electric field $E_1 = 4a_x + 3a_y + 5a_z$ is incident normally on the interface from region-1. Find the electric field E_2 in the region-2 at the interface.

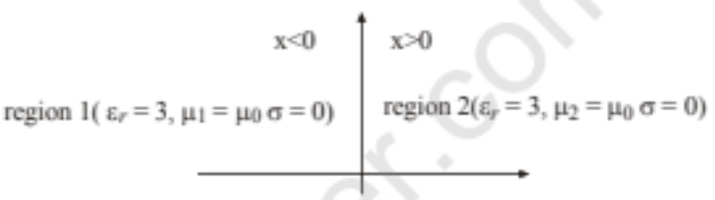

Fig.1

SECTION-C

6. Explain the concept of poynting vector and poynting theorem.

7. Write down Maxwell's equations for time-varying fields in both differential and the integral forms. Also write down the word statements of these equations from the mathematical statements in the integral form and define their significance.

8. What are the four basic rules for the boundary conditions at the interface of two different materials? Derive an expression for the reflection coefficient of a uniform plane wave Incident on a non lossy medium.

9. The electric field of a plane wave is given by $E = 20 \cos(10^9 t + 30z)\, a_y$ V/m where a_y is the unit vector along the y-direction. Determine :

   a. The magnetic field H

   b. The phase velocity V_p

   c. Dielectric constant ε_r of the medium when $\mu = \mu_0$

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.

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