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Total Pages : 3

007306

January 2023

B.Tech. (EL) - III SEMESTER

Electromagnetic Fields (ELPC 304)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) What is meant by loss tangent? (1.5)

(b) Explain the significance of Poynting Vector. (1.5)

(c) Differentiate between group velocity and phase velocity. (1.5)

(d) State and explain the Divergence Theorem. (1.5)

(e) Differentiate between displacement and conduction current. (1.5)

(f) Establish the vector identity $\nabla \times \nabla \phi = 0$. (1.5)

(g) If S is any closed surface enclosing a volume v, and A = iax + jby + kcz then prove that

$$\iint A.ds = (a + b + c)\ v. \qquad (1.5)$$

(h) Write Laplace equation in all three co-ordinate systems. (1.5)

(i) Find the gradient of $\Phi = \cosh xyz$. (1.5)

(j) If $H = yz(x^2 + y^2)\ a_x - y^2xza_y + 4x^2y^2a_z$ A/m, show that div of B = 0. (1.5)

PART–B

2. (a) Define electric field E and electric potential V at a point, derive $E = -\nabla V$ and write expression for ∇V in cylindrical coordinate system. (7)

(b) What is magnetic vector potential. Derive its expression both in integral and differential form. (8)

3. (a) Using Gauss and Stoke's theorem convert Maxwell's equation from integral to differential form and write the significance of each equation. (8)

(b) In free space $E(z, t) = 50 \cos(wt - \beta z)ax$ V/m. Find the average power crossing the circular area of radius 2.5 mts in plane z = constant. ($\eta = 120\ \pi$) (7)

4. (a) Derive the wave equations for a conducting medium. (8)

(b) Calculate the magnetic flux density at the centre of a current carrying conductor whose radius is 2 cm, conductor current is 1 mA and the conductor is placed in air. (7)

5. (a) Derive the boundary conditions for both electric and magnetic fields. (8)

(b) Derive the expressions for attenuation constant, phase constant, velocity of propagation and intrinsic impedance for propagation of wave through a good conductor. Find the velocity of plane wave in a lossless medium having $\epsilon_r = 4$ and $\mu_r = 1$. (7)

6. (a) Obtain the flux density B at a distance R from a thin linear conductor of infinite length carrying current I. Also derive the expression for magnetic field intensity. (10)

(b) If $H = x^2a_x + 2yza_y + (-x^2)a_z$ find the current density at (2, 3, 4). (5)

7. (a) Magnetization and permeability.

(b) Ampere's work law.

(c) Ohm's law in point form. (15)
