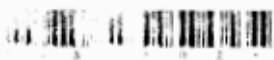


No. of Pages : 3



EC 402(MTU)

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 130402

Roll No.

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B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014 15

ELECTRONIC FIELD THEORY

Time : 2 Hours

[Total Marks : 50]

Note : Attempt all questions.

 1. Attempt any four questions : 3.5×4=14

- Prove the vector triple product identity

$$\mathbf{A} \times (\mathbf{B} \times \mathbf{C}) = \mathbf{B}(\mathbf{A} \cdot \mathbf{C}) - \mathbf{C}(\mathbf{A} \cdot \mathbf{B})$$
- What is the physical significance of gradient, divergence and curl.
- Evaluate $\text{div}(\text{curl } \mathbf{A})$ if

$$\mathbf{A} = \frac{\sin \phi}{r^2} \mathbf{a}_r - \frac{\cos \phi}{r^2} \mathbf{a}_\phi$$

- State Divergence theorem and Stokes's theorem.
- Express the vector in Cartesian coordinates

$$\mathbf{A} = r^2 \hat{\mathbf{a}}_r + \sin \theta \hat{\mathbf{a}}_\phi$$

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[Contd...

- (i) Verify the following vector fields are irrotational and solenoidal.

$$\vec{A} = yz\hat{a}_x + xz\hat{a}_y + xy\hat{a}_z$$

Attempt any two questions :

6×2=12

- (a) Given the potential $V = \frac{10}{r^2} \sin \theta \cos \phi$. Find the electric

flux density D at $(2, \frac{r}{2}, 0)$.

- (b) List the properties of conductors, dielectrics and semiconductors.
- (c) Derive the expression for capacitance of spherical capacitor using Gauss law. A spherical capacitor has radii $a = 1.5$ cm and $b = 4$ cm has an inhomogeneous dielectric of $\epsilon = \frac{10\epsilon_0}{r}$. Calculate the capacitance of the capacitor.

Attempt any two questions :

6×2=12

- (a) State Biot Savart's law. Prove that the magnetic field due to infinite conductor carrying current I at a distance r is $H = \frac{I}{2\pi r}$.
- (b) State and explain Maxwell's equations. Discuss its physical significance.
- (c) Derive an expression for energy in magnetic field.

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[Contd...

- Answer any two questions : 6×2=12
- (a) Derive the expression of reflection and transmission coefficients. Derive the relation between two.
- (b) State and Explain Poynting theorem
- (c) A uniform plane wave propagating in medium has

$$E = 2e^{-\alpha z} \sin(10^8 t - \beta z) a_y \text{ V/m.}$$

If a medium is characterized by $\epsilon_r = 4$, $\mu_r = 10$ and $\sigma = 5 \text{ S/m}$. Find :

- (i) Attenuation constant
- (ii) Phase constant
- (iii) Velocity of propagation
- (iv) Propagation constant
- (v) Intrinsic impedance.