



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

- (a) Prove the vector triple product identity  
 $A \times B \times C = B(A.C) - C(A.B)$ .
- (b) What is the physical significance of gradient, divergence and curl.
- (c) Evaluate  $\text{div}(\text{curl } A)$  if

$$A = \frac{\sin \phi}{r^2} a_r - \frac{\cos \phi}{r^2} a_r$$

- (d) State Divergence theorem and stokes's theorem.
- (e) Express the vector in Cartesian coordinates

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

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

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

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) Enlist 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.

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  $\epsilon_r = 2$ ,  $\mu_r = 10$  and  $\sigma = 5 \text{ S/m}$ . Find :

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