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

Paper ID: 131525 Roll No.

B.TECH

(SEM. V) THEORY EXAMINATION, 2015-16

FUNDAMETALS OF E.M. THEORY

[Time : 3 hours] **[MaximumMarks : 100]**

Note : The Question Paper contains Three Sections.

Section-A

1. Attempt all parts of the following. All parts carry **equal** marks. Write answer of each part in short. **(2×10=20)**

   (a) Write Maxwell's Equation in a simple, non-conducting and source-free region?

   (b) What is wave number?

   (c) Define Divergence theorem.

   (d) What is unit vector?

   (e) Explain the physical interpretation of Gradient.

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(f) Explain Electric potential. Write the relation between electric potential and electric field intensity.

(g) Define skin depth.

(h) Transform the point $P(2,2,5)$ in spherical coodinate system.

(i) Define Surface Integral.

(j) Give the wave equation in terms of electric field and magnetic field.

Section-B

Attempt any **five** of the following : **(5×10=50)**

2. Derive expression the expression for α *and* β in lossless dielectric medium.

3. State and prove continuity equation. Also explain relaxation time.

4. Explain reflection of plane wave incident normally at the dielectric-dielectric interface. Discuss about reflection & transmission coefficient.

5. What are the boundary conditions for static electric fields in the general form at the interface between two different dielectric media? Explain.

6. Define displacement and conduction current desities and derive Maxwell's equation associated with faraday law and modified ampere's circuital law.

7. Discuss the wave propagation in lossy dielectric also determine propagation constant, intrinsic impedance.

8. A positive point charge Q is at the center of a spherical dielectric shell of an inner radius R_i and an outer radius R_o dielectric constant of the shell is ε_r. Determine $\bar{E}, V, \bar{D}$ *and* $\bar{P}$ as a functions of the radial distance R.

9. Acoording to $W_e = \frac{1}{2}\iiint_v \rho V dv = \frac{1}{2}\iiint_v (\nabla \cdot \bar{D}) V dv$, show that the stored electic energy given by $W_e = \frac{1}{2}\iiint_v \bar{D}.\bar{E} dv$.

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Section-C

Attempt any **two** questions from this section.
(15×2=30)

10. Derive a general expression for the magnetic flux density B at any point along the axis of a long solenoid. Sketch the variation of B from point to point along the axis.

11. Derive an expression for the energy stored in the magnetic field of a coil possesing an inductance of L Henry when the current in the coil is 1 amp and considering toroidal coil, derive and expression for energy density.

12. What is Vector Helmholtz equation? A 100 M*Hz* uniform plane wave $\overline{E} = \hat{x}E_x$ propogates in the +z direction. Suppose $\varepsilon_r = 4, \mu_r = 1, \sigma = 0$ and it has a maximum value of 10^{-4} V/m at t=0 and z=0.125m.

    (a) Write the instantaneous expressions for $\overline{E}$ *and* $\overline{H}$.

    (b) Determine the location where $\overline{E}$ is a positive maximum when $t=10^8$ sec.

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