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

PAPER ID : 2110 **Roll No.** ☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. V) THEORY EXAMINATION 2011-12
FUNDAMENTALS OF E.M. THEORY

Time : 2 Hours   *Total Marks : 50*

Note :–Attempt **all** questions.

1. Attempt any **four** parts :   (3.5×4=14)

    (a) A spherical surface is uniformly charged. Calculate the electric field inside, on and outside the sphere. Plot the field.

    (b) State and prove Stoke's theorem.

    (c) Calculate the potential and electric field at any point on the right bisector of a uniform finite line charge.

    (d) Prove the following identities :

        (i) $A.(B \times C) = B.(C \times A) = C.(A \times B)$

        (ii) $A \times (B \times C) = B(A.C) - C(A.B)$

    (e) State and prove Gauss's law.

    (f) Explain the differences between gradient, divergence and curl.

2. Attempt any **two** parts : (6×2=12)

   (a) Derive the expression for the capacitance of a cylindrical capacitor of length 'L' formed by two coaxial cylinders of radii 'a' and 'b' by

   (i) using Gauss's law

   (ii) without using Gauss's law.

   (b) State and explain the Poisson's equation.

   A parallel plate capacitor of width 'W' separation of plates 'd' and length 'L' is partially filled with a dielectric slab of permittivity $\in_r$. Prove that the force acting on the dielectric is

   $$F = \frac{\in_0 E^2}{2} Ld(\in_r - 1)$$

   (c) Enlist the properties of conductors, dielectrics and semiconductors.

3. Attempt any **two** parts : (6×2=12)

   (a) Explain the difference between steady magnetic field and time varying magnetic field with the help of suitable examples.

   (b) State and explain the Maxwell's equations. Discuss its physical significance.

   (c) Find the expressions of the curl and divergence of a magnetic field 'B'.

4. Attempt any **two** parts : (6×2=12)

   (a) What is a plane wave ? Derive the condition for uniform plane wave ? Derive the general expression of a uniform plane wave and comment on its direction of propagation.

   (b) Derive the expressions of the reflection and transmission coefficients. Derive the relationship between the two. Explain what is the basis of that relationship.

   (c) Explain the phenomena of dispersion. What are phase and group velocities ? Explain taking a suitable example.