Total Number of Pages : 02

B.Tech
PEE3I001

3rd Semester Regular / Back Examination 2018-19
ELECTROMAGNETIC THEORY
BRANCH : ELECTRICAL
Time : 3 Hours
Max Marks : 100
Q.CODE : E885
Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** **(2 x 10)**
   a) Express the point (3,0,5) in cylindrical coordinate system.
   b) Define Stokes's Theorem.
   c) State the coulomb's law electrostatics.
   d) Define conduction current density.
   e) State Poisson's equation.
   f) What do you mean by loss tangent?
   g) What is surface resistance?
   h) What is Polarization ?What are its types.?
   i) Write the characteristic of ferromagnetic materials.
   j) Define potential field.

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**
   a)
$$A = \rho(z + 1)a_\rho - \rho(z + 1)sin\emptyset a_\emptyset + (\rho + 2z)a_z$$
$$B = -\rho cos\emptyset a_\rho + z\rho sin\emptyset a_\emptyset + z^2 a_z$$
   At P (4, π/2, -2), find
       a. The angle between A and B
       b. The component of B along A
       c. The unit vector perpendicular to both A and B
   b) If $V = x^2y^2z^2$ & $A = x^2ya_x + xz^3a_y - y^2z^2a_z$,find ∇^2V, ∇^2A & $Curl\ curl\ A$
   c) Derive the flux density for Uniform Charged Sphere.
   d) Derive the current equation of continuity and define the Relaxation time.
   e) A homogeneous dielectric (ε_{r1} = 2.5) fills the region 1 (x<0) while region 2 (x>0) is free space. If $D_1 = 12a_x - 10a_y + 4a_z nC/m^2$, find D_2 & θ_2.
   f) Calculate the capacitance of Spherical capacitor.
   g) What is method of image? Discuss the case where the line charge is above a grounded conducting Plane.
   h) Discuss all the Maxwell's equations in both differential and integral form with their physical significance.
   i) Calculate the self-inductance per unit length of an infinitely long solenoid.
   j) Define uniform plane wave propagation. Discuss its properties. A uniform plane electromagnetic wave propagating in air is given by $E = ix \cos[wt - \frac{2\pi}{\lambda}y]$ .Derive by using the Maxwell's equations, the expression for the vector magnetic field.
   k) State Poynting Theorem. Give an expression for Poynting Theorem.
   l) A 60 MHz plane wave travels in a lossless medium with $\varepsilon = 3\varepsilon_0$ & $\mu = \mu_0$. Find the wave velocity u, its wavelength λ, and the intrinsic impedance η of the medium.

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Let $A = 4x^2 e^{-y} a_x + 8xe^{-y} a_y$. Determine $\nabla \times [\nabla(\nabla \cdot A)]$. **(8)**

b) A circular disc of radius a carries charge $\rho_s = \frac{1}{\rho} c/m^2$, calculate the potential at (0,0,h). **(8)**

Q4 **a)** Find conduction & displacement current densities in a material having conductivity of 10^{-3} S/m & ϵ_r = 2.5 if the electric field in the material is E = 5.0×10^{-6} sin $(9.0 \times 10^9 t)$ V/m. **(8)**

b) The finite sheet $0 \le x \le 1, 0 \le y \le 1$ on the z=0 plane has a charge density $\rho_s = xy(x^2 + y^2 + 25)^{3/2} nC/m^2$. Find **(8)**
  a. The total charge on the sheet
  b. The electric field at (0,0,5)
  c. The force experienced by a -1mC charge located at (0,0,5)

Q5 **a)** Apply Ampere's law to determine H for infinite sheet of current. **(8)**
b) An electric field in free space is given by $E = 50 \cos(10^8 t + \beta x) a_y V/m$, **(8)**
  i.   Find the direction of wave propagation
  ii.   Calculate β and the time it takes to travela distance of $\lambda/2$.

Q6 **a)** In a linear homogeneous and isotropic conductor, show that the charge density ρ_v satisfies $\frac{\partial \rho_v}{\partial t} + \frac{\sigma}{\varepsilon} \rho_v = 0$ **(8)**

b) Derive the transmission line equation. **(8)**