B.E/B.TECH. Degree Examination, December 2020

Third Semester

EE16302–ELECTROMAGNETIC THEORY

(Regulation 2016)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A vector field A is termed solenoidal if

   (i) $\nabla . A = 0$ (ii) $\nabla \times A = 0$ (iii) $\nabla . A \neq 0$ (iv) $\nabla . A = \rho$

2. Electric field intensity inside a conductor is equal to

   (i) Zero (ii) Infinity (iii) its electric flux density (iv) its charge density

3. Propagation of electromagnetic waves can be explained by means of

   (i)Conduction current (ii) Displacement current

   (iii) Both conduction and displacement current (iv) Conduction current density

4. Conductivity of a good conductor is

   (i)Zero (ii) Infinite (iii) same as its permeability (iv) same as its permittivity

5. If U=3xyz+y-2z, examine whether U satisfies Laplace's equation or not.

6. Classify dielectrics based on polarization.

7. Why is Maxwell's third equation for static magnetic field not valid for time varying fields?

8. Compare the conductivity of a wave propagating in free space to the wave propagating in a lossless dielectric?

PART B - (4 X16 = 64 marks)

09. (a) If $F = 2\rho z a_\rho + 3z\sin\varphi a_\varphi - 4\rho\cos\varphi a_z$, verify Stokes's theorem for open surface defined by z=2, $0<\rho<2$, $0<\varphi<45°$. **(16)**

(OR)

(b) For a sphere of radius *a* centered at origin, determine the electric field intensity at any point P along the z axis using Coulomb's law. **(16)**

10. (a) Dielectric region 1 with $\rho \leq 5\,cm$ and region 2 with $\rho \geq 5\,cm$ have dielectric constants 3.5 and 1.5 respectively. If $D_2 = 12a_\rho - 6a_\varphi + 9a_z\, nC/m^2$, Calculate E_1, D_1 and energy density in region 1. **(16)**

(OR)

(b) (i) Derive an expression for the capacitance of a parallel plate capacitance assuming a potential of V(y=0) = 0 and V(y=d) = V_o. **(10)**

(ii) If free space $V = x^2y(z+3)$, find the charge within a cube defined by *0<x<2, 0<y<2, 0<z<2*. **(6)**

11. (a) Derive the expression for the magnetic field intensity of a co-axial transmission line consisting of two concentric cylinders having their axes along z direction. **(16)**

(OR)

(b) Derive an expression for the magnetic boundary conditions for a field H to exist at the boundary between two dielectric mediums. **(16)**

12. (a) Derive the Maxwell's equation in generalized form and tabulate the results in differential and integral forms. **(16)**

(OR)

(b) In certain region, $J = (2ya_x + xza_y + z^3a_z)sin10^4t\ A/m$, find ρ_v if $\rho_v(x, y, 0, t) = 0$. **(16)**