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EEC-303	Roll No.									

B. Tech.
(SEM III) EVEN SEMESTER EXAMINATION 2016-17
ELECTROMAGNATIC FIELD THEORY

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- ***Attempt All Questions. All Questions carry equal marks*:-**

Q.1. ***Attempt any four parts of the following.*** **4x5=20**

(a) Explain physical significance of divergence and curl

(b) Write all four Maxwell's equations in point and integral form for time varying field.

(c) State Stokes theorem and Divergence Theorem

(d) Express in $A = r\sin\theta\, a_r$ in Cartesian coordinates system

(e) Derive an expression for electric field intensity due to line charge density ρ_L

(f) Derive the boundary conditions between conductor-free space interfaces

Q.2. ***Attempt any four parts of the following.*** **4x5=20**

(a) Derive an expression for electric field intensity at any point due to an electric dipole.

(b) Find the stored energy in a system of four identical charges q = 2nC at the corners of a square with sides 1m.

(c) Derive poisson's and Laplace's equations.

(d) State and explain uniqueness theorem.

(e) Verify stokes theorem for the vector $A = x^2 a_x + xy\, a_y$ integrated around the square, in the plane z =0 whose sides are along the line x=0, y=0, x=a and y=a.

(f) Determine the divergence of the vector $B = \rho z\sin\phi\, a_\rho + 3\rho z^2\cos\phi\, a_\phi$ at $(5,\pi/2,1)$.

Q.3. ***Attempt any TWO parts of the following.*** **10x2=20**

(a) Two extensive homogeneous isotropic dielectric meet on plane z = 0. For z > 0, ε_{r1} =4 and z < 0 ε_{r2} =3. A uniform electric field $E_1 = 5\, a_x - 2\, a_y + 3\, a_z$ kV/m exist for z > 0. Determine

(i) E_2 for z < 0 (ii) The angles E_1 and E_2 make with the interface.

(b) What is equipotential surface? Explain the method of images.

(c) State and explain ampere circuit law. A thin ring of radius 5 cm is placed on plane z = 1 cm so that its center is at (0, 0, 1 cm). If the ring carries 50 mA along a_ϕ find H at (0, 0,-l cm).

(d) The magnetic field component of an EM wave propagating through a nonmagnetic medium ($\mu = \mu_0$) is $H = 25\sin(2\times10^8 t + 6x)a_y$ mA/m determine:

(i) The direction of wave propagation

(ii) The permittivity of the medium.

(iii)The electric field intensity.

Q.4. *Attempt any **TWO** parts of the following.* 10x2=20

a) Describe biot-savart's law. A circular loop located on $x^2+y^2= 9$, z=0 plane and carries a direct current of 10A along a_φ direction. Determine H at (0, 0, 4) and (0, 0, -4).

b) Describe the magnetic boundary condition. Given that $H=24a_x-30a_y+40a_z$kA/m in region 1, Z>0 with $\mu_{r=}50$. If z=0 separates regions 1 and 2 and carries $6a_x$ kA/m, determine the magnetic flux density in region 2, z<0, with $\mu_{r=}100$.

c) State and explain Maxwell's equation in both differential and integral form for time varying field and also discuss its physical significance.

d) Drive the expression for the capacitance of a coaxial capacitor. Two conducting spherical shells have radii a=3cm and b=6cm. The interior is a perfect dielectric for which ε_r =8, calculate its capacitance.

Q.5. ***Attempt any TWO parts of the following.*** **10x2=20**

(a) Discuss about diamagnetic, paramagnetic and ferromagnetic substances.

(b) Establish the boundary conditions between the two magnetic materials having different permeability's μ_1 and μ_2. Also show that $\frac{\tan\theta_1}{\tan\theta_2} = \frac{\mu_1}{\mu_2}$, where θ_1 and θ_2 are the angles with normal's in the region 1 and 2 respectively.

(c) Define electric potential and derive an expression for spherical capacitor

(d) Find E at point P (1,5,2) is in free space, if point charge of 6 μC is located at (0,0,1), the infinite line charge density ρ_L =180 nc/m along X axis and infinite sheet of charge with ρ_s =25 nc/m^2 is over Z plane