K S SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year : 2023-24 (Odd Sem)

Course Code / Name: 21EC54: Electromagnetic Waves

Year / Semester: III / V

QUESTION BANK-MODULE-1

1. State and Prove Coulombs law in vector form for N-point charges
2. What is Electric Field Intensity? Derive electric field intensity at point P due to many charges
3. Given, $D = \frac{\rho^2 z^2}{3}\cos\phi \hat{a}_\phi$ Find flux crossing $\phi = \frac{\pi}{4}$ half plane defined by $0 \le \rho \le 3, 2 \le z \le 4.$
4. The Flux Density within the Cylinder volume bounded by r = 5m, z = 0 & z = 2m. Find Total Flux crossing the surface of cylinder.

$\vec{D} = 30e^{-r}\hat{a}_r - 2z\hat{a}_z \text{C/m}^2.$

5. Find total charge, if $0.1 \le |x|,|y|,|z| \le 0.2$; $\rho_v = \frac{1}{x^3 y^3 z^3}$
6. Find total charge, if Universe: $\rho_v = e^{-2r}/r^2$
7. Interpret Coulombs law to find E at P(0,0,3), when Four charges each of 25nC are located in xy plane of freespace. They are symmetrically placed on x,y axes from the origin, distance to each charge is 2m.
8. Interpret the relation between charge and volume density to find total charge containing in the 2cm length of electron beam, cylindrical in shape

with ρ = 1cm, height = 2cm (from 2cm to 4cm), ϕ = 0 to 2Π, $\rho_v = -5 * 10^{-6}[\exp(-10^5 \rho z)]$.

9. Interpret the relation between charge and volume density to find total charge in semi sphere of r = 2m, $\rho_v = r\ sin^2\Theta$
10. Interpret Coulombs law to find the relation between charges Q1 and Q2 such that force on unit positive charge at (-1,1,0) have (i) No x-component (ii)No y-component. Two point charges Q1 and Q2 are located at (1,2,0)m and (2,0,0)m.
11. Derive an equation for electric field intensity for infinite line of charges
12. Given a 60μC point charge located at the origin, **Compute** the total electric flux passing through:

    i) that portion of the sphere r = 26cm bounded by

    $$0 < \theta < \frac{\pi}{2}\ and\ 0 < \varphi < \frac{\pi}{2}$$

    ii) the closed surface defined by

    $$\rho = 26cm\ and\ z = \pm 26cm$$

    iii) the plane z = 26cm

13. Determine electric field intensity at origin, if the following charge distributions are present in free space: i) Point charge 12nC at P(2,0,6). ii) Uniform line charge of linear charge density 3nC/m at x = 2, y = 3. iii) Surface charge density at x = 2.