ARAB ACADEMY FOR SCIENCE & TECHNOLOGY & MARITIME TRANSPORT
COLLEGE OF ENGINEERING & TECHNOLOGY
Electronics and Communications Department

Lecturer: Dr. Darwish Abd-El-Aziz
T.A. : Eng. Wael Abd Ellatif

Electromagnetics
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Sheet (3)

1. A uniform line charge of $\rho_L = 3\mu C/m$ lies along the z-axis, and a coaxial circular cylinder of radius 2m has $\rho_s = \frac{-1.5}{4\pi}\ \mu C/m^2$. Both distributions are infinite in extent with z. Use Gauss's law to find $\overline{D}$ in all regions.

2. Charge is distributed uniformly within a sphere of radius a, with volume charge density ρ_{vo} c/m^3. Determine $\vec{E}$ inside and outside the sphere.

3. A point charge of 6 μC is located at the origin, a uniform line charge density of 180 nC/m lies along the x-axis, and a uniform sheet of charge equal to 25 nC/m^2, lies in the z = 0 plane.
   a. Find the $\overline{D}$ at A(0, 0, 4).
   b. Calculate the total electric flux leaving the surface of a sphere of 4m radius centered at the origin.

4. Cylindrical surfaces at $r_c = 2$, 4, and 6m carry uniform charge densities of 20 nC/m^2, – 4 nC/m^2, and ρ_{so}, respectively.
   a. Find $\overline{D}$ at r_c = 1, 3, and 5m.
   b. Determine ρ_{so} such that $\overline{D}$ = 0 at r_c = 7m.

5. Given that $\vec{A} = (x^2 - y^2)\,\hat{a}_x + 2xy\,\hat{a}_y + (y^2 - xy)\,\hat{a}_z$, verify the divergence theorem for the region bounded by a cube centered at the origin and of side length "a".

6. If $(G) = 5r_s \sin^2\theta \cos^2\phi\ \hat{a}_{rs}$. Evaluate both sides of the divergence theorem for the region $r_s \leq 2$.

7. Given $\overline{D} = 10\ \frac{r_c^3}{4}\ \hat{a}_{rc}\ C/m^2$ in cylindrical coordinates. Evaluate both sides of the divergence theorem for the volume enclosed by r_c = 1m, r_c = 2m, z = 0, z = 10m.