Fields and Waves
Tutorial-5 (16^{th} Feb, 2016)

Q1. Find the total charge on a circular disk defined by $r \leq a$ and $z = 0$ if:
(a) $\rho_s = \rho_{s0} \cos\phi$ (C/m^2)
(b) $\rho_s = \rho_{s0} \sin^2\phi$ (C/m^2)
(c) $\rho_s = \rho_{s0}e^{-r}$ (C/m^2)
(d) $\rho_s = \rho_{s0}e^{-r}\sin^2\phi$ (C/m^2)
where ρ_{s0} is a constant.

Q2. An infinitely long cylindrical shell extending from r=1m to r=3m contains uniform charge density ρ_{v0}. Using Gauss Law, find **D** in all directions.

Q3. Show that the electric potential difference V_{12} between two points in air at radial distances r_1 and r_2 from an infinite line of charge with density ρ_l along the z-axis is

$$V_{12} = (\rho_l/2\pi\varepsilon_0) \ln(r_1/r_2)$$

Home Assignment to be submitted and discussed during tutorial session.

Q1. Suppose we have two negative charges: one located at the origin and carrying charge -9C and the other located on the positive x-axis at a distance d from the first charge with magnitude -36C. Determine the location, polarity and magnitude of a third charge whose placement would bring the entire system into equilibrium. A charge system is in equilibrium if the force acting on any one charge is identical in magnitude and direction to the force acting on any of the other charges in the system.

Q2. Two infinite lines of charge, both parallel to the z-axis, lie in the x–z plane, one with density ρ_l and located at $x = a$ and the other with density $-\rho_l$ and located at $x = -a$. Obtain an expression for the electric potential $V(x, y)$ at a point $P = (x, y)$ relative to the potential at the origin.