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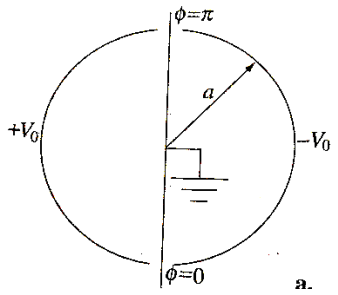
Problem Set no. V **Due date: Wednesday, Feb 21, 2024**

1. The curved surface of a cylindrical shaped conductor of infinite length (oriented along z axis) has been divided into two equal haves. The first part having, polar angle φ in the range of $0 \leq \varphi < \pi$, is maintain at a potential of V_1 and that of the remaining part at V_2, V_1 and V_2 being constant. Obtain the expression of the potential inside as well outside. Cross check your results back at the surface. Obtained the electric field and the surface charge density if any on the surface of the cylinder.

2. The curved surface of an infinitely long cylindrical shell, of radius R, carries a surface charge density $\sigma(\varphi) = k\cos 5\varphi$ (where k is a constant).
    a. Find the potential inside as well outside the cylinder.
    b. From above work out the electric field for $\rho > R$ as well as $\rho < R$.

3. The principal of electrostatic precipitator is based on the above problem. It is used to collect all the charged particles from the ashes. The schematic of the top view of one such electrostatic precipitator is shown the diagram below. The central conductor is in the form of a mesh to allow the passage of the particles. Calculate the potential inside and outside using above results (neglecting the formation of any space charges).



4. A long metallic cylinder of Radius R is divided into four equal sections section (length wise). Three of these are grounded and fourth one (e.g. $-\pi/4 < \varphi < \pi/4$) insulated from rest is maintained at a constant potential V_o. Obtained the expression for induced surface charge density on all the surfaces.