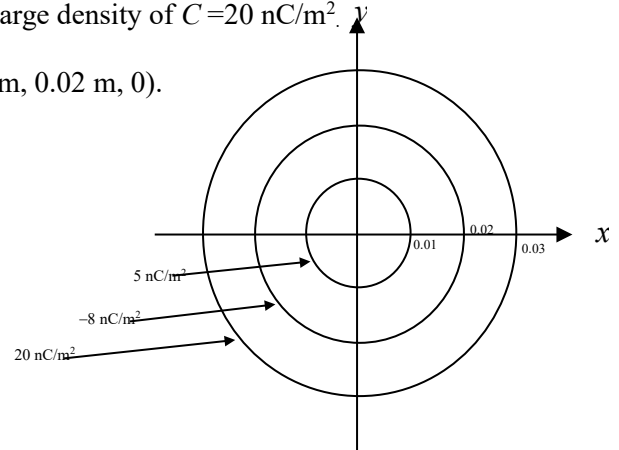


EE2104 Introduction to Electromagnetics
Assignment 3

Deadline (for uploading): 11:59 pm, 4 Nov 2022
Please put down your name and university ID.

1. In the figure below, suppose that we have three concentric infinitely long cylinders. They are centered around the origin and extends along the z direction. The innermost cylinder has a radius of $a = 0.01$ m and it carries a surface charge density of $A = 5 \text{ nC/m}^2$. The middle one has a radius of $b = 0.02$ m and it carries a surface charge density of $B = -8 \text{ nC/m}^2$. The outermost cylinder has a radius of $c = 0.03$ m and it carries a surface charge density of $C = 20 \text{ nC/m}^2$.

Using Gauss's law, find $\mathbf{D}$ at point $(x, y, z) = (0.02 \text{ m}, 0.02 \text{ m}, 0)$.

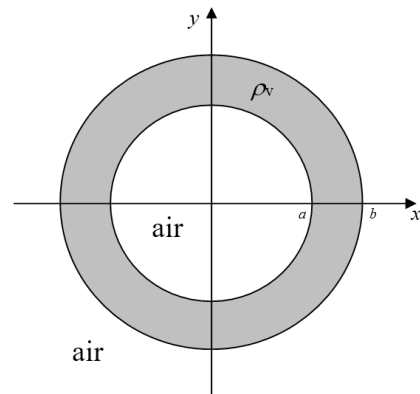


2. Consider a hollow spherical structure with inner radius a and outer radius b . The figure below shows the cross-section of the structure. In the spherical coordinate system, the charge density of the structure for $a < \rho < b$ is

$$\rho_v = \rho_{v0} \frac{\rho}{b}$$

where $\rho_{v0} (\text{C/m}^3)$ is a constant.

Find the electric field $\mathbf{E}$. Then, sketch its magnitude as a function of the radial coordinate ρ .



3. In a dielectric material, the electric flux density is 1.5 times the polarization. Find the dielectric constant of the material.
4. Consider a solid wire consisting of two conductive materials. The core has radius a and conductivity σ_1 . The jacket has conductivity σ_2 . Its inner radius is a and outer radius is b . Show that the ratio of the current densities in the two materials is independent of a and b .