KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Department of Electrical Engineering

EE 340 Electromagnetic

Homework 5 (Due Sat. Nov. 24)

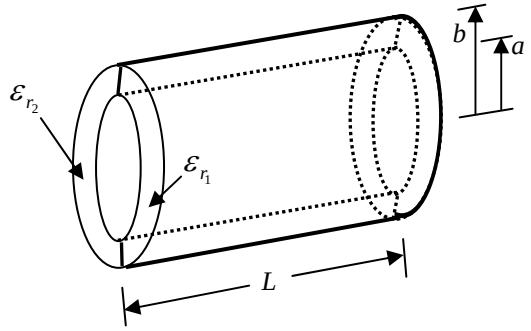
1- Solve the following problems:

(a) Find the breakdown voltage of a parallel plate capacitor, assuming that conducting plates ar 50 mm apart and the medium between them is air.

(b) Find the breakdown voltage if the entire space between the conducting plates is filled with plexiglass, which has a dielectric constant 3 and a dielectric strength of 20 KV/mm.

(c) If a 10 mm thick plexiglass is inserted between the plates, what is the maximum voltage that can be applied to the plates without breakdown.

2- A cyulindrical capacitor of length *L* consists of coaxial conducting surfaces of radii *a* an *b*. Two dielectric media of different dielectric constants ε_{r1} and ε_{r2} fill the space between the conducting surfaces as shown in the figure. Determine its capacitance.



3- Coaxial conducting cylinders are located at $\rho = 4$ and 15 cm. The value of $\overline{E}$ is $20\hat{a}_\rho$ kV/m at $\rho = 6\,cm$, and the potential of the more positive conductor is 200 V. Find:

a- the magnitude of the potential difference between the conductors.

b- The capacitance of the system, if the medium between the cylinders has $\varepsilon_r = 2.7$.

4- The region $2 < r < 5$ m between two concentric conducting shperes contains an inhomogeneous didelectric for which $\varepsilon_r = (r+1)/r$.

a- Is Laplace'sequation is satisfied in the region between the shperes.

b- If the inner sphere is at V= 1000 V and the outer is at V= 200 V, find V(r).

c- What is the capacitance between the sphees.

5- A parallel plate capacitor of area *A* is filled with a dielectric of permittivity $\varepsilon = \varepsilon_o[1+(\varepsilon_r y/d)]$, where $y = 0$ at one plate and $y = d$ at the other plate. Neglct fringing

a- Find $\overline{E}$, $\overline{D}$ and *V* as a function of distance *y* between plates.

b- Make a graph showing the variation of ε, $\overline{E}$, $\overline{D}$ and *V* as a function of *y*.

c- Find the capacitance.