

## Problem set 02

### Problem 1

A long cylindrical capacitor is made of two concentric cylindrical metal plates with radii  $b > a > 0$ . The space between the cylindrical metal plates is filled with dielectric materials having dielectric constants  $\epsilon_1$  in the region  $a < r < d$ , but  $\epsilon_0$  for  $b > r > d$ , where  $r$  is the radial cylindrical coordinate and  $d$  is a fixed radius where the two dielectric materials meet. The two metal plates have the potential difference  $V_0$ .

- (a) Find the capacity of the system per length.
- (b) Find the density of free charges in the system and the equivalent bound polarized charges.
- (c) Find the electrostatic force acting on the plates per length.

### Problem 2

Uniformly charged nonconducting shell with radius  $R$  carries total charge  $Q$ . Find the net force the northern hemisphere exerts on the southern one.

*The problems are due Monday January 27 2025 at 20:00*