4.59 Use the expressions given in Problem 4.58 to determine the capacitance for the configurations in Fig. P4.57(a) when the conducting plates are placed on the right and left faces of the structure.

Solution:

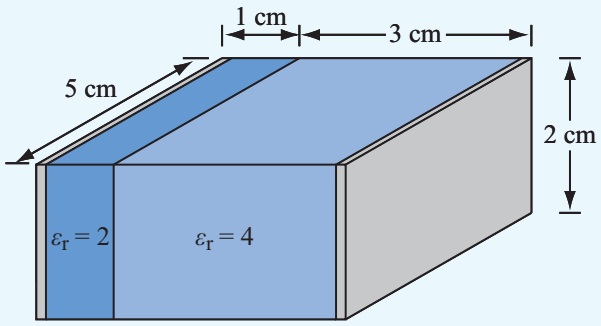

Figure P4.59 Dielectric section for Problem 4.59.

$$C_1 = \varepsilon_1 \frac{A}{d_1} = 2\varepsilon_0 \frac{(2\times 5)\times 10^{-4}}{1\times 10^{-2}} = 20\varepsilon_0 \times 10^{-2} = 1.77\times 10^{-12}\ \text{F},$$

$$C_2 = \varepsilon_2 \frac{A}{d_2} = 4\varepsilon_0 \frac{(2\times 5)\times 10^{-4}}{3\times 10^{-2}} = 1.18\times 10^{-12}\ \text{F},$$

$$C = \frac{C_1 C_2}{C_1 + C_2} = \frac{1.77\times 1.18}{1.77+1.18}\times 10^{-12} = 0.71\times 10^{-12}\ \text{F}.$$