

HOMEWORK 1

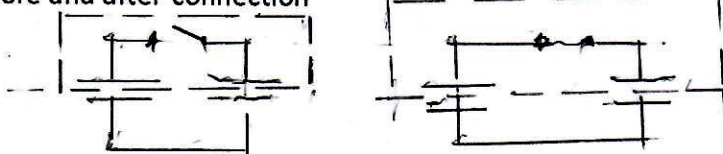
Ece 580, 2023

In a switched capacitor circuit, initially $C_1 = 1 \text{ pF}$ is charged to $V_1 = 2 \text{ V}$, and $C_2 = 1 \text{ pF}$ to $V_2 = 3 \text{ V}$. At $t = 0$, the two capacitors are connected in parallel.

- (a) What will be the final voltage across them?
- (b) What will be the stored energy before joining the capacitors?
- (c) What will it be after the transient?
- (d) Where did the lost power go?

SOLUTIONS

Circuit before and after connection



(a) Using Gaussian surface, after switching

$$Q_{12} = Q_1 + Q_2 = 2 + 3 = 5 \text{ pC}$$

$$V_{12} = Q_{12}/2 = 2.5 \text{ V}$$

(b) $E_1 + E_2 = \frac{1}{2} \cdot 1.4 + \frac{1}{2} \cdot 1.9 = 6.5 \text{ pJ}$

(c) $E_{12} = \frac{1}{2} \cdot 5 \cdot 2.5 = 6.25 \text{ pJ}$

(d) Dissipated in the switches.