

Exercise 2:

$$1) \frac{V_2 - V_1}{R_2} = I$$

$$\frac{0.1}{R_2} = 10^{-6}$$

$$R_2 = \frac{0.1}{10^{-6}} = 100 \text{ k}\Omega$$

$$2) \frac{R_4}{R_3 + R_4} = \frac{1}{10}$$

$$\frac{R_4}{R_3} = \frac{1}{9}$$

we can choose

$$R_4 = 22 \text{ k}\Omega, R_3 = 200 \text{ k}\Omega$$

which yields:

$$\frac{22}{22+200} \cdot 5 = 0.4955 \text{ V}$$

$$3) Q = CV$$

$$I = C \dot{V}$$

$$I = SCV$$

$$Z_C = \frac{1}{SC}$$

$$\left| \frac{R}{R + \frac{1}{j\omega C}} \right| = \frac{1}{2}$$

$$\left| \frac{j\omega RC}{j\omega RC + 1} \right| = \frac{1}{\sqrt{2}}$$

$$\frac{(j\omega RC)^2}{1 + (j\omega RC)^2} = \frac{1}{2}$$

$$2(j\omega RC)^2 = 1 + (j\omega RC)^2$$

$$j\omega RC = 1$$

$$RC = \frac{1}{\omega}$$

$$= \frac{1}{2\pi \cdot 100}$$

$$= 1.59155 \text{ E-3 s}$$

$$R_5 = 1.6 \text{ k}\Omega$$

$$C_1 = 1 \text{ nF are close}$$