Kondensator opgaver 1

Opgave 1.1

$$100\mu F + 10\mu F = 110\cdot\mu F$$

Opgave 1.2

$$C := \frac{1}{\frac{1}{100\mu F} + \frac{1}{10\mu F}} = 9.091\cdot\mu F$$

Kondensator DC opgave 1

Opgave 1.1

$t := 2s \qquad U_{bat} := 9\cdot V \qquad R := 10\cdot 10^3 ohm \qquad C := 100\mu F$

$$U_e := U_{bat}\cdot\left(1 - e^{\frac{-t}{R\cdot C}}\right) = 7.782\ V$$

Opgave 1.2

$U_e := 5V \qquad U_{bat} := 9\cdot V \qquad R := 10\cdot 10^3 ohm \qquad C := 100\mu F$

$$U_e = U_{bat}\cdot\left(1 - e^{\frac{-t}{R\cdot C}}\right) \text{ solve } \rightarrow -1000000\cdot ohm\cdot\mu F\cdot\ln\left(\frac{4}{9}\right) = 0.811\ s$$

Opgave 1.3

$U_{bat} := 5V \qquad U_C := 2V \qquad R := 10\cdot 10^3 ohm \qquad C := 100\mu F$

$$U_C = U_{bat}\cdot e^{\frac{-t}{R\cdot C}} \text{ solve, t } \rightarrow -1000000\cdot ohm\cdot\mu F\cdot\ln\left(\frac{2}{5}\right) = 0.916\ s$$

Kondensator AC opgave 1

Opgave 1.1

$V_{in} := 30V \qquad C_1 := 100nF \qquad C_2 := 1\mu F$

$$V_{out} := V_{in}\cdot\frac{C_1}{C_1 + C_2} = 2.727\ V$$

Alternativ:

$$V_{out} := V_{in}\cdot\frac{\frac{1}{C_2}}{\frac{1}{C_1} + \frac{1}{C_2}} = 2.727\ V$$

Opgave 1.2

Den generelle formel for en spændingsdeler er:

$$U_2 = U \cdot \frac{R_2}{R_1 + R_2}$$

Dette kan erstattes med kondensatorens modstand:

$$U_2 = U \cdot \frac{X_{C2}}{X_{C1} + X_{C2}}$$

Formlen for kondensatorens modstand er:

$$X_C = \frac{1}{2\pi \cdot f \cdot C}$$

Dette sættes ind i ligningen:

$$U_{C2} = U \cdot \frac{\frac{1}{2\pi \cdot f \cdot C_2}}{\frac{1}{2\pi \cdot f \cdot C_1} + \frac{1}{2\pi \cdot f \cdot C_2}}$$

2π*f kan nu fjernes:

$$U_{C2} = U \cdot \frac{\frac{1}{C_2}}{\frac{1}{C_1} + \frac{1}{C_2}}$$

Dette forlænges med $C_1 * C_2$:

$$U \cdot \frac{\frac{1}{C_2} \cdot C_1 \cdot C_2}{\left(\frac{1}{C_1} + \frac{1}{C_2}\right) \cdot C_1 \cdot C_2} = \frac{C_1}{C_2 + C_1}$$

Opgave 1.3

$f := 50Hz$ $C := 1\mu F$

$$X_C := \frac{1}{2\pi \cdot f \cdot C} = 3.183 \times 10^3 \Omega$$

Opgave 1.4

$I := 2mA$ $f := 60Hz$

$$X_C := \frac{1}{2\pi \cdot f \cdot C} = 2.653 \times 10^3\ \Omega$$

$U = I \cdot R$

$$U_C := I \cdot X_C = 5.305\ V$$