



Exercices d'application

Branche: Electrotechnique

Sujet:

Condensateur

Profession: Electronicien Mult.

Année d'apprentissage: 2^{ème}

Corrections

1. $\tau = R * C = 100 * 10^3 * 100 * 10^{-6} = 10s$

a)

$$i = \frac{U}{R} * e^{-\frac{t}{\tau}} = \frac{12}{100 * 10^3} * e^{-\frac{3}{10}} = 88.9\mu A$$

$$u_R = R * i = 100 * 10^3 * 88.9 * 10^{-6} = \underline{\underline{8.89V}}$$

b)

$$u_R = \frac{37 * 12}{100} = 4.44V$$

$$i = \frac{u_R}{R} = \frac{4.44}{100 * 10^3} = 44.4\mu A$$

$$i = \frac{U}{R} * e^{-\frac{t}{\tau}}$$

$$\frac{i * R}{U} = e^{-\frac{t}{\tau}}$$

$$\ln\left(\frac{i * R}{U}\right) = -\frac{t}{\tau}$$

$$t = -\tau * \ln\left(\frac{i * R}{U}\right) = -10 * \ln\left(\frac{44.4 * 10^{-6} * 100 * 10^3}{12}\right) = \underline{\underline{10s}}$$

2.

a)

$$\tau_1 = R_1 * C = 1 * 10^6 * 10 * 10^{-6} = 10s$$

$$u_C(t_1) = U * (1 - e^{-\frac{t_1}{\tau_1}}) = 10 * (1 - e^{-\frac{5}{10}}) = 3.93V$$

$$u_C(t_2) = U * (1 - e^{-\frac{t_2}{\tau_1}}) = 10 * (1 - e^{-\frac{10}{10}}) = 6.3V$$

$$u_C(t_3) = U * (1 - e^{-\frac{t_3}{\tau_1}}) = 10 * (1 - e^{-\frac{15}{10}}) = 7.76V$$

$$u_C(t_4) = U * (1 - e^{-\frac{t_4}{\tau_1}}) = 10 * (1 - e^{-\frac{20}{10}}) = 8.64V$$

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$$\tau_2 = (R_1 + R_2) * C = (1 * 10^6 + 500 * 10^3) * 10 * 10^{-6} = 15s$$

$$u_C(t_5) = U_C * e^{-\frac{t_5}{\tau_2}} = 8.64 * e^{-\frac{5}{15}} = 6.18V$$

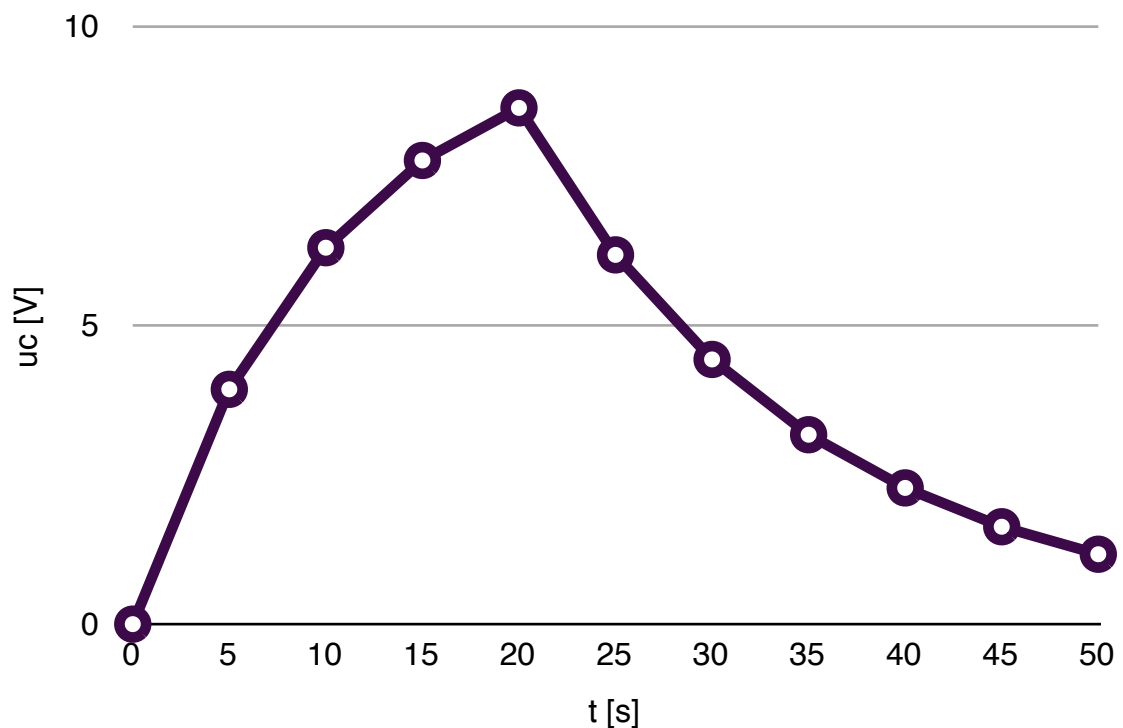
$$u_C(t_6) = U_C * e^{-\frac{t_6}{\tau_2}} = 8.64 * e^{-\frac{10}{15}} = 4.43V$$

$$u_C(t_7) = U_C * e^{-\frac{t_7}{\tau_2}} = 8.64 * e^{-\frac{15}{15}} = 3.17V$$

$$u_C(t_8) = U_C * e^{-\frac{t_8}{\tau_2}} = 8.64 * e^{-\frac{20}{15}} = 2.28V$$

$$u_C(t_9) = U_C * e^{-\frac{t_9}{\tau_2}} = 8.64 * e^{-\frac{25}{15}} = 1.63V$$

$$u_C(t_{10}) = U_C * e^{-\frac{t_{10}}{\tau_2}} = 8.64 * e^{-\frac{30}{15}} = 1.17V$$



b)

$$i(t_1) = \frac{U}{R_1} * e^{-\frac{t_1}{\tau_1}} = \frac{10}{1 * 10^6} * e^{-\frac{5}{10}} = 6.06\mu A$$

$$i(t_2) = \frac{U}{R_1} * e^{-\frac{t_2}{\tau_1}} = \frac{10}{1 * 10^6} * e^{-\frac{10}{10}} = 3.7\mu A$$

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$$i(t_3) = \frac{U}{R_1} * e^{-\frac{t_3}{\tau_1}} = \frac{10}{1 * 10^6} * e^{-\frac{15}{10}} = 2.23 \mu A$$

$$i(t_4) = \frac{U}{R_1} * e^{-\frac{t_4}{\tau_1}} = \frac{10}{1 * 10^6} * e^{-\frac{20}{10}} = 1.35 \mu A$$

$$i(t_{4+}) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_4}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{0}{15}} = -5.76 \mu A$$

$$i(t_5) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_5}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{5}{15}} = -4.12 \mu A$$

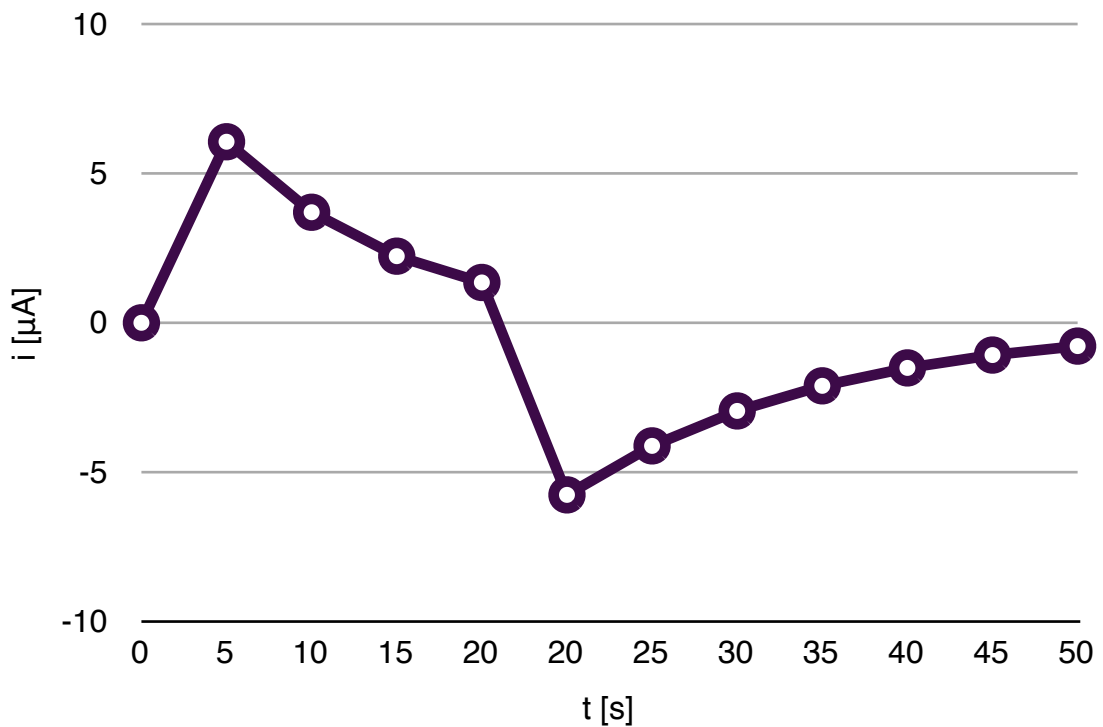
$$i(t_6) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_6}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{10}{15}} = -2.95 \mu A$$

$$i(t_7) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_7}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{15}{15}} = -2.11 \mu A$$

$$i(t_8) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_8}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{20}{15}} = -1.51 \mu A$$

$$i(t_9) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_9}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{25}{15}} = -1.08 \mu A$$

$$i(t_{10}) = -\frac{U_C}{R_1 + R_2} * e^{-\frac{t_{10}}{\tau_2}} = -\frac{8.64}{1 * 10^6 + 500 * 10^3} * e^{-\frac{30}{15}} = -0.78 \mu A$$



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c)

$$i(t_4) = \underline{\underline{1.35\mu A}}$$

d)

$$W_C = \frac{1}{2} * C * u_C^2(t_{10}) = \frac{1}{2} * 10 * 10^{-6} * 1.17^2 = \underline{\underline{6.8\mu J}}$$