

Electric Circuits II – Assignment

01

Source Free RC Circuit

#	Student ID	Student Name	Grade (10)
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Delivery Date	
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١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير
٢. يتم التسليم لمعيد المقرر مباشرة
٣. تتم أجابه التمرين في نفس ورق الأسئلة

Q4

7.8 For the circuit in Fig. 7.88, if

$$v = 10e^{-4t} \text{ V} \quad \text{and} \quad i = 0.2e^{-4t} \text{ A}, \quad t > 0$$

- Find R and C .
- Determine the time constant.
- Calculate the initial energy in the capacitor.
- Obtain the time it takes to dissipate 50 percent of the initial energy.

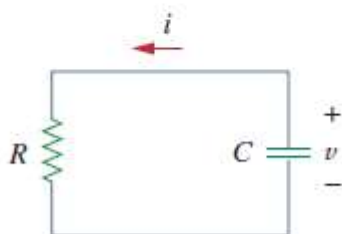


Figure 7.88

For Prob. 7.8.

Sol 4

.....

..... (a) $\tau = RC = \frac{1}{4}$

..... $-i = C \frac{dv}{dt}$

..... $-0.2e^{-4t} = C(10)(-4)e^{-4t} \longrightarrow C = \mathbf{5 \text{ mF}}$

..... $R = \frac{1}{4C} = \mathbf{50 \Omega}$

..... (b) $\tau = RC = \frac{1}{4} = \mathbf{0.25 \text{ s}}$

..... (c) $w_C(0) = \frac{1}{2} CV_0^2 = \frac{1}{2} (5 \times 10^{-3})(100) = \mathbf{250 \text{ mJ}}$

..... (d) $w_R = \frac{1}{2} \times \frac{1}{2} CV_0^2 = \frac{1}{2} CV_0^2 (1 - e^{-2t_0/\tau})$

..... $0.5 = 1 - e^{-8t_0} \longrightarrow e^{-8t_0} = \frac{1}{2}$

..... or $e^{8t_0} = 2$

..... $t_0 = \frac{1}{8} \ln(2) = \mathbf{86.6 \text{ ms}}$

.....

Q5

7.10 For the circuit in Fig. 7.90, find $v_o(t)$ for $t > 0$. Determine the time necessary for the capacitor voltage to decay to one-third of its value at $t = 0$.

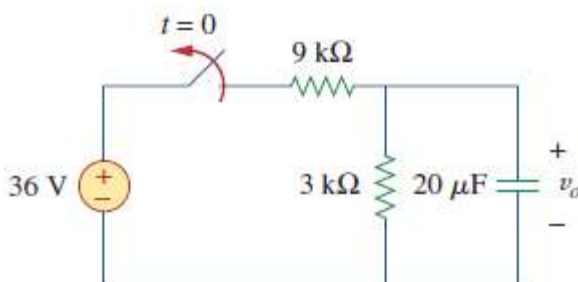


Figure 7.90
For Prob. 7.10.

Sol 5

.....

... For $t < 0$,
$$v(0^-) = \frac{3}{3+9}(36V) = 9V$$

... For $t > 0$, we have a source-free RC circuit

...
$$\tau = RC = 3 \times 10^3 \times 20 \times 10^{-6} = 0.06s$$

...
$$v_o(t) = 9e^{-16.667t} V$$

... Let the time be t_o .

...
$$3 = 9e^{-16.667t_o} \text{ or } e^{16.667t_o} = 9/3 = 3$$

...
$$t_o = \ln(3)/16.667 = 65.92 \text{ ms.}$$

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