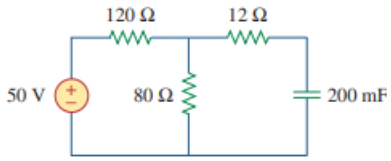
(Chapter-07) First order circuits

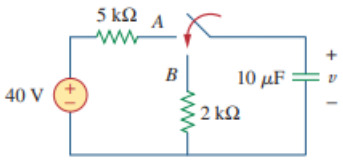
Practice Problems

The Source-Free RC Circuit

Q1. Find the time constant for the RC circuit in Fig given below.



Q2. The switch in Fig. below has been in position A for a long time. Assume the switch moves instantaneously from A to B at t=0. Find V for t>0.



Q3. For the given circuit, if:

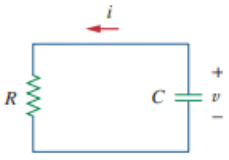
$v = 10e^{-4t}$ V and $i = 0.2\,e^{-4t}$ A, $t > 0$

(a) Find R and C.

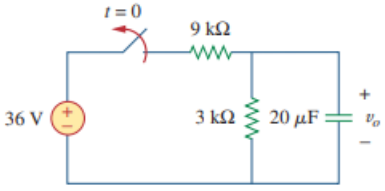
(b) Determine the time constant.

(c) Calculate the initial energy in the capacitor.

(d) Obtain the time it takes to dissipate 50 percent of the initial energy.

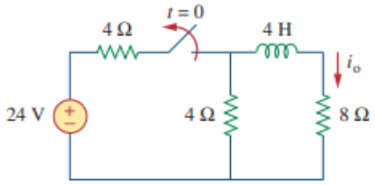


Q4. For the given circuit, find Vo(t) for t>0. Determine the time necessary for the capacitor voltage to decay to one-third of its value at t = 0.

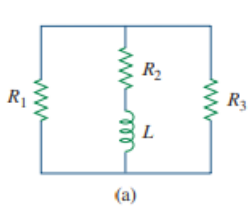


The Source-Free RL Circuit

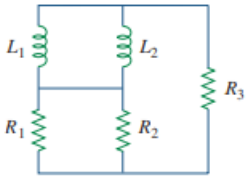
Q1. For the circuit given, find io for t>0.



Q2. Determine the time constant for each of the circuits.



(a)



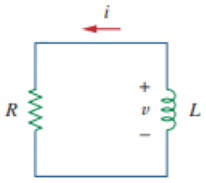
(b)

Q3. In the circuit of Fig given below:

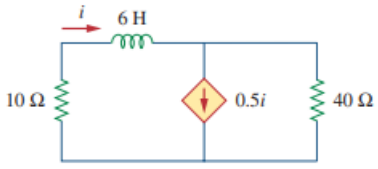
$$v(t) = 80e^{-10^3 t}\ \text{V}, \quad t > 0$$
$$i(t) = 5e^{-10^3 t}\ \text{mA}, \quad t > 0$$

(a) Find R, L, and τ.

(b) Calculate the energy dissipated in the resistance for $0 < t < 0.5$ ms.

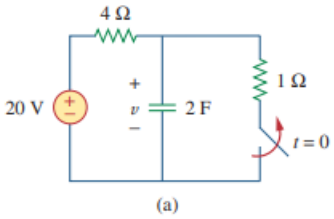


Q4. In the given circuit, find i(t) for t>0 if i(0) = 6 A.

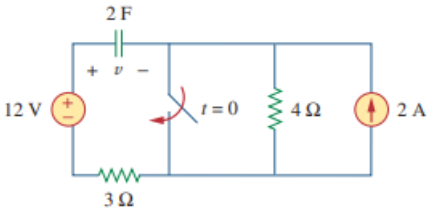


Step Response of an RC Circuit

Q1. Calculate the capacitor voltage for t<0 and t>0 for each of the circuits given below:



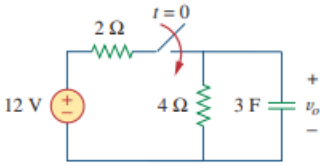
(a)



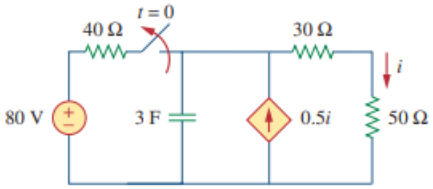
(b)

Q2. (a) If the switch in Fig has been open for a long time and is closed at t=0, find Vo(t)

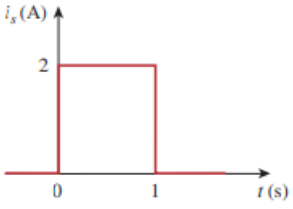
(b) Suppose that the switch has been closed for a long time and is opened at t=0, Find Vo(t).



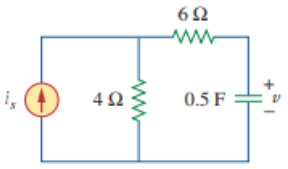
Q3. Consider the circuit in Fig given below, Find i(t) for t<0 and t>0.



Q4. If the waveform in Fig(a) is applied to the circuit of Fig(b), find V(t). Assume V(0) = 0.



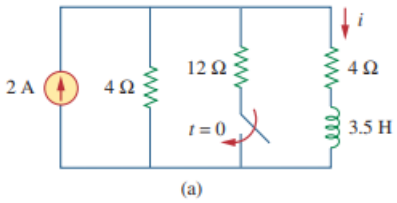
(a)



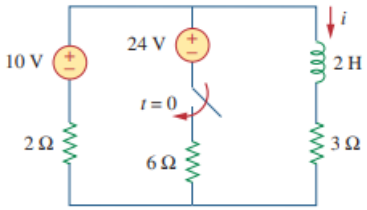
(b)

Step Response of an RL Circuit

Q1. Obtain the inductor current for both t<0 and t>0 in each of the circuits given below.

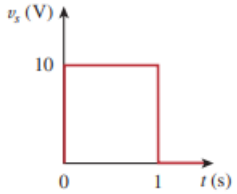


(a)

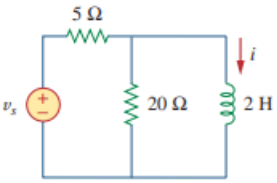


(b)

Q2. If the input pulse in Fig(a) is applied to the circuit in Fig(b), determine the response i(t)

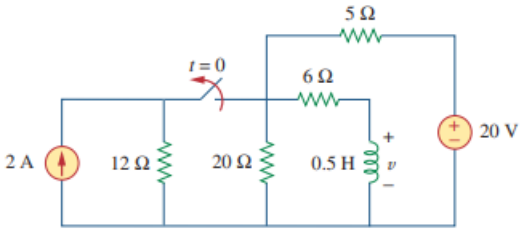


(a)



(b)

Q3. For the network shown in Fig, find V(t) for t>0.



Q4. Switch S1 in fig is closed at t=0, and switch S2 is closed at t = 2s. Calculate i(t) for all t.

Also find i(1) and i(3).