Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 203: Problem Set 14

Semester/Year: **2/2014**
Course Title: Basic Electrical Engineering
Instructor: Asst. Prof. Dr. Prapun Suksompong (prapun@siit.tu.ac.th)
Course Web Site: http://www2.siit.tu.ac.th/prapun/ecs203/

Due date: None

Questions

1. [Alexander and Sadiku, 2009, Q7.10] Consider the circuit in Figure 1.
   (a) Find $v_o(t)$ for $t > 0$.
   (b) Determine the time necessary for the capacitor voltage to decay to one-third of its value at $t = 0$.

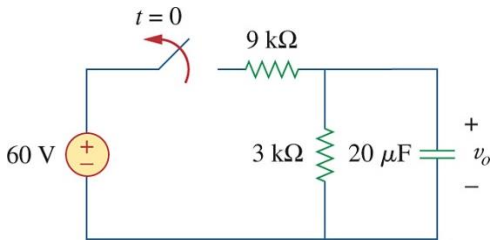

Figure 1

2. [Alexander and Sadiku, 2009, Q7.2] Determine the time constant for the circuit in Figure 2.

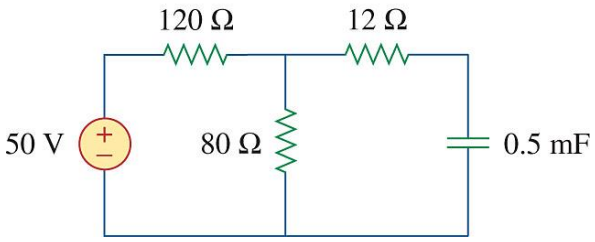

Figure 2

3. [Alexander and Sadiku, 2009, Q7.7] Assuming that the switch in Figure 3 has been in position A for a long time and is moved to position B at $t = 0$, find $v_o(t)$ for $t \geq 0$.

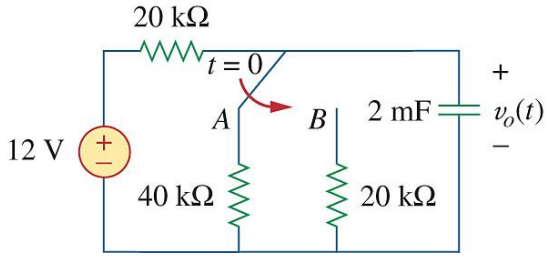

Figure 3

4. [F2010] Consider the circuit in Figure 4 below. **Assume** the switch has been **<u>at position 1 for a long time</u>** and moves to position 2 at t = 0 sec.

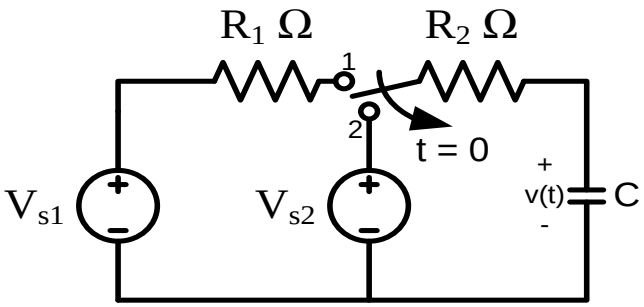

Figure 4

Let

$$V_{s1} = 5 \text{ V}, V_{s2} = 0 \text{ V}, R_1 = 6\ \Omega, R_2 = 3\ \Omega, \text{ and } C = 10 \text{ F}.$$

(a) (3 pt) Find $v(\mathbf{0}^-)$. Do not forget to justify your answer.
(b) (1 pt) Find $v(0)$. Do not forget to justify your answer.
(c) (4 pt) Find $v(t)$ for $t > 0$.

5. [F2010] Consider the circuit in Figure 5 below. Assume the switch has been at position 1 for a long time and moves to position 2 **at t = 5 sec.**

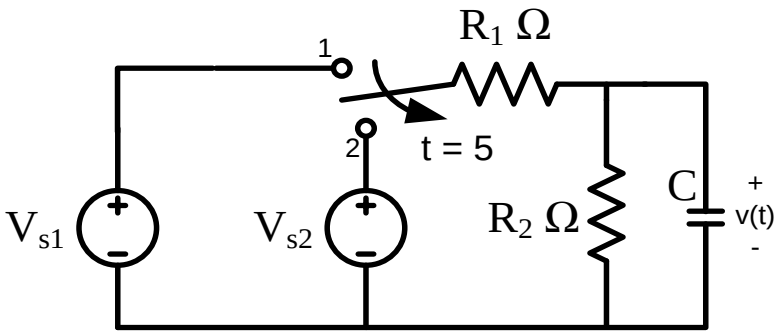

Figure 5

Let

V_{s1} = 16 V, V_{s2} = 8 V, R_1 = 3 Ω, R_2 = 5 Ω, and C = 8 F.

(a) (3 pt) Find *v*(0).
(b) (2 pt) Find *v*(5).
(c) (4 pt) Find *v*(*t*).
(d) (1 pt) Evaluate *v*(*t*) at t = 7.

6. [Alexander and Sadiku, 2009, Q7.40] Find the capacitor voltage **for $t < 0$ and $t > 0$** for each of the circuits in Figure 6.

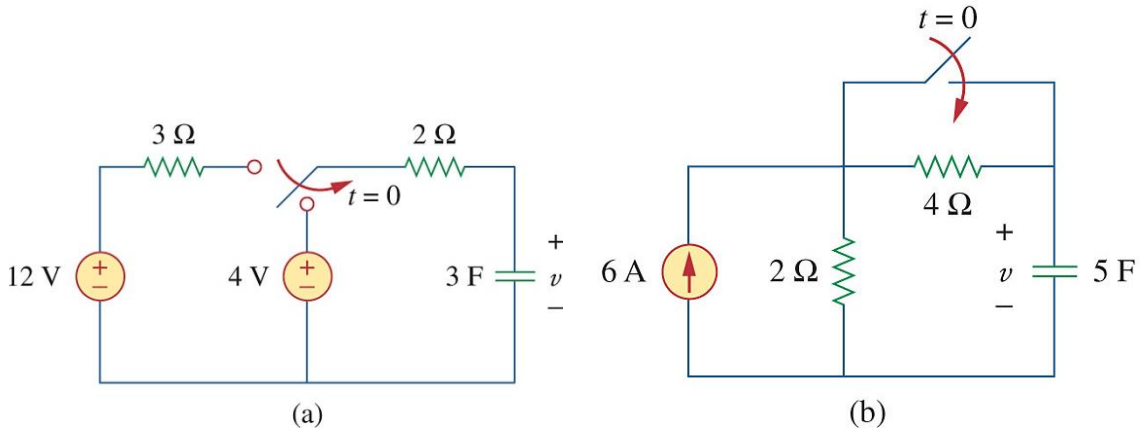

Figure 6

7. [Alexander and Sadiku, 2009, Q7.42]
   (a) If the switch in Figure 7 has been open for a long time and is closed at $t = 0$, find $v_o(t)$.
   (b) Suppose, instead, that the switch has been closed for a long time and is opened at $t = 0$. (Note that this is not shown in the figure.) Find $v_o(t)$.

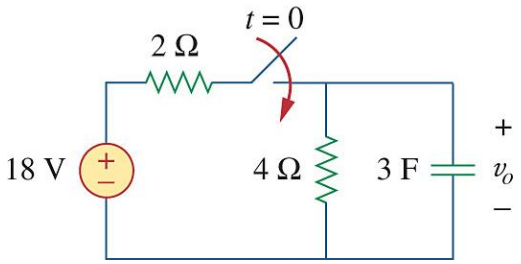

Figure 7

8. [Alexander and Sadiku, 2009, Q7.44] The switch in Figure 8 has been in position *a* for a long time. At $t = 0$, it moves to position *b*. Calculate $i(t)$ for all $t > 0$.

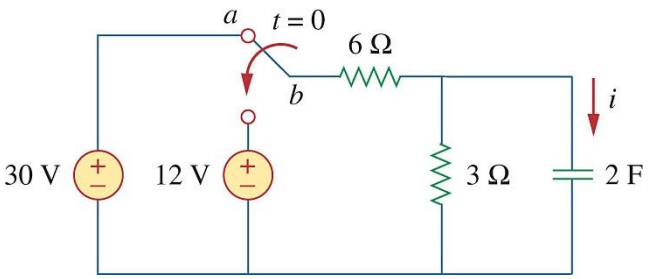

Figure 8

9. Consider the circuit in Figure 9 below. Let

V_s = 10 V, R_1 = 30 kΩ, R_2 = 10 kΩ, and C = 4 μF.

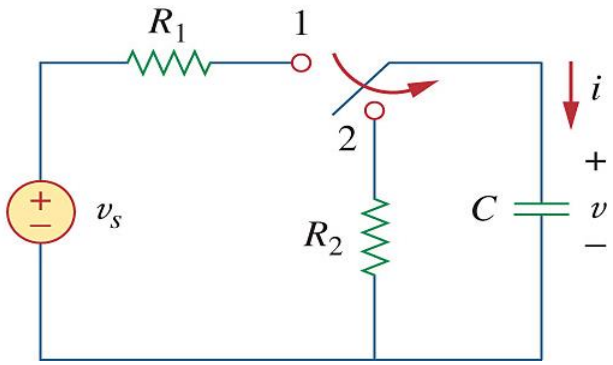

Figure 9

Assume that the switch has been in position 1 during time t < 0. Then, during time t ≥ 0 the switch changes its position five times: at t_1 = 0 ms, t_2 = 25 ms, t_3 = 50 ms, t_4 = 75 ms, t_5 = 100 ms.

(At time t_1, the switch changes to position 2. At time t_2, the switch changes back to position 1. At time t_3, the switch changes again to position 2….)

Plot the voltage *v*(t) for time *t* > 0.

Hint: You should have v(t_5) ≈ 4.59 V.