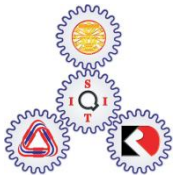

Sirindhorn International Institute of Technology
Thammasat University at Rangsit
School of Information, Computer and Communication Technology

ECS 203: Problem Set and Tutorial 12

Semester/Year: **2/2015**
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: Not Due

Instructions

1. All phasor should be answered in polar form where the magnitude is positive and the phase is between -180° and 180°.
2. All sinusoid should be answered in the cosine form where the amplitude is positive and the phase is between -180° and 180°.

Questions

1) [Alexander and Sadiku, 2009, Q9.17] Two voltages v_1 and v_2 appear in series so that their sum is $v = v_1+v_2$.
If $v_1 = 10\cos(50t - \pi/3)$ V and $v_2 = 12\cos(50t + 30^\circ)$ V,
Simplify v. (Your answer should be a time-dependent sinusoid in standard form.)

2) [Alexander and Sadiku, 2009, Q9.56] At ω = 377 rad/s, find the input impedance of the circuit shown in Figure 1.

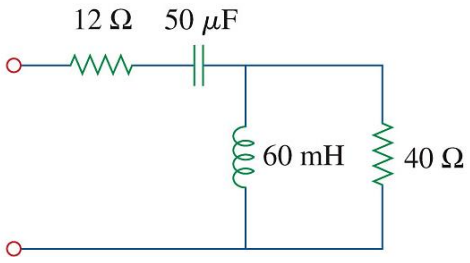

Figure 1

Remark: Impedance value should be answered in rectangular form. Unit is Ω.

3) [F2010] In this question, you **must** use the specified techniques to solve the problem. There will be **no credit** given if you do not follow the instructions. As always, your score depends strongly on your explanation of your answer. If the explanation is incomplete, zero score may be given even when the final answer is correct.

Consider the circuit below.

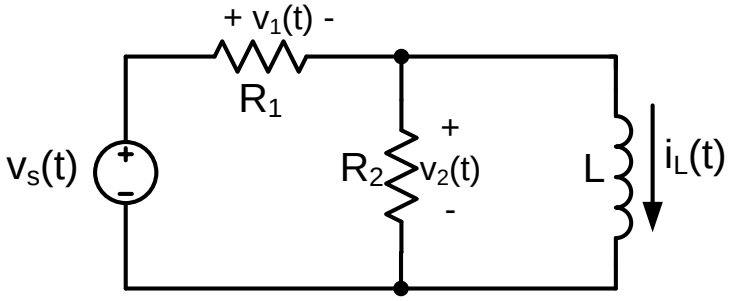

Figure 2

Suppose

$$v_s(t) = 7\cos\left(200t + 30^\circ\right) \text{ V},$$

R_1 = 6 Ω, R_2 = 4 Ω, and L = 5 mH.

a. Find $\mathbf{V_s}$ (which is the phasor representation of $v_s(t)$).

b. Find the impedance of the inductor.

c. Use **<u>nodal analysis</u>** to find the voltage $v_2(t)$ across the resistor R_2.

d. Find the voltage $v_1(t)$ across the resistor R_1.

e. Use **<u>mesh analysis</u>** to **<u>find all mesh currents</u>** (in the clockwise direction) in phasor form.

f. Use the mesh current(s) to find the current $i_L(t)$ through the inductor.

g. Use **source transformation**(s) and/or **impedance combination**(s) to transform the part of the circuit to the left of the inductor

into

a phasor voltage source $\mathbf{V_A}$ in series with an impedance $\mathbf{Z_A}$.

h. Use $\mathbf{V_A}$, $\mathbf{Z_A}$, and the impedance of the inductor to find $i_L(t)$.

4) [Alexander and Sadiku, 2009, Q10.43] Using the **superposition** principle, find i_x in the circuit of Figure 3.

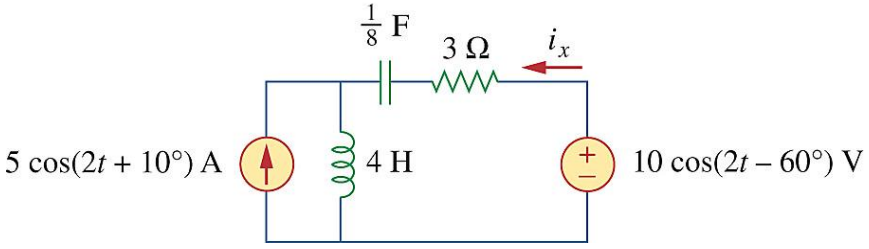

Figure 3

5) [Alexander and Sadiku, 2009, Q10.58] For the circuit depicted in Figure 4, find the **Thevenin equivalent** circuit at terminals *a*-*b*.

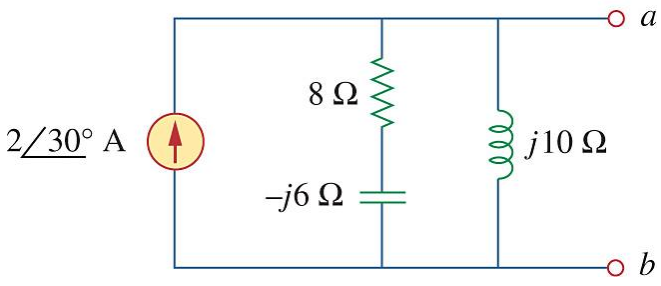

Figure 4

6) [Alexander and Sadiku, 2009, Q10.49] Using **source transformation**, find i in the circuit of Figure 5.

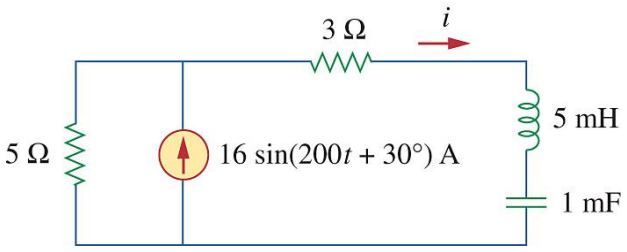

Figure 5

7) [Alexander and Sadiku, 2009, Q11.5] Assuming that $v_s(t) = 16\cos(2t - 40°)$ V in the circuit shown in Figure 6, find the average power delivered to each of the passive elements.

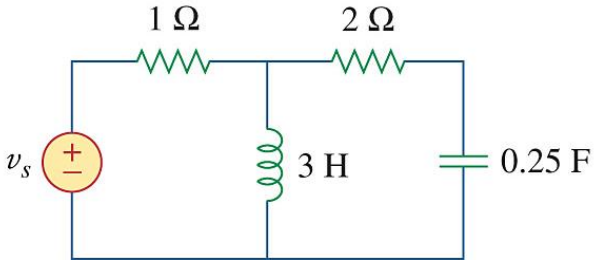

Figure 6

8) [F2010] Continue from Question 3. Consider the circuit below.

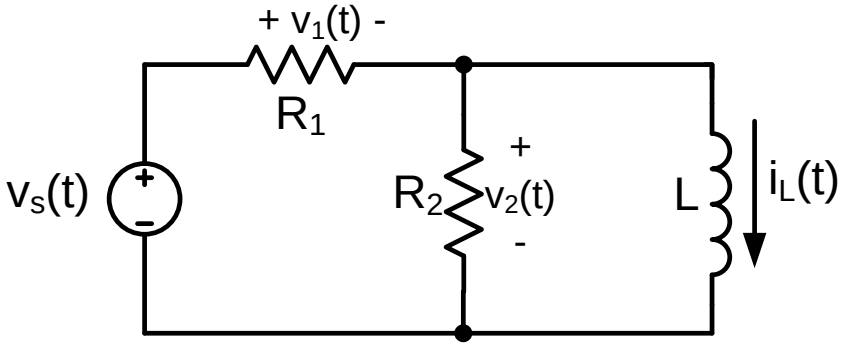

Figure 7

Suppose

$$v_s(t) = 7\cos\left(200t + 30^\circ\right) \text{ V},$$

$R_1 = 6\ \Omega$, $R_2 = 4\ \Omega$, and $L = 5$ mH.

a. Find the instantaneous power absorbed by R_1.

b. Find the average power absorbed by R_1

c. Find the average power absorbed by L

d. Find the average power **absorbed** by the voltage source.