Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 203: Problem Set 11

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: April 24

Instructions

i. Solve all problems. (5 pt)
ii. ONE sub-question will be graded (5 pt). Of course, you do not know which part will be selected; so you should work carefully on all of them.
iii. Late submission will be heavily penalized.
iv. ***Write down all the steps*** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
v. All phasor should be answered in polar form where the magnitude is positive and the phase is between -180° and 180°.
vi. All sinusoid should be answered in the cosine form where the amplitude is positive and the phase is between -180° and 180°.

Questions

1) [F2010]
   a) Find the sinusoid $x(t)$ which is represented by a phasor $\mathbf{X} = -7+7j$. Assume $\omega = 100$ rad/s. (Your answer should be a time-dependent sinusoid in standard form.)
   b) Simplify $x(t) = 7\cos(t-777^\circ) - 7\sin(t-77^\circ)$. (Your answer should be a time-dependent sinusoid in standard form.)
2) [Alexander and Sadiku, 2009, Q9.24a] Find $v(t)$ in the following integrodifferential equation using the phasor approach:

$$v(t) + \int v\,dt = 5\cos(t+45^\circ).$$

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

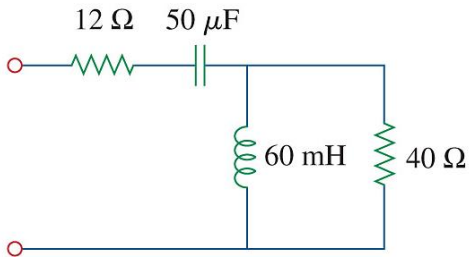

Figure 1

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

4) [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.

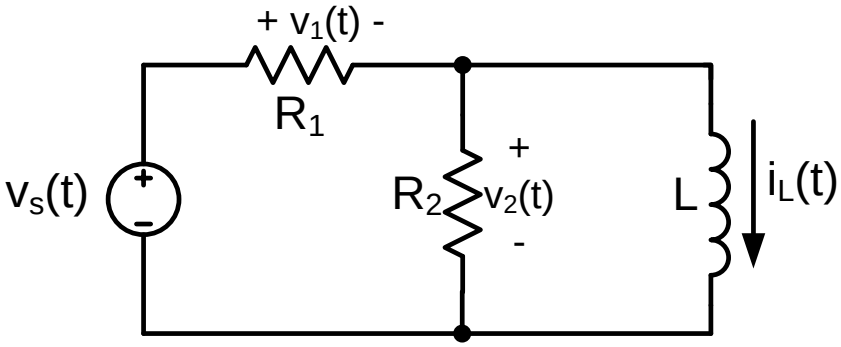

Figure 2

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 **nodal analysis** 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 **mesh analysis** to **find all mesh currents** (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 $i_L(t)$.

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

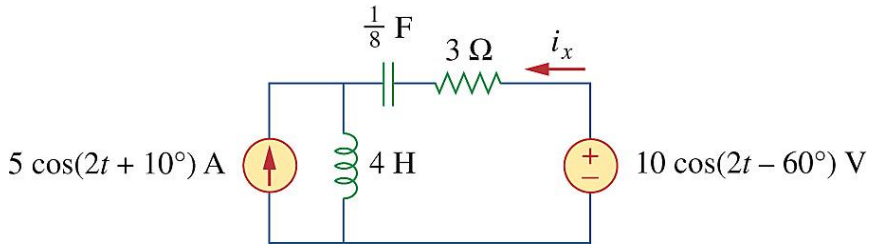

Figure 3

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

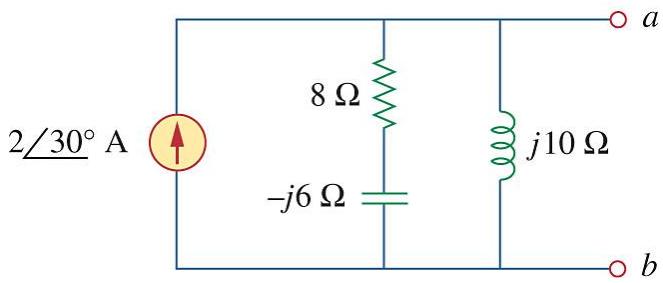

Figure 4