Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 203: Problem Set 13

Semester/Year: **2/2014**
Course Title: Basic Electrical Engineering
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Course Web Site: http://www2.siit.tu.ac.th/prapun/ecs203/

Due date: May 8

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. [Alexander and Sadiku, 2009, Q11.12] For the circuit shown in Figure 1, determine the load impedance Z_L for maximum power transfer (to Z_L). Calculate the maximum power absorbed by the load.

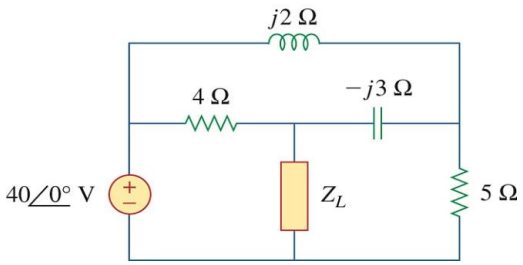

Figure 1

2. [F2010] Consider the circuit in Figure 2 below.

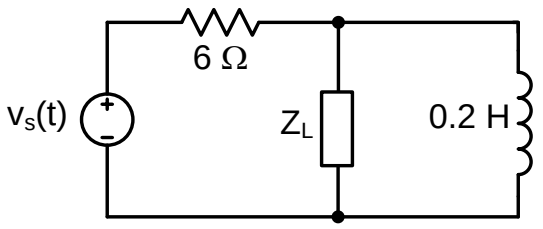

Figure 2

Suppose

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

a. Determine the **load impedance** Z_L for maximum power transfer (to Z_L).
b. How can you build the optimal Z_L which you got in part (a) from a combination of resistor(s)/inductor(s)/capacitor(s)? **Draw and explain** your answer. Indicate the values of each component (in Ω/H/F).
c. Calculate the **maximum power** absorbed by the load Z_L.

3. [Alexander and Sadiku, 2012, Q11.26] Find the effective value of the voltage waveform in Figure 3.

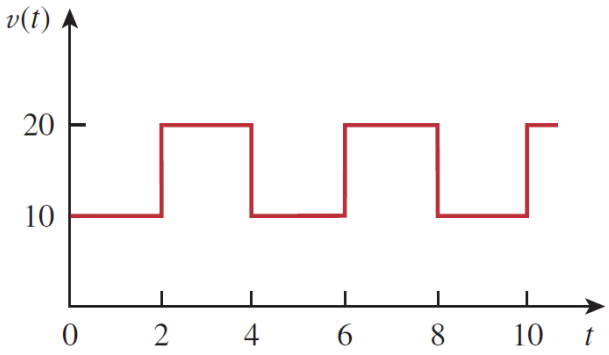

Figure 3: [Alexander and Sadiku, 2012, Figure 11.57]

4. [Alexander and Sadiku, 2012, Q11.36a-c] Calculate the rms value for each of the following functions:
   a. i(t) = 10 A
   b. v(t) = 4 + 3 cos 5t V
   c. i(t) = 8 - 6 sin 2t A

5. Find the solution of the following (first order) differential equations

(a) $\frac{d}{dt}x(t)+5x(t)=0,\ x(0)=5$

(b) $\frac{d}{dt}x(t)=-3x(t)+2,\ x(0)=0$

6. [Alexander and Sadiku, 2009, Q7.8] For the circuit in Figure 4 if
$v(t) = 10e^{-4t}$ V and $i(t) = 0.2e^{-4t}$ A, $t > 0$

(a) Find R and C.
(b) Determine the time constant τ.
(c) Calculate the initial energy in the capacitor.
(d) Obtain the time it takes to dissipate 50 percent of the initial energy.

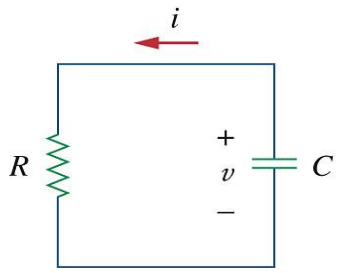

Figure 4

7. [Alexander and Sadiku, 2009, Q7.3] Determine the time constant for the circuit in Figure 5.

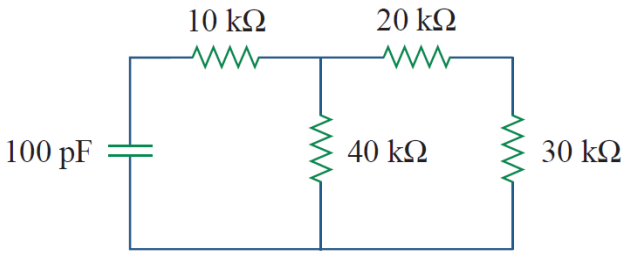

Figure 5: [Alexander and Sadiku, 2009, Figure 7.83]