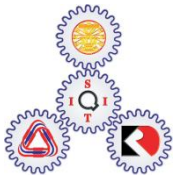

Sirindhorn International Institute of Technology
Thammasat University at Rangsit
School of Information, Computer and Communication Technology

ECS 203: Problem Set 7

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: Mar 21, 5 PM

Instructions

1. Solve all problems. (5 pt)
   a. Write your name and ID on the top of **every** submitted page.
   b. For each part, write your explanation/derivation and answer in the space provided.
2. 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.
3. There is no need to submit (or even print out) page 1 (this cover sheet).
4. Late submission will be rejected.
5. ***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.

Questions

1) Continue from Example 5.1.7 and 5.1.9 in the lecture.

a) We got two equations with two unknowns v_o and v_B:

$$\frac{v_B - v_i}{R_1} + \frac{v_B}{R_i} + \frac{v_B - v_o}{R_f} = 0 \quad \text{and} \quad \frac{v_o - v_B}{R_f} + \frac{v_o - A(-v_B)}{R_o} = 0.$$

Solve for v_o (in terms of $R_1, R_f, R_i, R_o, A,$ and v_i).

b) Use the expression of v_o derived in part (a) above to find $\frac{v_o}{v_i}$ under the following four scenarios (the first one is solved as ex.):

R_1	R_f	A	R_i	R_o	$\frac{v_o}{v_i}$ (exact)	$\frac{v_o}{v_i}$ (approx. to five decimal places)
10 kΩ	20 kΩ	2×10^5	2 MΩ	50 Ω	$-\frac{15999999800}{8000120601}$	-1.99997
10 kΩ	20 kΩ	10^4	1 MΩ	1 kΩ		
10 kΩ	20 kΩ	10^3	100 kΩ	10 kΩ		
20 kΩ	20 kΩ	10^3	100 kΩ	10 kΩ		

2) [Alexander and Sadiku, 2009, Q5.8] Obtain v_o for each of the op amp circuits in Figure 1.

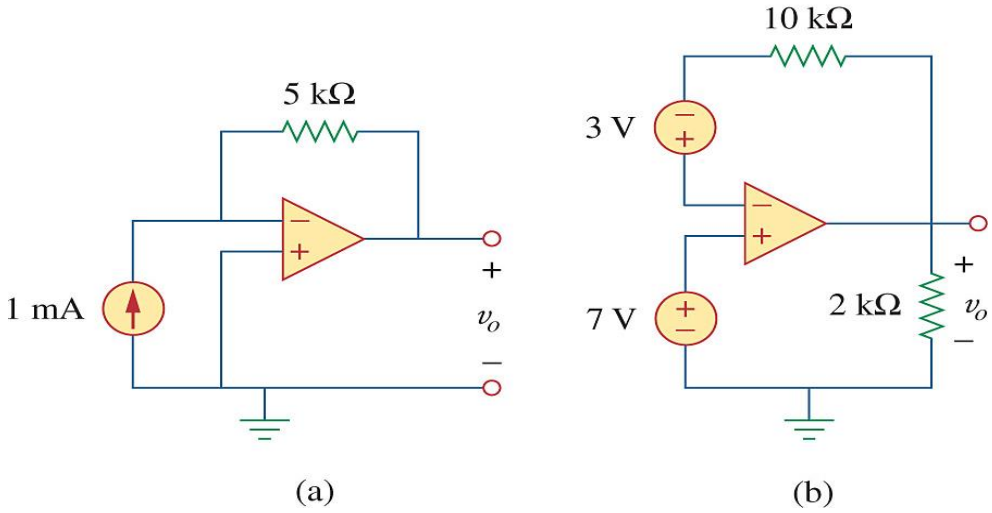

Figure 1

3) [Alexander and Sadiku, 2009, Q5.10] Find the gain v_o/v_s of the circuit in Figure 2.

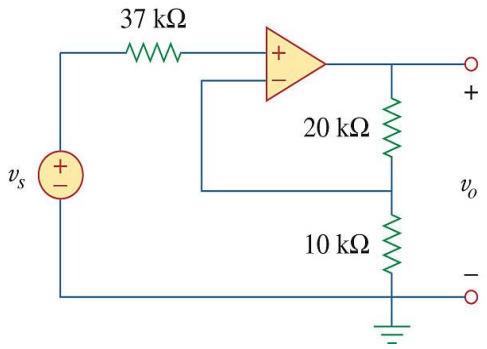

Figure 2

4) [Alexander and Sadiku, 2009, Q5.20] In the circuit in Figure 3, calculate v_o if $v_s = 0$.

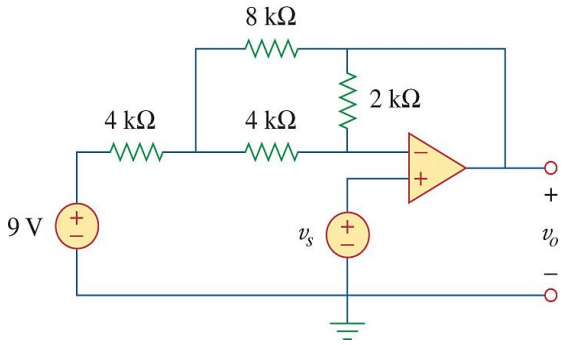

Figure 3