

ECSE 2010  
Electric Circuits  
Exam 2  
Spring 2005

Name \_\_\_\_\_

Section Number (please circle one)

1	2	3
MTR	MWR	MTR
10-12	4-6	2-4

Problem No.	Pts.	Score
1	20pts	
2	20pts	
3	20pts	
4	10pts	
5	30pts	
Total	100pts	

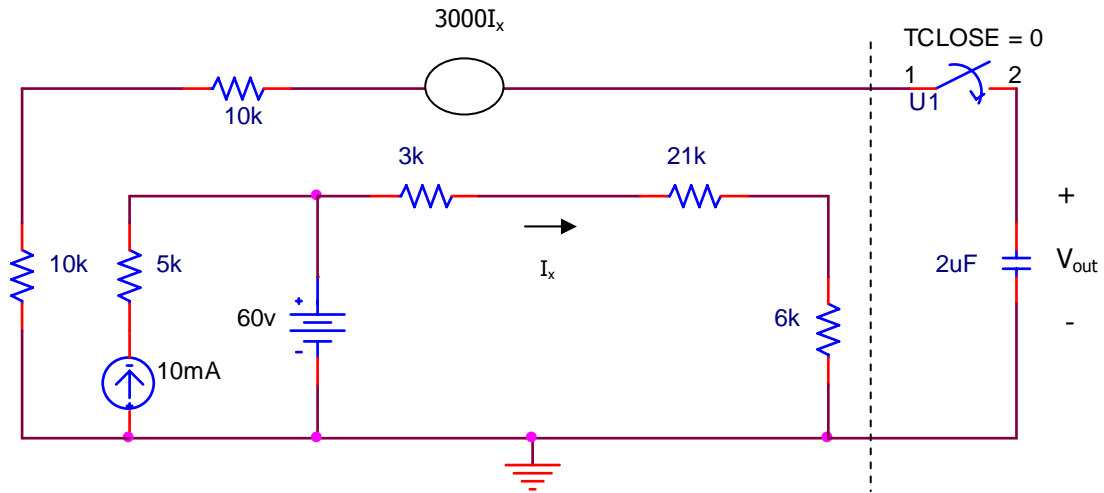
Please Note:

- \* Place all your answers in the spaces provided.
- \* You MUST show ALL your work or thoroughly describe your solution process to receive any credit.

Problem 1 (20pts)

Name \_\_\_\_\_

a.) The switch is open for a long time before closing at  $t=0$  in the circuit shown below. Find the Thevenin equivalent (to the left of the dashed line) for  $t=0^+$ . (6pts)

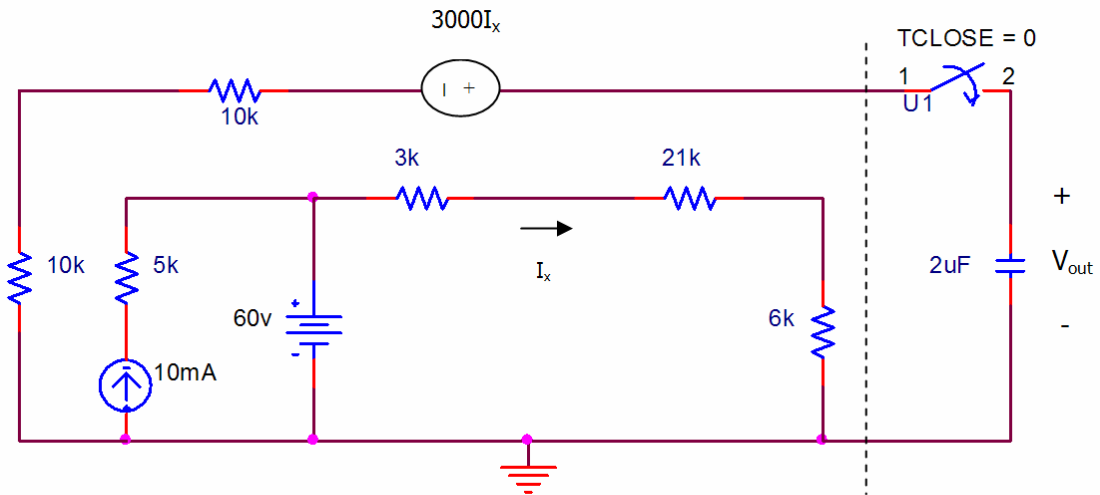


$V_{TH}$	
$R_{TH}$	

Problem 1 (cont)

Name \_\_\_\_\_

b.) Find  $V_{out}(t)$  for  $t \geq 0$  given the circuit shown below. (14pts)



$V_{out}(t)$	
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Problem 2 (20pts)

Name \_\_\_\_\_

A circuit has an output voltage whose Laplace transform is:

$$V_o(s) = \frac{37s^2}{(s+4)(s^2+6s+45)}$$

a.) Find  $V_o(t)$  for the circuit. (10pts)

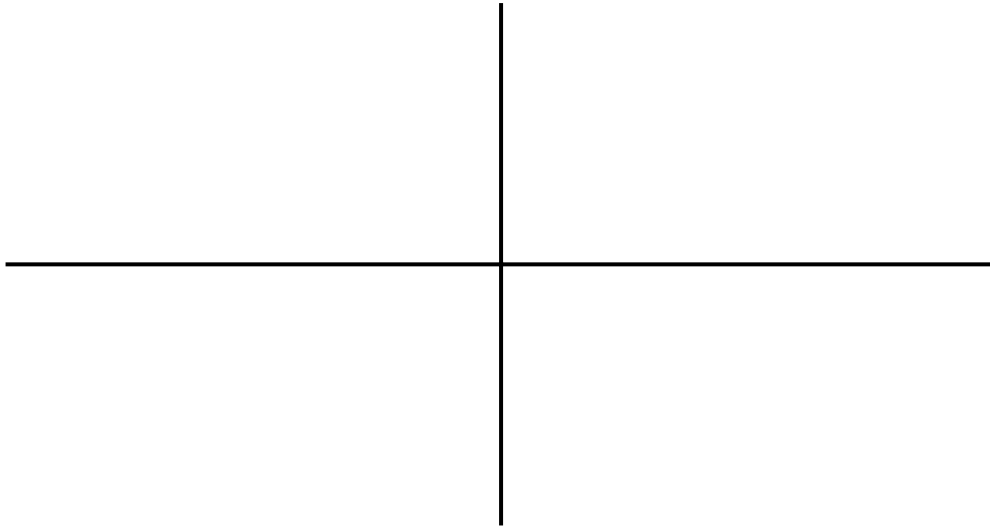
$V_o(t)$	
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Problem 2 (cont)

Name \_\_\_\_\_

Given: 
$$V_o(s) = \frac{37s^2}{(s+4)(s^2+6s+45)}$$

b.) Sketch the pole/zero diagram of  $V_o(s)$ . (5pts)



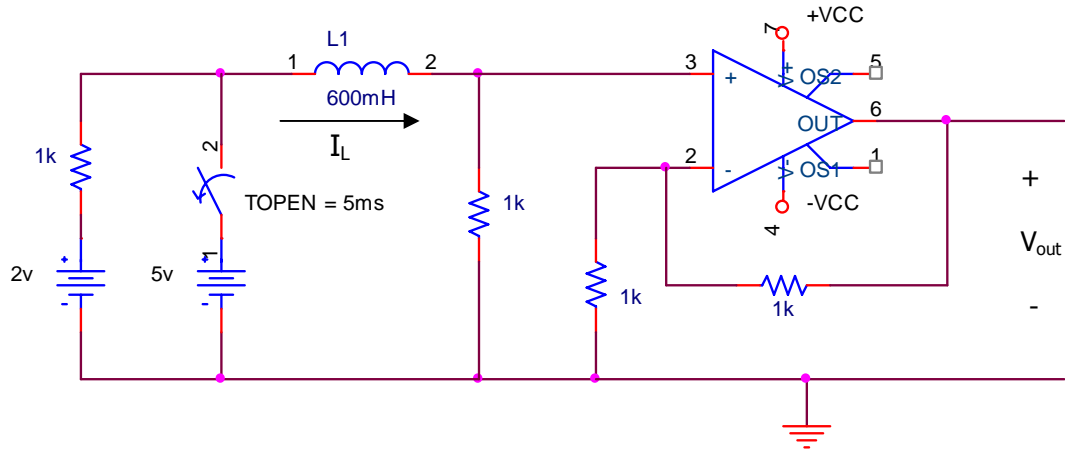
c.) Find the steady-state value of  $V_o(t)$  as  $t \rightarrow \infty$ . (5pts)

$V_o(t)$	
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Problem 3 (20pts)

Name \_\_\_\_\_

Sketch  $V_{out}(t)$  and  $I_L(t)$  for the following circuit, identifying all the pertinent and significant values for the time constants, currents and voltages for  $t \geq 0$ . Assume that both the 2v and the 5v sources were initially turned on at  $t=0$ .



$V_{out}(t)$



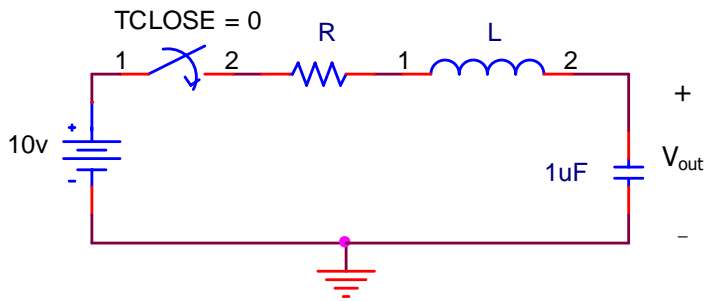
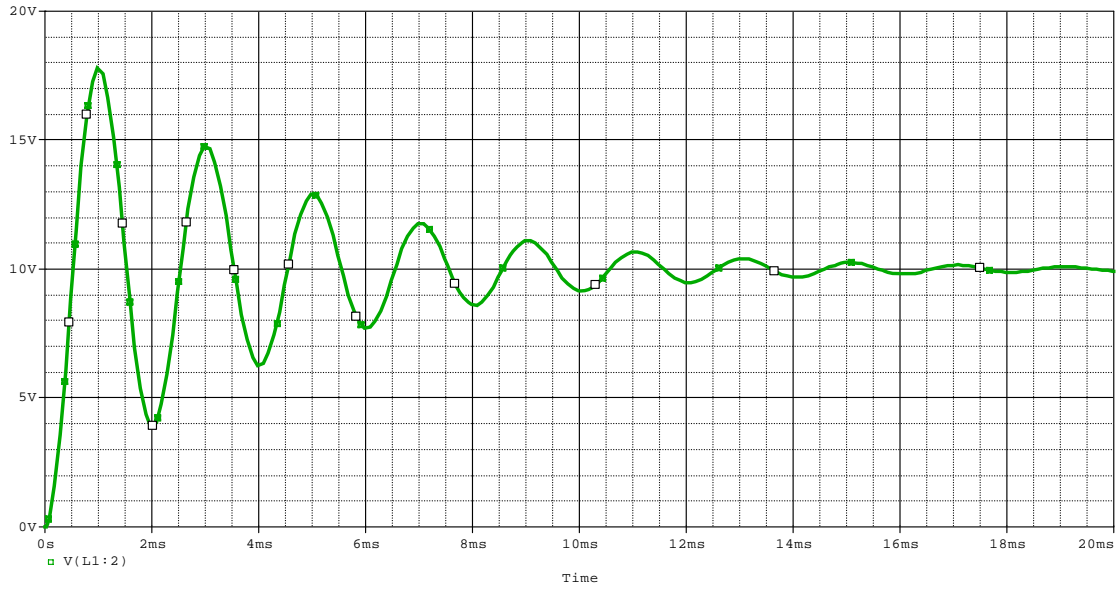
$I_L(t)$



Problem 4 (10pts)

Name \_\_\_\_\_

Find R and L in the given circuit that would produce the  $V_{out}(t)$  shown below.



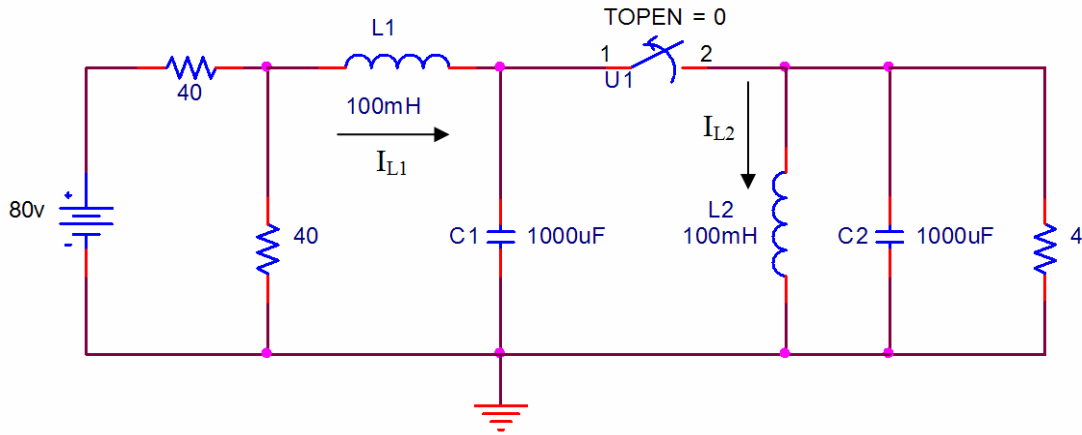
R	
L	

Problem 5 (20pts)

Name \_\_\_\_\_

The switch in the circuit below has been closed for a long time. At  $t=0$  it opens.

a.) Calculate  $I_{L1}(0^-)$ ,  $V_{C1}(0^-)$ ,  $I_{L2}(0^+)$ ,  $V_{C2}(0^+)$ , being careful to place your answers in the correct boxes below (8pts).

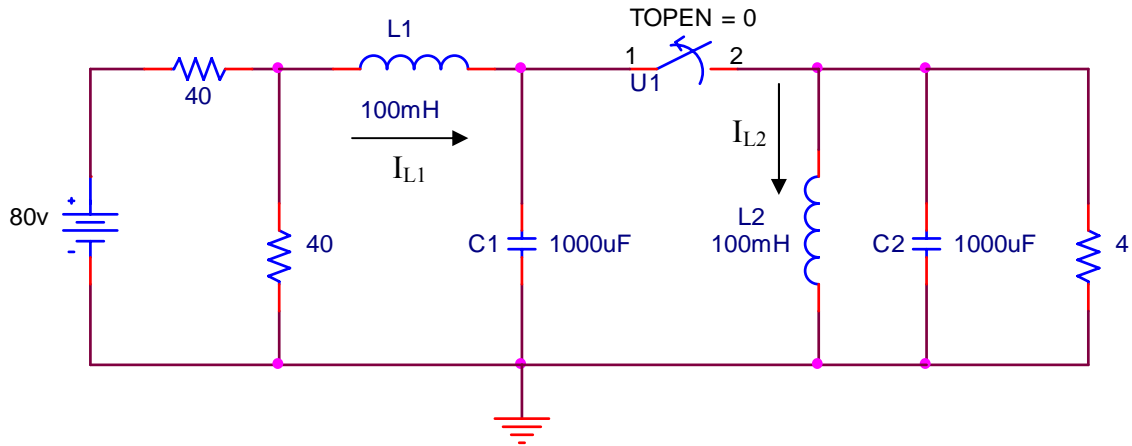


$I_{L1}(0^-)$	
$V_{C1}(0^-)$	
$I_{L2}(0^+)$	
$V_{C2}(0^+)$	

Problem 5 (cont.)

Name \_\_\_\_\_

b.) Find the form of the differential equations that describe the natural responses of  $I_{L1}(t)$  and  $I_{L2}(t)$  for  $t > 0$ . Do NOT solve for the associated constants. (10pts)

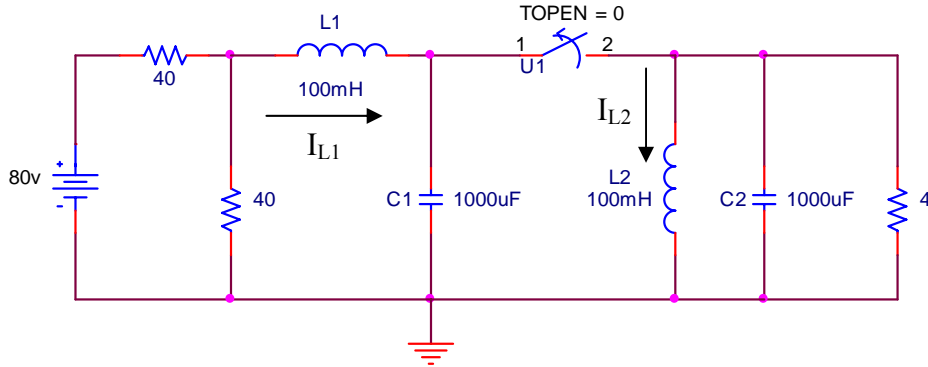


$I_{L1}(t)$	
$I_{L2}(t)$	

Problem 5 (cont.)

Name \_\_\_\_\_

c.) Characterize the responses for  $I_{L1}(t)$  and  $I_{L2}(t)$  as underdamped, critically damped, or overdamped – and justify your responses in the space below. (6pts)



$I_{L1}(t)$	
$I_{L2}(t)$	

d.) Find  $I_{L1}(t)$  and  $I_{L2}(t)$  at  $t = \infty$ . (6pts)

$I_{L2}(\infty)$	
$I_{L2}(\infty)$	

Extra space (if needed)

Name \_\_\_\_\_

Extra space (if needed)

Name \_\_\_\_\_