

ECSE 2010  
Electric Circuits  
Exam 3  
Fall 2007

Name \_\_\_\_\_

Section (please circle one)

10-12  
Millard

12-2  
Zhang

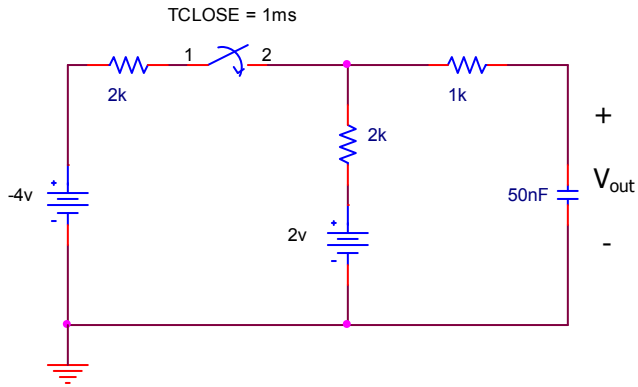
Problem No.	Pts.	Score
1	20pts	
2	30pts	
3	10pts	
4	25pts	
5	15pts	
Total	100pts	

Please Note:

- All your answers must be placed in the spaces provided.
- You MUST show your work to receive any credit.
- Assume ALL sources are turned ON at  $t=0$ , unless noted otherwise.
- **The Laplace transform of  $10u(t) = 10/s$ .**

Problem 1 (20pts)

a.) The switch is open for a long time before closing at  $t = 1\text{ms}$  in the circuit shown below. Find  $V_{\text{out}}(s)$  for  $t \geq 1\text{ms}$  and sketch  $V_{\text{out}}(t)$  for  $t \geq 0$ . (10pts)

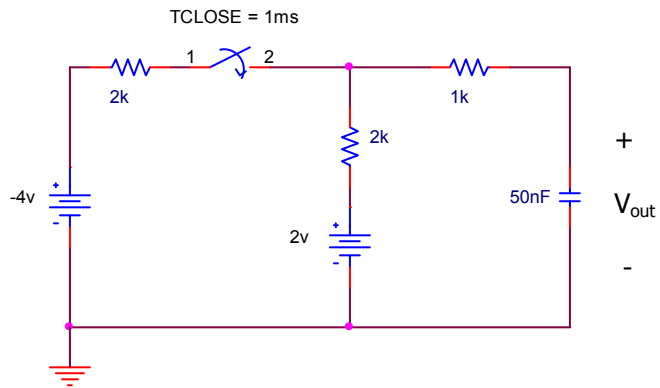


$V_{\text{out}}(s)$	
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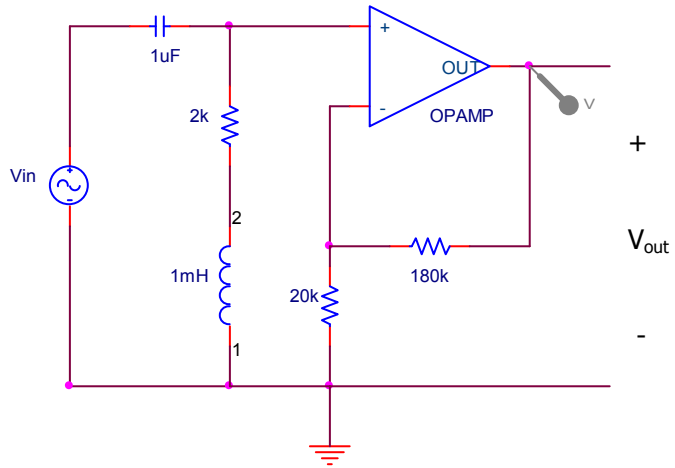
Problem 1 (cont)

b.) Find  $V_{out}(t)$  for  $t \geq 1\text{msec}$  given the circuit shown below, showing all pertinent values. (10pts)



$V_{out}(t)$	
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**Problem 2 (30pts)**

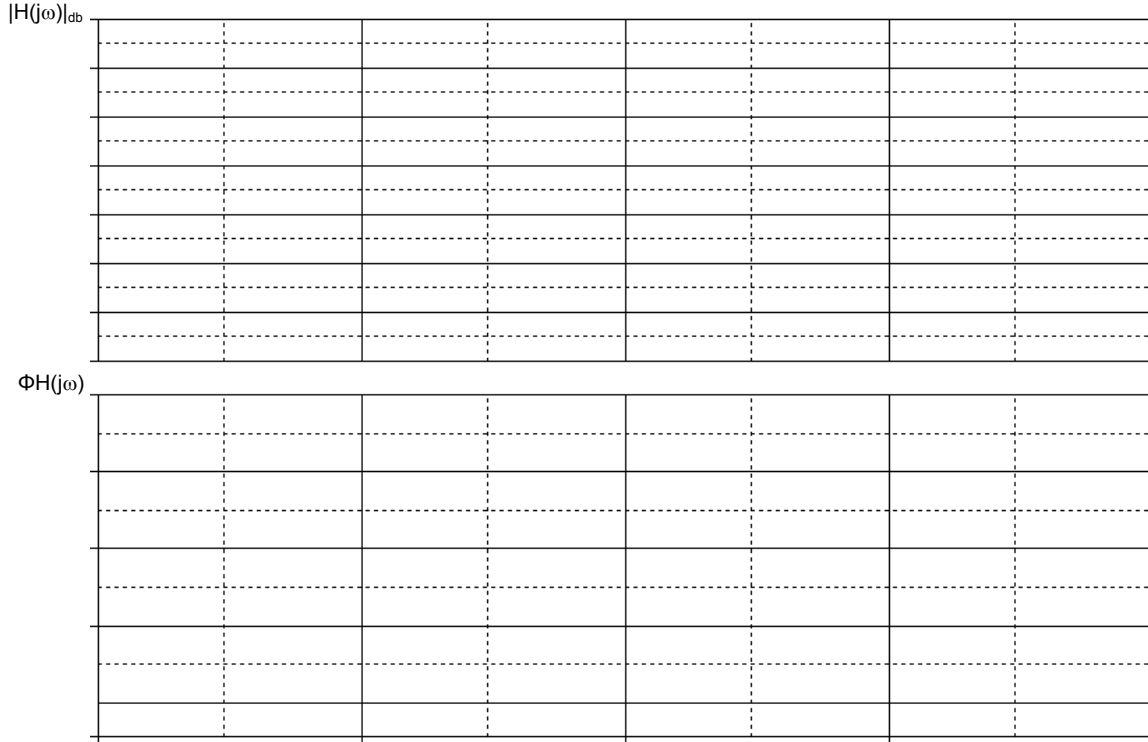


a.) Find  $H(s) = \frac{V_{out}(s)}{V_{in}(s)}$  for the above circuit. (10pts)

H (s)	
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Problem 2 (cont)

b.) Sketch the asymptotic Bode plot  $|H(j\omega)|_{dB}$  and  $\Phi H(j\omega)$  for the circuit shown in part (a). Please label your axes and critical values. (10pts)



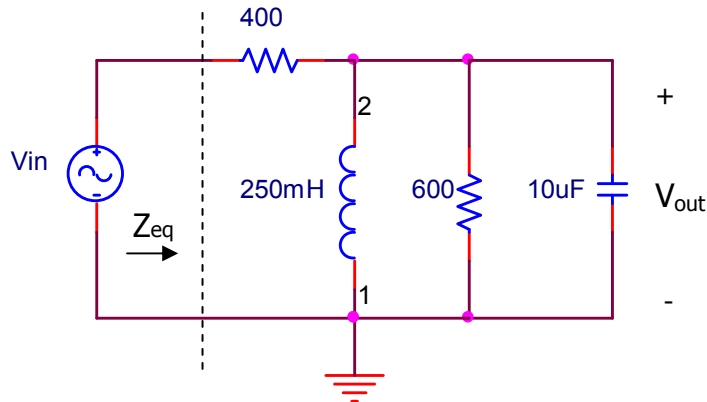
c.) For an input  $V_{in}(t) = 5\cos(100t)$ , what is the output voltage  $V_{out}(t)$ ? (5pts)

$V_{out}(t)$	
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d.) For an input  $V_{in}(t) = 1\cos(500kt)$ , what is the output voltage  $V_{out}(t)$ ? (5pts)

$V_{out}(t)$	
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Problem 3 (10pts)



a.) Determine the frequencies ( $\omega$ , in radians/sec) where  $Z_{eq}$ , the equivalent load impedance of the circuit above, is either at a minimum or at a maximum. (6pts)

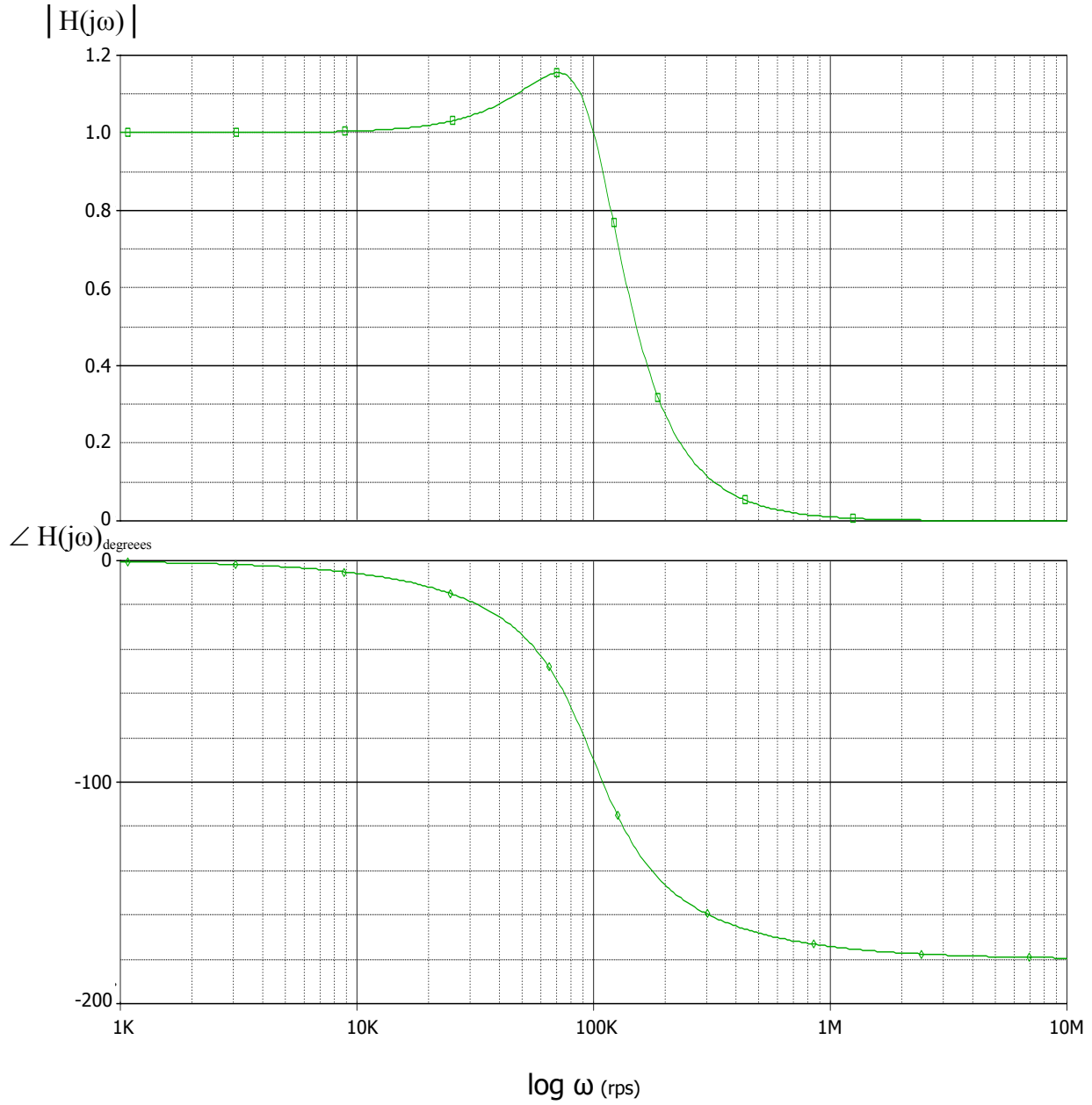
$\omega$ $Z_{eq}$ (min)	
$\omega$ $Z_{eq}$ (max)	

b.) What is  $V_{out}(t)$  for  $V_{in}(t) = 1\cos(\omega_0 t + 45^\circ)$ , where  $\omega_0$  is the resonant frequency? Please justify your response. (4pts)

$V_{out}(t)$	
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**Problem 4 (25pts)**

a) Given the plots shown below, find  $\omega_{co}$ . (Please note: **the graph is not in dB**)



$\omega_{co} =$

Problem 4 (cont)

b) What output voltage  $V_{\text{out}}(t)$  would be produced by an input  $V_{\text{in}}(t) = 10\cos(\omega t)$ , where  $\omega = 200\text{krps}$ ?

$V_{\text{out}}(t) =$

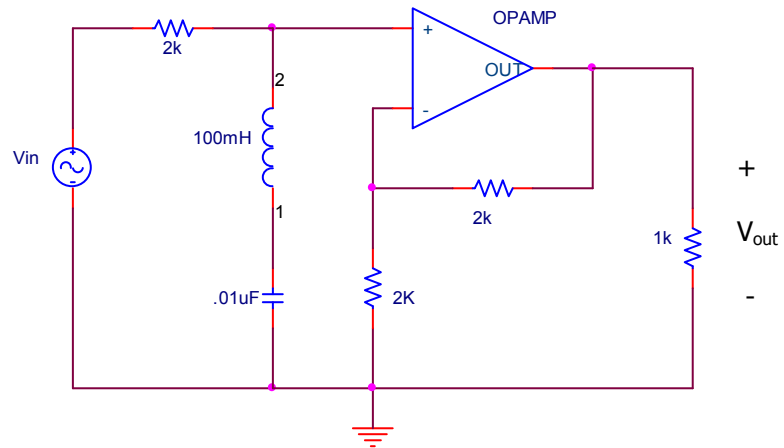
Problem 4 (cont)

c) Design a circuit that would produce the plots shown (on the prior page), using only three components. Please support your work.

Problem 5 (15pts)

Name \_\_\_\_\_

a.) Find  $H(s) = \frac{V_{out}(s)}{V_{in}(s)}$  for the circuit shown. (5pts)



H(s)	
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Problem 5 (cont.)

Name \_\_\_\_\_

b.) What  $V_{out}(t)$  would be produced if  $V_{in}(t) = 5\cos(1_{rps}t + 45^\circ)$ ? Justify your response. (5pts)

$V_{out}(t)$	
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c.) What kind of filter could this circuit represent? Please explain your response in the space provided below. (5pts)

Filter Type	
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Extra space (if needed)

Name \_\_\_\_\_

Extra space (if needed)

Name \_\_\_\_\_