

ECSE 2010
Electric Circuits
Exam 3
Spring 2008

Name _____

Section (please circle one)

10-11

11-12

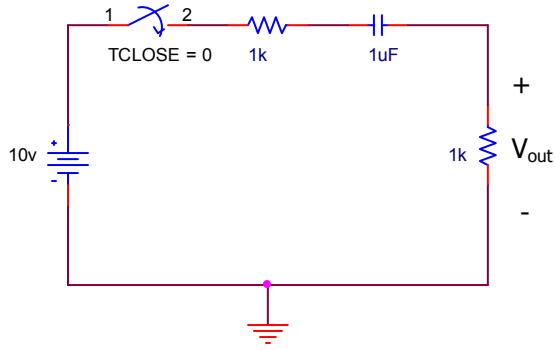
Problem No.	Pts.	Score
1	20pts	
2	30pts	
3	10pts	
4	25pts	
5	15pts	
Total	100pts	

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)

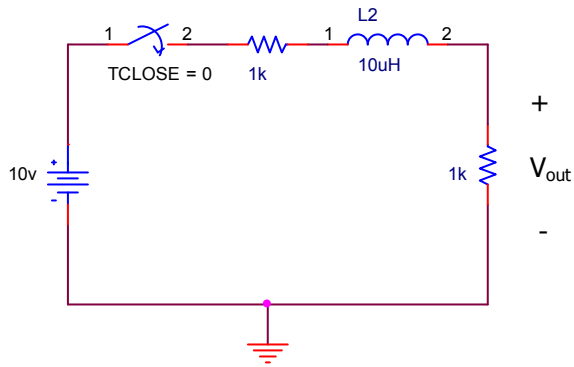


$V_{\text{out}}(s)$	
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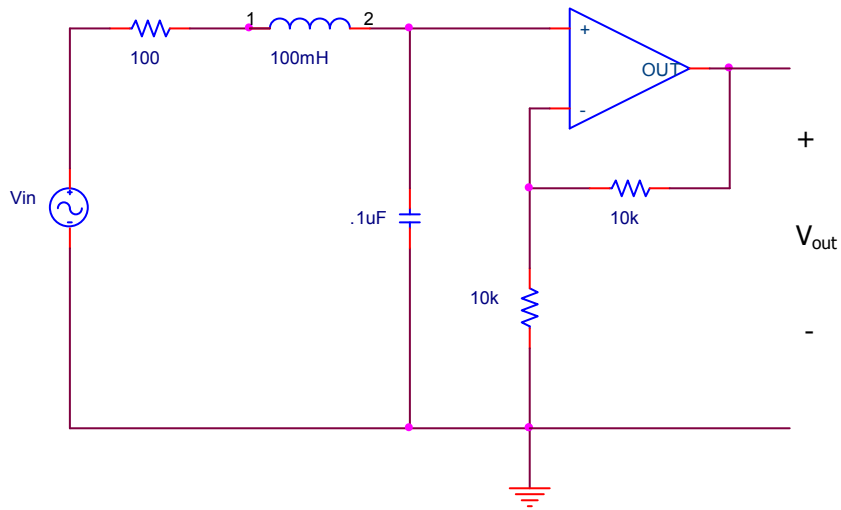
Problem 1 (cont)

b.) Find $V_{out}(t)$ for $t \geq 0$ given the circuit shown below, showing all pertinent values. (10pts) NOTE THIS IS A DIFFERENT CIRCUIT THAN PART A.



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

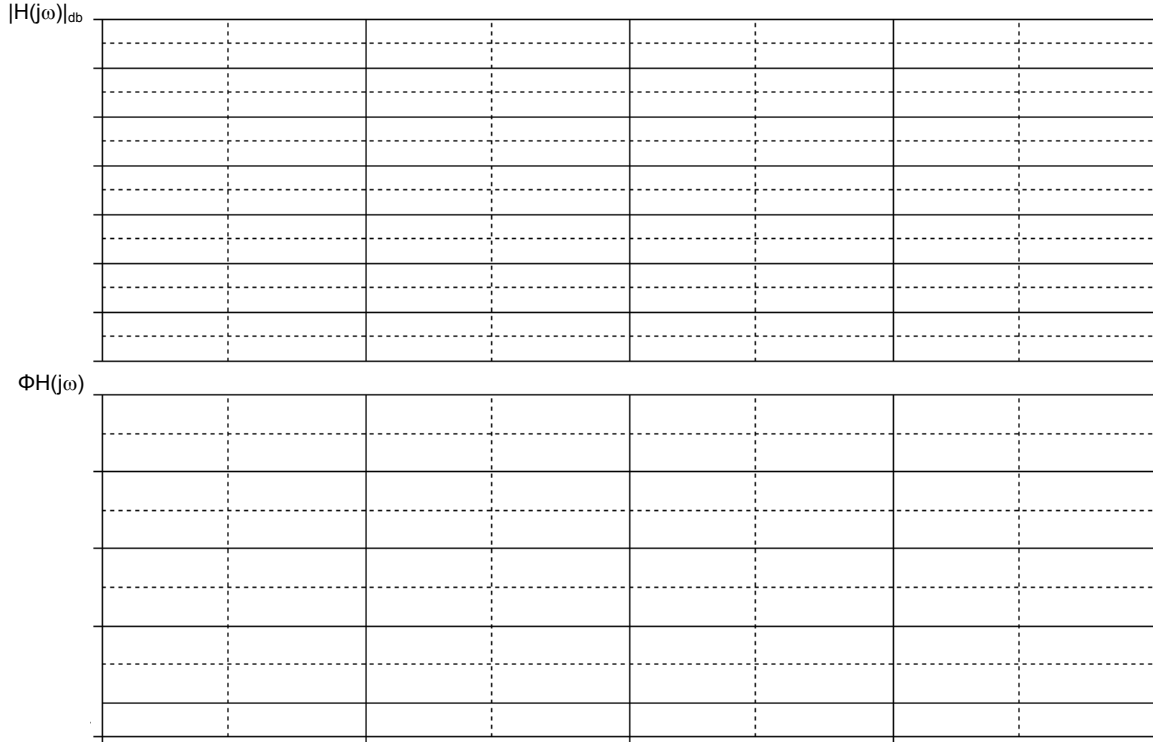


a.) Find $H(s) = \frac{V_{out}(s)}{V_{in}(s)}$ for the above circuit. (10pts)

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)



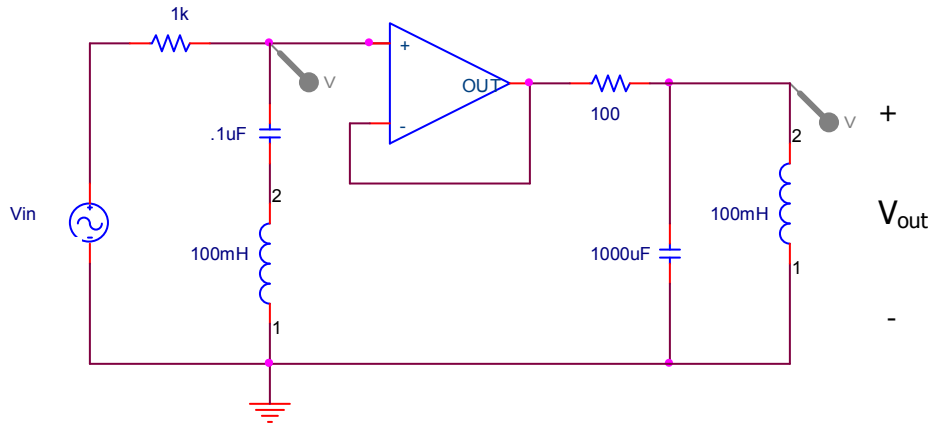
c.) For an input $V_{in}(t) = 1\cos(500kt)$, what is the output voltage $V_{out}(t)$? (5pts)

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

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



a.) Sketch the magnitude (as a function of frequency) that would appear at the two markers. Please identify any critical frequencies. (6pts)

Marker 1

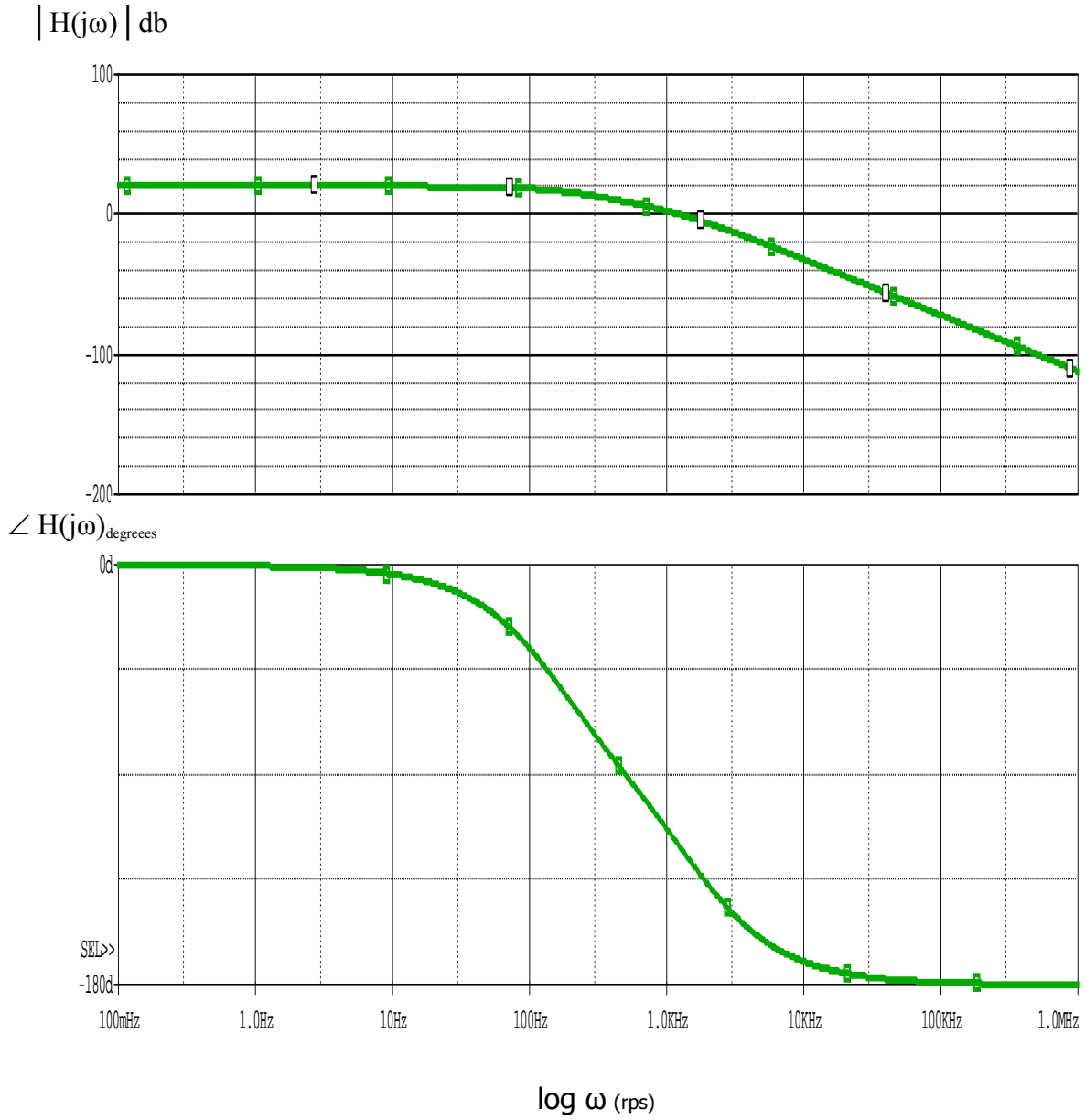
Marker 2

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b.) What is $V_{out}(t)$ for $V_{in}(t) = 1\cos(\omega_0 t)$, where ω_0 is the resonant frequency? Please justify your response. (4pts)

Problem 4 (25pts)

a) Given the plots shown below, find ω_{co} . (Please note: **the graph is in dB**)



$\omega_{cutoff} =$

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 $\omega = 1\text{Krps}$?

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

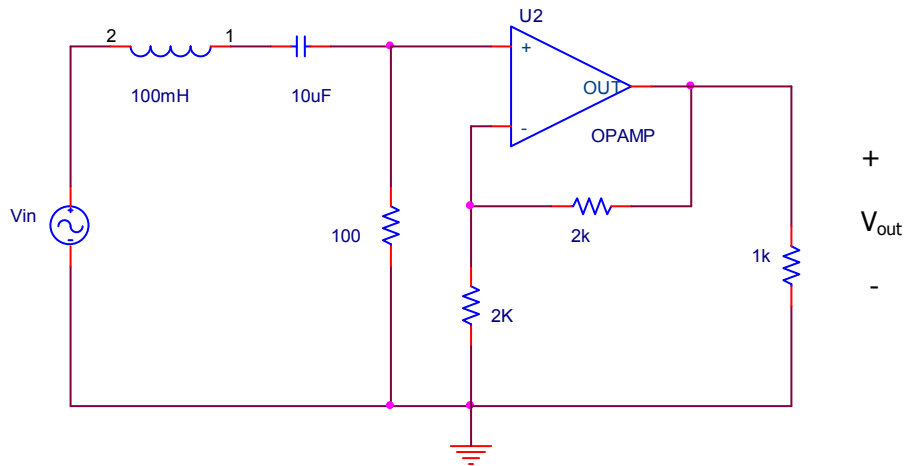
Problem 4 (cont)

c) Design a circuit that would produce the plots shown (on the prior page), using only 4 resistors, 2 capacitors, and an op amp. 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 $V_{\text{out}}(t)$ would be produced if $V_{\text{in}}(t) = 10\cos(100_{\text{rps}}t + 45^\circ)$? Justify your response. (5pts)

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