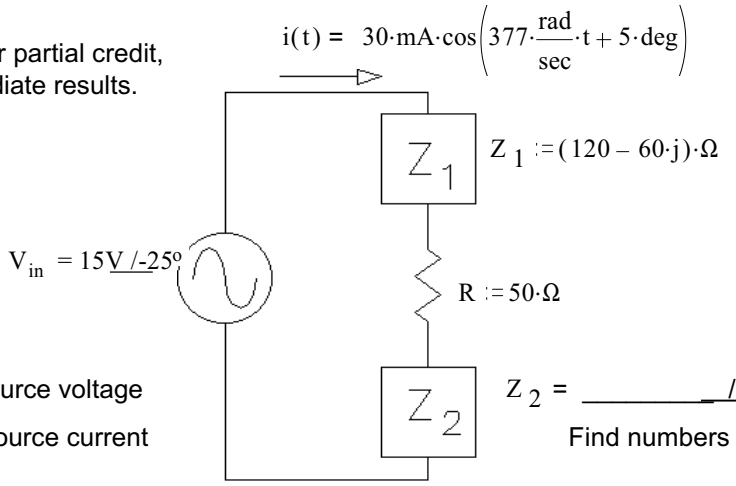
ECE1050 Exam 3 given: Fall 03

(The space between problems has been removed.)

1. (20 pts)

a) Find Z_2 in polar numeric form. For partial credit, you must show work and/or intermediate results.



b) Circle 1:

i) The source current leads the source voltage

ii) The source voltage leads the source current

2. (24 pts) a) Draw the asymptotic Bode plot (the straight-line approximation) of the transfer function below. Accurately draw it on the graph provided.

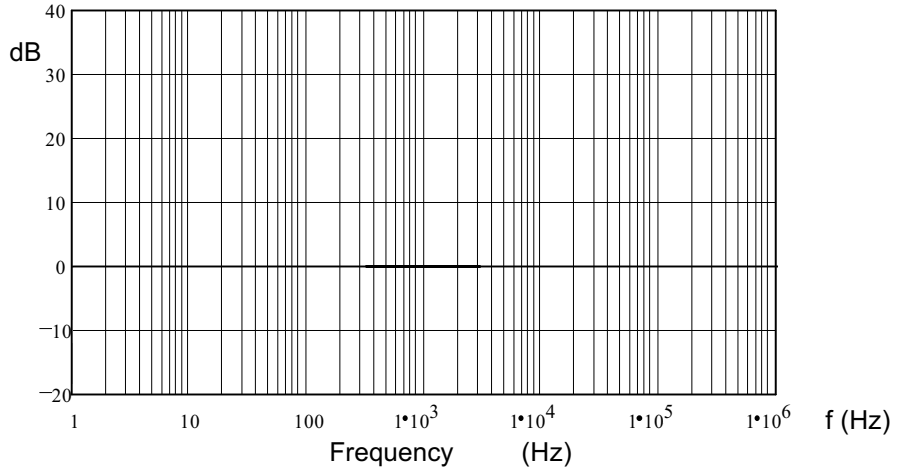
To be eligible for partial credit, show the steps you use to get the Bode plot. That is, show things like the corner frequency(ies) , the approximations of the transfer function in each frequency region, etc..

$$H(f) := \frac{63245 \cdot j \cdot f}{\left(1 + \frac{0.05}{Hz} \cdot j \cdot f\right) \cdot (40000 \cdot Hz + j \cdot f)}$$

Magnitude plot $|H(f)|$

Straight-line approximation ____

Actual _ _ _ _

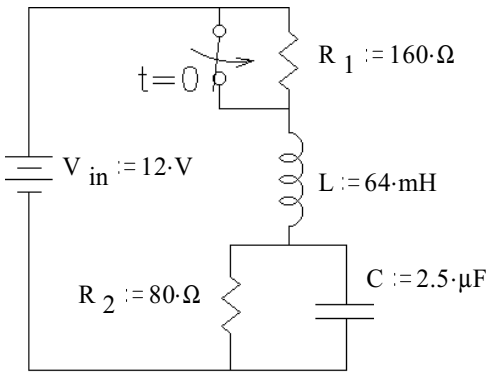


b) The asymptotic Bode plot is not exact. Using a dotted line, sketch the actual magnitude of the transfer function |H(f)| on the plot above. Indicate the point(s) where the difference between the two lines is the biggest (draw arrow(s)) and write down the actual magnitude(s) at that (those) point(s).

3. (27 pts) Analysis of the circuit shown yields the characteristic equation and s values below.

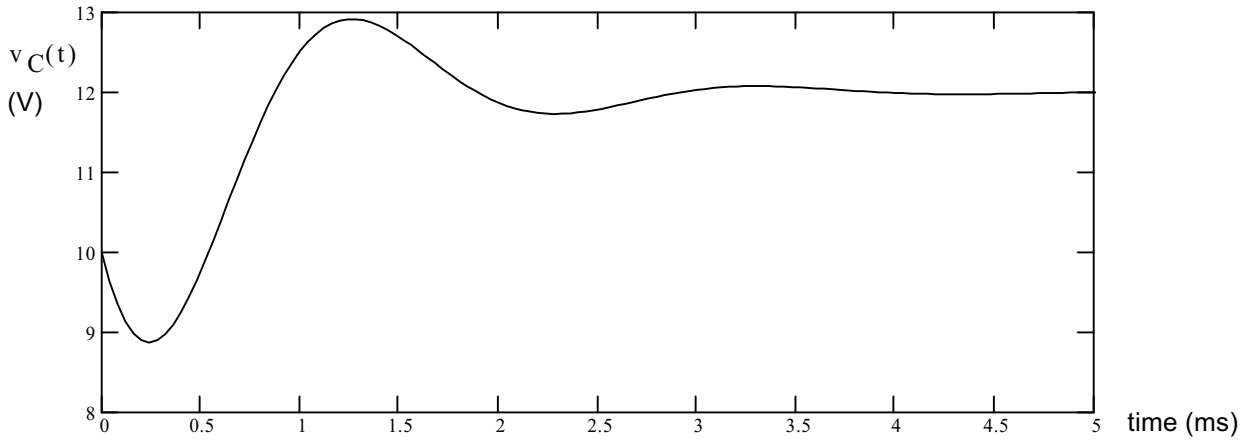
The switch has been in the open position for a long time and is closed (as shown) at time t = 0. Find the initial and final conditions and write the full expression for $i_L(t)$, including all the constants that you find. Don't let the odd position of the switch throw you, just use it to find your initial conditions.

Clearly show important numbers (like initial and final conditions) to get partial credit. If you can't find some of these, guess, so that you can move on and demonstrate what you do know.



$$0 = s^2 + \frac{1}{R_2 \cdot C} \cdot s + \frac{1}{L \cdot C} \qquad s_1 := -2500 \cdot \frac{1}{sec} \quad \text{and} \quad s_2 := -2500 \cdot \frac{1}{sec}$$

4. (11 pts) Consider the following transient waveform, produced by an unknown circuit.



a) The circuit is: (circle one)
i) underdamped ii) critically damped iii) overdamped iv) not enough information to determine damping

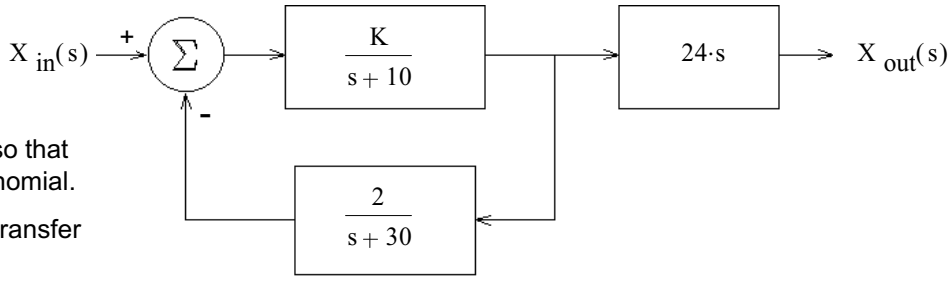
b) The final value of the capacitor voltage is:

c) The initial value of the capacitor voltage is:

d) The initial current through the capacitor is: (circle one)
i) positive (+) ii) zero (0) iii) negative (-) iv) not enough information to determine this

5. (18 pts) a) A feedback system is shown in the figure. What is the transfer function of the whole system, with feedback.

$$H(s) = \frac{X_{out}(s)}{X_{in}(s)} = ?$$



Simplify your expression for H(s) so that the denominator is a simple polynomial.

b) Find the value of K to make the transfer function critically damped.

c) If K is more than this value the system will be:
underdamped or overdamped Circle one

Answers

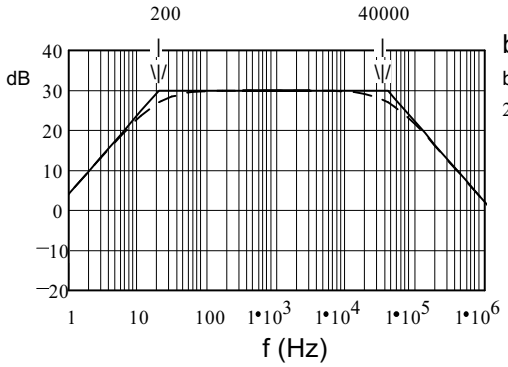
1. $Z_2 = 325\Omega \angle -35.8^o$ b) i)

2.

Magnitude plot $|H(f)|$

Straight-line approximation ____

Actual _ _ _ _



b) both 27dB

3. $150 \cdot mA - 100 \cdot mA \cdot e^{-\frac{2500}{sec} \cdot t} - 125 \cdot \frac{A}{sec} \cdot t \cdot e^{-\frac{2500}{sec} \cdot t}$

4. a) i) b) $12 \cdot V$ c) $10 \cdot V$ d) iii)

5. a) $\frac{K \cdot 24 \cdot s \cdot (s+30)}{s^2 + 40 \cdot s + 300 + 2 \cdot K}$ b) 50

c) underdamped

ECE 1050 Midterm #3
Arn Stolp

Name _____
Scores:
P 1&2 _____ of a possible 44 points
P 3&4 _____ of a possible 38 points
P 5 _____ of a possible 18 points
Total _____ of a possible 100 points