Circuits

Exam 2 Rework Videos

Spring 2023

1. ***Choose 1*** of the 3 problems (**1.1, 2.1, or 2.2**.) that represents the sub-problem you missed the most points on (by percentage). You can choose between problems with the same percentage missed.
2. ***Using ONLY a crib sheet*** (no internet, books, conversations, or help please), **explain your process of solving the problem** via **5-minute maximum** VIDEO or AUDIO (WebEx Teams record or cell phone recording is fine…please **send video or audio directly to me via chat in WebEx Teams**).
3. ***Repeat, don't just write numbers and equations, explain how and why you are doing what you are doing to solve the problem.***
4. Be sure to answer the conceptual questions associated with problem in the video
5. Write out descriptions or diagrams that represent your solving process. **Please upload your document to Gradescope.** This is necessary as an indication for me to search for your video as well as providing a guide for your work. Without it, you'll get zero points.
6. You will have one hour to complete this. (If you have trouble with uploading contact me directly via WebEx teams. I will use this contact as at time stamp.)
7. Many folks with video problems uploaded to Google drive and sent the link to me via WebEx. Do this as needed.

Name Hayden Fuller

Please sign below:
I have not consulted any person or collaborated with anyone to complete this exam. I did not post and will not post any part of this exam to Chegg.com or any other equivalent websites. I understand that if my exam is found online, I will be given an F for the semester and the academic dishonesty process will be initiated. I did not look for answers on any website to this exam. If any signification portion of this exam is found to match with any other student, I will be given an automatic 0 for the entire exam. Further actions due to academic dishonesty may be warranted after discussion with all parties.

Signature: Hayden Fuller

Problem 1) First Order Differential Equations

1.1: This problem is an OPEN First Order Diff. Eq. Circuit design problem with the following parameters.

1. The circuit must use at least one switch
2. The circuit must have a non-zero initial condition
3. The circuit must require the use of thevenin at least one time
4. The circuit must use an capacitor

2. Solve your designed problem and explain why it is unique, creative, or challenging to you (helps to ask youself, "What concept within the main concept am I testing with it?")
3. **Explain each step regarding how you would go about solving the problem (MOST IMPORTANT)**
4. Solve as much of the problem as you can within an hour on paper (if you have time, not important just to correspond with your solving steps to help us follow what you say)
5. Submit this paper ***and your integrity signature*** to Gradescope.

*****NOTE***: A chosen top three First Order Diff Eq Designs in the class will ended up on one of the available finals (with slight Sawyer modifications of course.) You can live in Circuits Glory or Infamy depending on ones perspective!!! Strive to be a Chosen One.)**

YOUR BRAND NEW ORIGINAL (Do not copy old exams. Do not use computer. Think about it.)

1.1 Find the voltage across _____ (Yes you can decide to find current through _____ instead)

Standards Based Assessment

Student created a first order circuit

Student analyzed using differential equation analysis and NOT laplace analysis

Student demonstrates knowledge and use of a non-zero initial condition

Student demonstrates the use of Thevenin in the context of a first order problem

Student can analyze first order circuit with an capacitor

Student can either recognize or derive the correct differential equation that represents the circuit

Student can determine the solution and find appropriate coefficients with initial condition and final conditions

(+5 bonus) Student designed a problem that demonstrates a core concept in first order differential equations with the placement of the switch or by other means

More space on the next page! If you are writing out the exam, please make the same chart on your paper and show all your work.

Problem 2) Second Order Circuits Diff. Eq. For 2.1.

2.1: This problem is an OPEN Second Order Diff. Eq. Circuit design problem with the following parameters.

1. The circuit must use at least one switch in series with any part of the circuit
2. The circuit must have an inductor and capacitor
3. The circuit must have a non-zero initial condition
3. The circuit MUST be designed to be ***between underdamped and overdamped (explaining how to ensure it is exactly between underdamped and overdamped is fine, use calculations and follow through as much as reasonable in the time you have!)***

2. Solve your designed problem and explain why it is unique, creative, or challenging to you (helps to ask youself, "What concept within the main concept am I testing with it?")
3. **Explain each step regarding how you would go about solving the problem (MOST IMPORTANT)**
4. Solve as much of the problem as you can within an hour on paper (if you have time, not important just to correspond with your solving steps to help us follow what you say)
5. Submit this paper ***and your integrity signature*** to Gradescope.

*****NOTE***: A chosen top three Second Order Diff Eq Designs in the class will ended up on one of the available finals (with slight Sawyer modifications of course.) You can live in Circuits Glory or Infamy depending on ones perspective!!! Strive to be a Chosen One.)**

YOUR BRAND NEW ORIGINAL (Do not copy old exams. Do not use computer. Think about it.)

2.1: Find _____

More space on the next page!

Standards Based Assessment

Student created a second order circuit

Student analyzed using differential equations and NOT Laplace analysis

Student demonstrates knowledge of dampening with precise calculations

Student understands which components or component controls dampening in their circuit

Student demonstrates knowledge of what is exactly between underdamped and overdamped

Student can either recognize or derive the correct differential equation that represents the circuit

Student can determine the solution and find appropriate coefficients with initial condition and final conditions

(+5 bonus) Student designed a problem that demonstrates a core concept in second order differential equations with the placement of the switch or by other means

Problem 2) Second Order Circuits Laplace For 2.2.

2.1: This problem is an OPEN Second Order Laplace Circuit design problem with the following parameters.

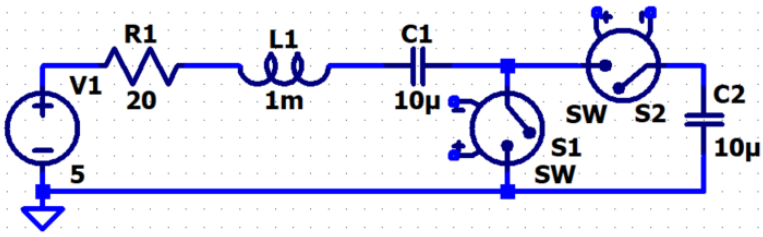
1. The circuit must use at least one switch in series with any part of the circuit
2. The circuit must have an inductor and capacitor
3. The circuit must have a non-zero initial condition
4. The circuit MUST be designed to be ***between underdamped and overdamped (explaining how to ensure it is exactly between underdamped and overdamped is fine, use calculations and follow through as much as reasonable in the time you have!)***

2. Solve your designed problem and explain why it is unique, creative, or challenging to you (helps to ask youself, "What concept within the main concept am I testing with it?")
3. **Explain each step regarding how you would go about solving the problem (MOST IMPORTANT)**
4. Solve as much of the problem as you can within an hour on paper (if you have time, not important just to correspond with your solving steps to help us follow what you say)
5. Submit this paper ***and your integrity signature*** to Gradescope.

*****NOTE***: A chosen top three Second Order Laplace Designs in the class will ended up on one of the available finals (with slight Sawyer modifications of course.) You can live in Circuits Glory or Infamy depending on ones perspective!!! Strive to be a Chosen One.)**

YOUR BRAND NEW ORIGINAL (Do not copy old exams. Do not use computer. Think about it.)

2.2: Find Vc1(t) (hint: peacewise)



at t=0 V1 turns on,
at t=0.2ms S1 closes and s2 opens

Standards Based Assessment

Student created a second order circuit

Student analyzed Laplace analysis and not Diff. Eq.

Student draw an s-domain circuit representative of their time-domain circuit

Student can create a s-ratio based on their circuit analysis

Student demonstrates knowledge of dampening with precise calculations

Student understands which components or component controls dampening in their circuit

Student demonstrates knowledge what is exactly between underdamped and overdamped

Student can determine the solution and find appropriate coefficients using partial fraction expansion

(+5 bonus) Student designed a problem that demonstrates a core concept in second order Laplace analysis with the placement of the switch or by other means

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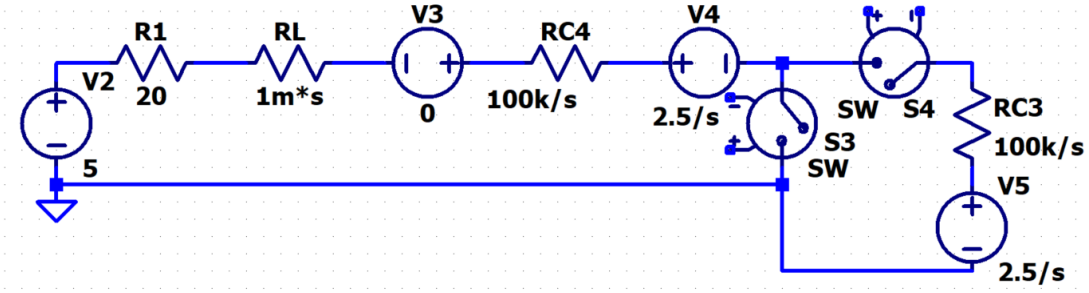
RLC series critically damped circuit
a=w_0
0.5R/L=1/sqrt(LC)
R/L=2/sqrt(LC)
R=2L/sqrt(LC)
choose L=1mH and C=10uF
R=2*1*10^-3/sqrt(1*10^-3*10*10^-6)
R=20
this must be the equivalent circuit after the switch changes
incorperate a switch by adding an extra capacitor in series that will be "turned off" with a switch

this is a unique and interesting problem because a capacitor is being switched off while in oscilation, and you use that as your initial conditions for the critically damped circuit

to solve:
use laplace to convert everthing to impedance
Z_L=sL, Z_C=1/(sC), Z_R=R
find initial conditions
I=0 because a capacitor is an open circuit in dc steady state
since the caps are equal, VC1=VC2=2.5V
Inductor voltage source is LI(0+)=0V
each capacitor has voltage source VC(0+)/s=2.5/s V
resulting circuit looks like this



begins as underdamped, solve for VC1(t), use that as initial condition for when swithches change, at this point it becomes critically damped and you solve from here with initial conditions
interesting because you have to find the equation to give you initial conditions
to solve the criticaly damped problem