23W-EC ENGR-11L-LEC-1 Module 3: Transient Response of the 1st -Order Circuits

SANJIT SARDA

TOTAL POINTS

78.5 / 90

QUESTION 1

RC Circuit Analysis 22 pts

1.1 Waveforms Image 5 / 5

✓ **- 0 pts** *Correct*

- 3 pts Incorrect image shown

1.2 Time Constant Table 5 / 5

✓ **- 0 pts** *Correct*

- 2 pts Minor Mistake

- 3 pts Wrong experimental value

1.3 Discussion 1 3 / 3

✓ **- 0 pts** *Correct*

- 3 pts Incorrect

1.4 Discussion 2 3 / 3

✓ **- 0 pts** *Correct*

- 3 pts Incorrect.

- 1 pts Slightly incorrect

- 1 pts Partial explanation

1.5 Discussion 3 3 / 3

✓ **- 0 pts** *Correct*

1.6 Discussion 4 3 / 3

✓ **- 0 pts** *Correct*

- 3 pts Incorrect

- 2 pts Partial explanation

QUESTION 2

RL Circuit Analysis 22 pts

2.1 Waveforms Image 5 / 5

✓ **- 0 pts** *Correct*

- 1 pts Slightly incorrect.

- 2 pts Frequency of square wave is too high.

- 2 pts Time Constant measurement is wrong.

- 2 pts Uninterpretable image

- 5 pts Missing

2.2 Inductor Resistance 3 / 3

✓ **- 0 pts** *Correct*

- 1 pts Slightly Incorrect.

- 2 pts Incorrect.

- 3 pts Missing

2.3 Time Constant Table 5 / 5

✓ **- 0 pts** *Correct*

- 2 pts Slightly incorrect

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- 3 pts Incorrect.

- 5 pts Missing

2.4 Discussion 1 3 / 3

✓ - 0 pts *Correct*

- 1 pts Slightly incorrect
- 3 pts Missing

2.5 Discussion 2 3 / 3

✓ - 0 pts *Correct*

- 1 pts Slightly incorrect. Inductor resistance must be included for theoretical calculation.
- 3 pts Missing

2.6 Discussion 3 1.5 / 3

- 0 pts Correct
- 1 pts Slightly incomplete/incorrect

✓ - 1.5 pts *Slightly incomplete/incorrect*

- 3 pts Missing

QUESTION 3

DC Switching Analysis 31 pts

3.1 Waveforms Image 10 / 10

✓ - 0 pts *Correct*

- 5 pts Some images missing
- 3 pts Partially wrong
- 10 pts Missing

3.2 Voltage Value Table 16 / 18

✓ - 0 pts *Correct*

- 18 pts Missing

✓ - 2 pts *Minor Differences*

- 5 pts One Major Difference
- 8 pts Two Major Mistakes
- 13 pts Wrong Experimental values
- 8 pts Wrong Theoretical values
- 12 pts Experimental values missing

3.3 Discussion 1 3 / 3

✓ - 0 pts *Correct*

- 3 pts Missing
- 1 pts Partial explanation

QUESTION 4

First Order Circuit Design 15 pts

4.1 Waveforms Image 3 / 5

- 0 pts Correct

✓ - 2 pts *Slighly Incorrect*

- 2 pts Time Constant Measurement Incorrect
- 5 pts Missing

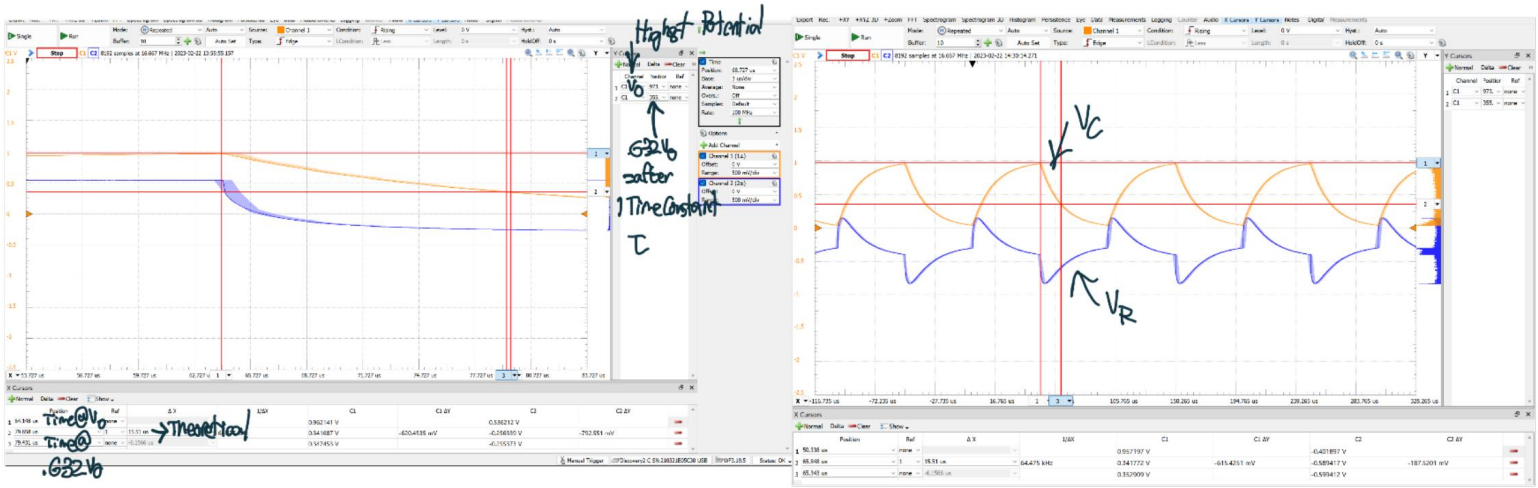
4.2 Circuit Parameter Table 4 / 10

- 0 pts Correct
- 2 pts Slightly Incorrect.
- 4 pts Incorrect

✓ - 6 pts *Major Mistake*

- 10 pts Missing

1. RC Circuit Analysis



Theoretical Time constant	Experimental Time Constant
$\tau = RC = (3.3k\Omega)(4.7\mu F) = 15.51\mu s$	$79.43 - 64.15 = 15.28\mu s$

Discussion

- How does the experimental time constant compare with the theoretical values?

<Answer in 1-2 lines. >

The theoretical Time Constant Value is within 1.5 % of the actual (experimental) values
∴ They agree.

- How does the voltage response of the resistor differ from that of the capacitor?

The V_R accounts for the potential difference between the Square Function &

<Answer in 1-2 lines.>

V_C. Aka: $V_R = S_q - V_C$

Additionally
$V_R = IR$, which represents a scaled version of the current
Aka! V_R is τ, when current is τ which happens when the capacitor is charging. V_R ! — ! current is — & discharging

1.1 Waveforms Image **5 / 5**

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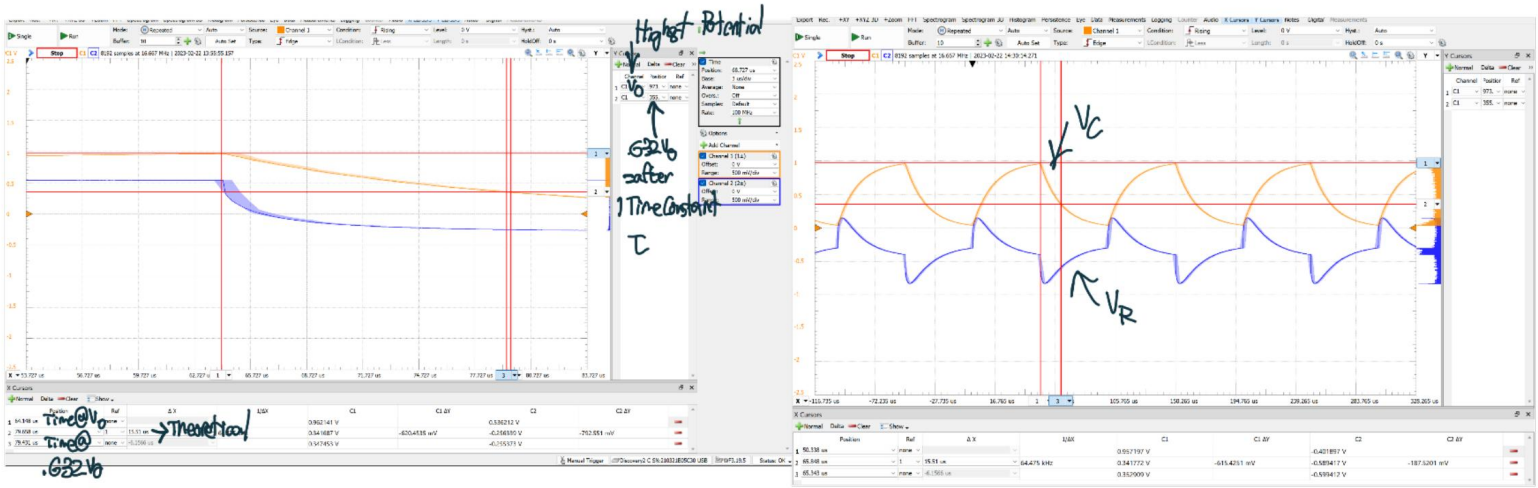

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1.2 Time Constant Table **5 / 5**

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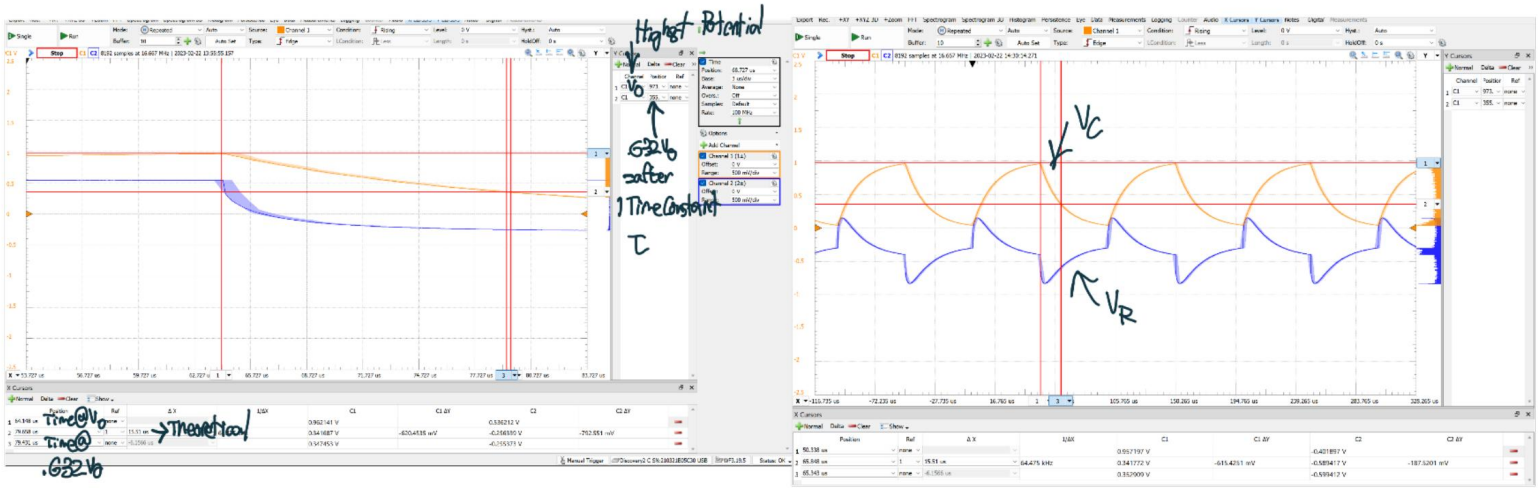

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1.3 Discussion 1 **3 / 3**

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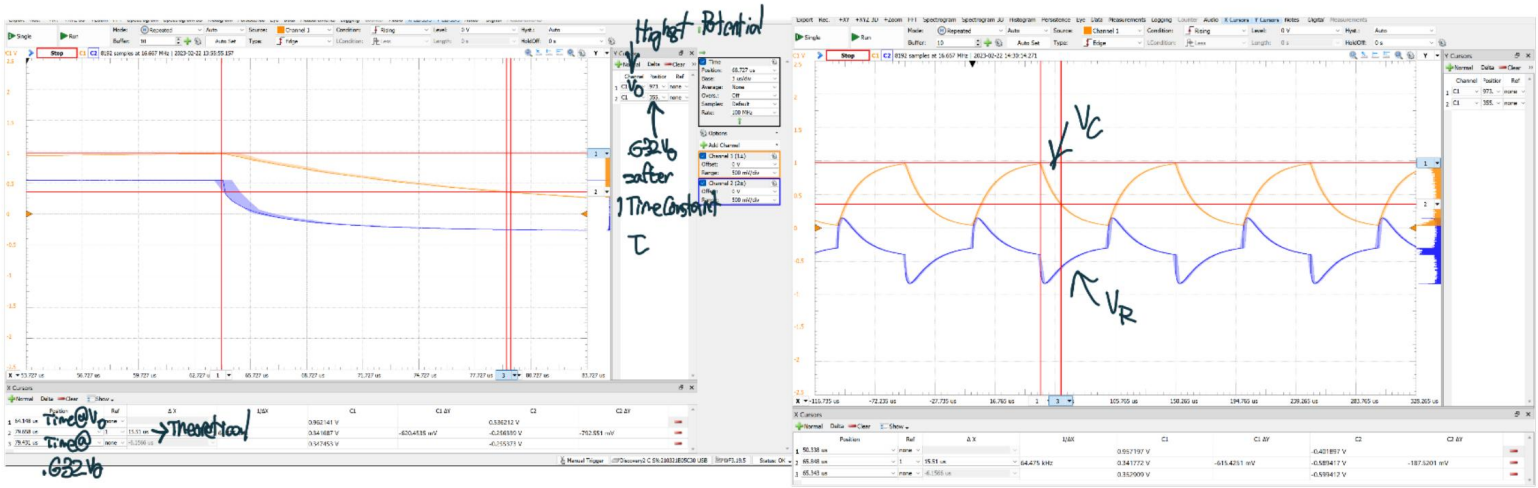
1. RC Circuit Analysis



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1.4 Discussion 2 **3 / 3**

✓ **- 0 pts** *Correct*

- 3 pts Incorrect.

- 1 pts Slightly incorrect

- 1 pts Partial explanation

- How does zooming in time resolution (mS/div -> μS/div) change the sampling rate and your measurements?

Zooming in does not change the sampling Rate, but it changes the scale with which you see the data.

<Answer in 1-2 lines.>

- Explain what happened when you increased the frequency of the input.

When I increased the frequency, the Capacitor did not get enough time to charge & discharge, so it starts to look "cut off"

<Answer in 1-2 lines.>

1.5 Discussion 3 **3 / 3**

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1.6 Discussion 4 **3 / 3**

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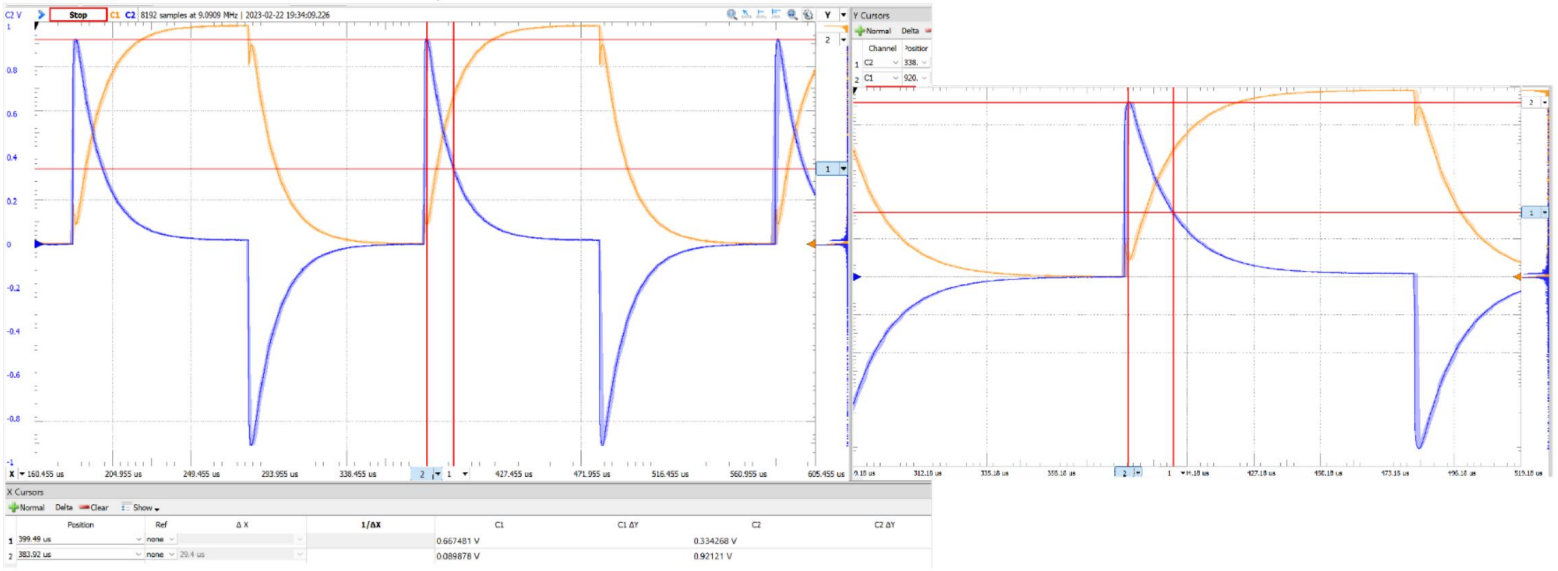
- 3 pts Incorrect

- 2 pts Partial explanation

2. RL Circuit Analysis



- What is the inductor resistance?

$R_{inductor} =$ 163.3Ω

Theoretical Time constant	Experimental Time Constant
14.76 μS	399.49 − 383.92 = 15.57 μS

Discussion

- How does the experimental time constant compare with the theoretical value?

It is within 5.2% of experimental, ! . they agree.

<Answer in 1-2 lines. >

2.1 Waveforms Image **5 / 5**

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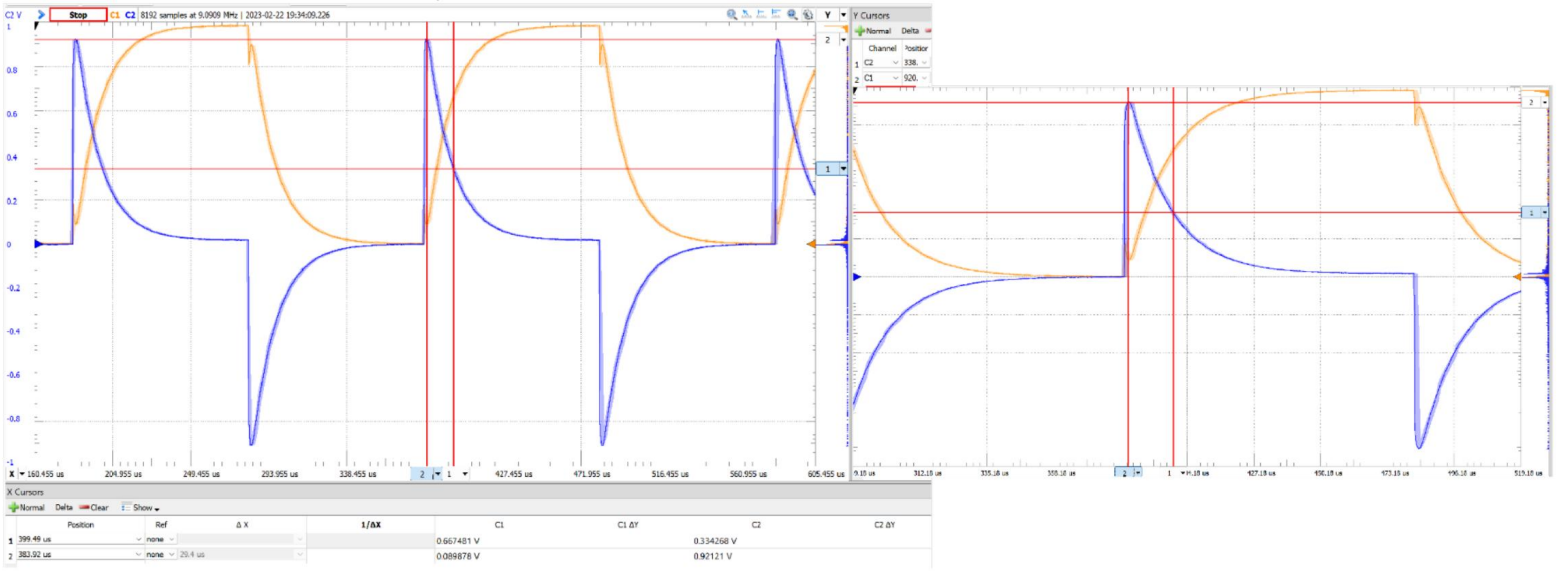

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2.2 Inductor Resistance **3 / 3**

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- 2 pts Incorrect.

- 3 pts Missing

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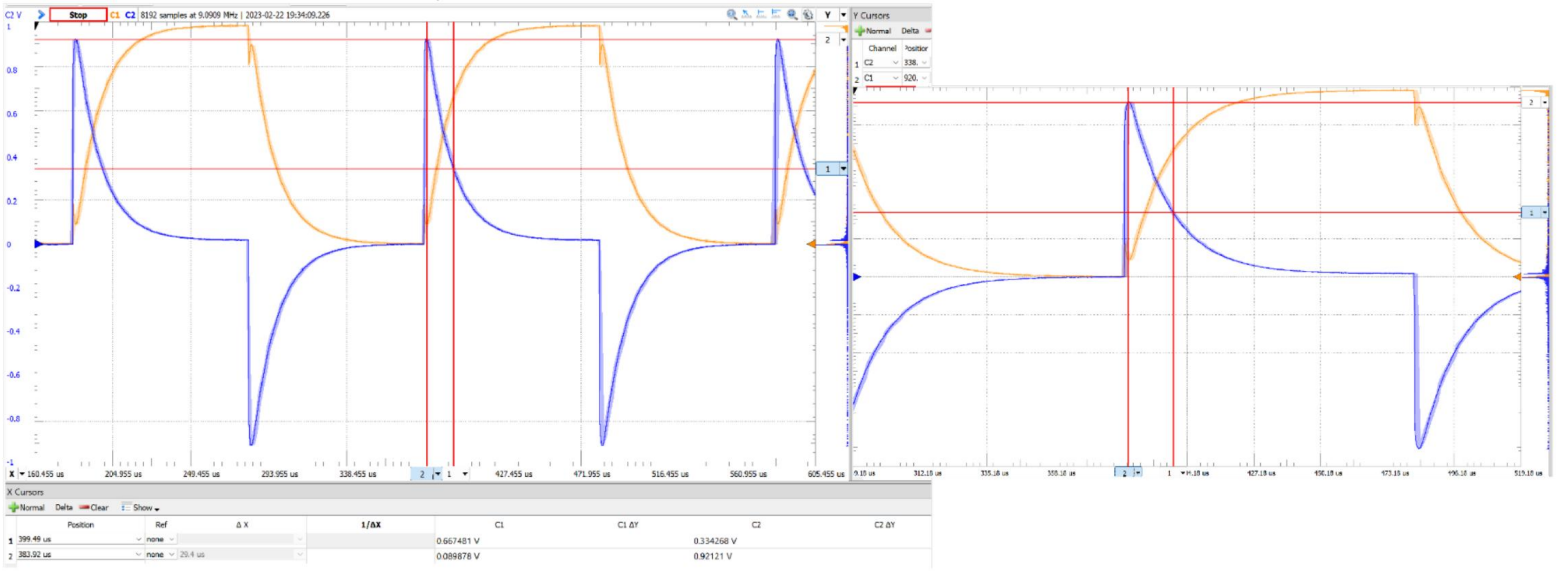

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2.3 Time Constant Table **5 / 5**

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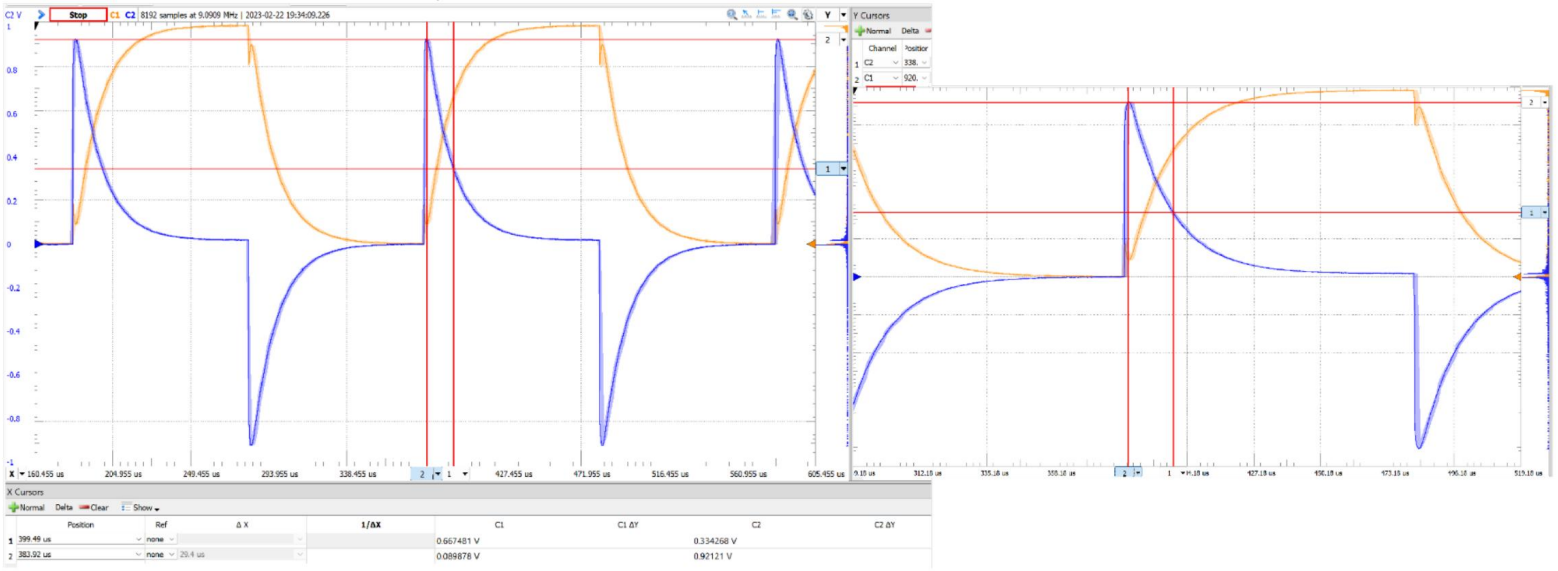

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2.4 Discussion 1 **3 / 3**

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- 3 pts Missing

- When calculating the theoretical time constant of the RL circuit, should the resistance of the inductor be included?

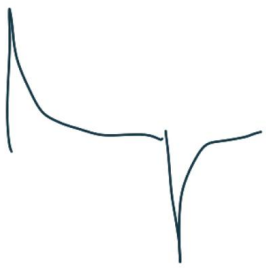
<Answer in 1-2 lines.>

Yes, because if we dont, then we are not holding KVL.

- How does the response of the RL circuit compare with the response of the RC circuit?

The RC circuit charges and discharges in response to the sq wave. The RL circuit Impulses to max voltange and gradually decreases. Then when the voltage switches, it impulses in that direction & gradually Stedies out.

<Answer in 1-2 lines.>



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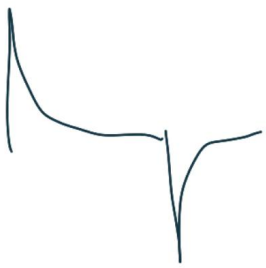


2.6 Discussion 3 **1.5 / 3**

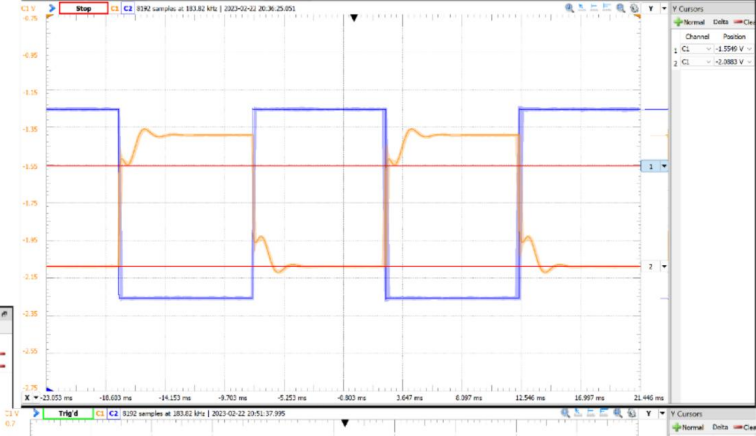
- **0 pts** Correct
- **1 pts** Slightly incomplete/incorrect

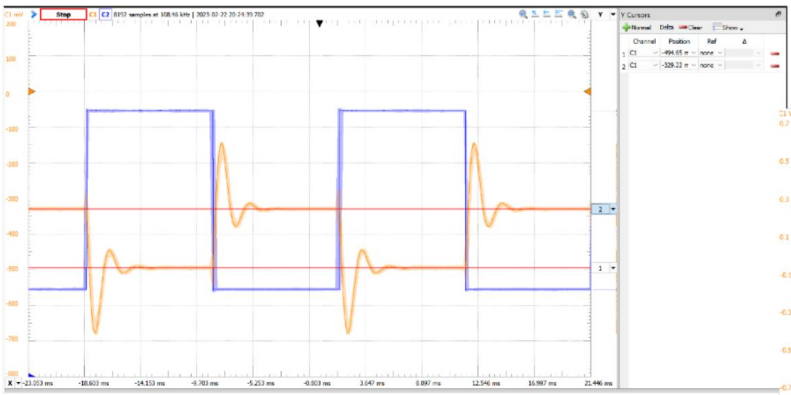
✓ **- 1.5 pts** *Slightly incomplete/incorrect*

- **3 pts** Missing

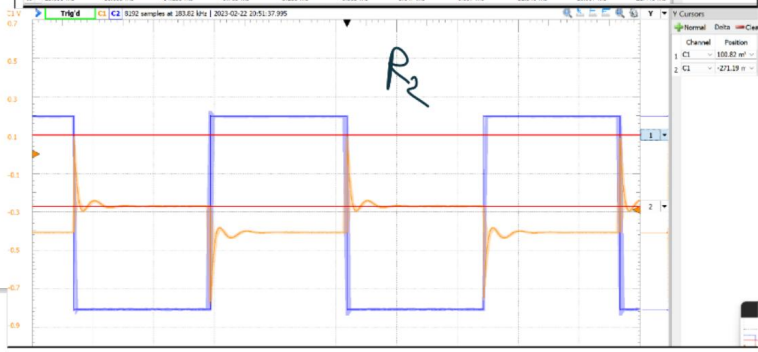
3. DC Switching Analysis

R_1





C_1



R_2

	Theoretical Value (V)	Experimental Value (V)
$v_{C1}(0^-)$	0	−200 mV
$v_{C1}(0^+)$	0	−100 mV
$v_{C1}(\infty)$	0	0 V
$v_{R1}(0^-)$	1.5V	−0.45V
$v_{R1}(0^+)$	1V	3V
$v_{R1}(\infty)$	2V	2.5V
$v_{R2}(0^-)$	1.5V	0.1V
$v_{R2}(0^+)$	1 V	−0.5V
$v_{R2}(\infty)$	0V	0V

Discussion

- What did you observe of the voltage across the elements? Explain any behavior that strays from the ideal expectations.

The voltage across the elements are a bit off from that of ideal expectations, this is probably because it is impossible to generate a real impulse/ Discontinuity.

<Answer in 2-3 lines.>

3.1 Waveforms Image **10 / 10**

✓ **- 0 pts** *Correct*

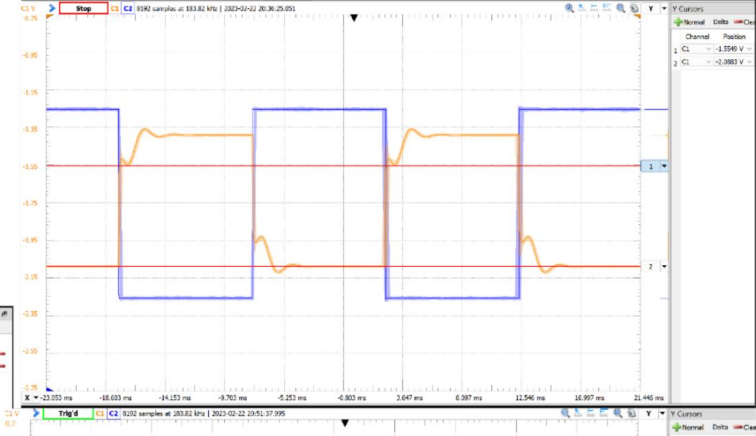
- 5 pts Some images missing

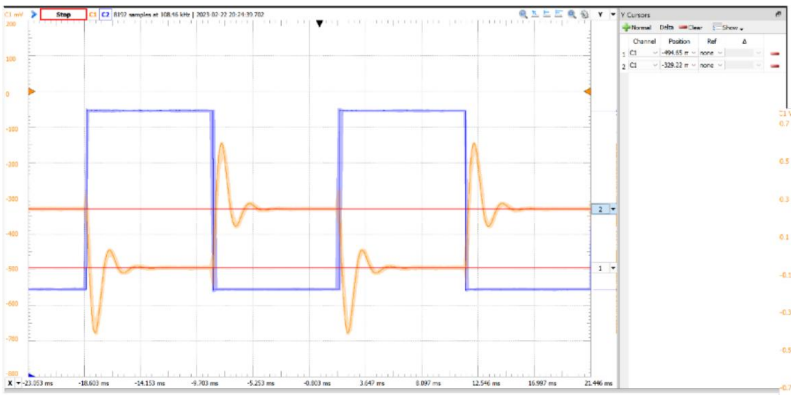
- 3 pts Partially wrong

- 10 pts Missing

3. DC Switching Analysis

R_1





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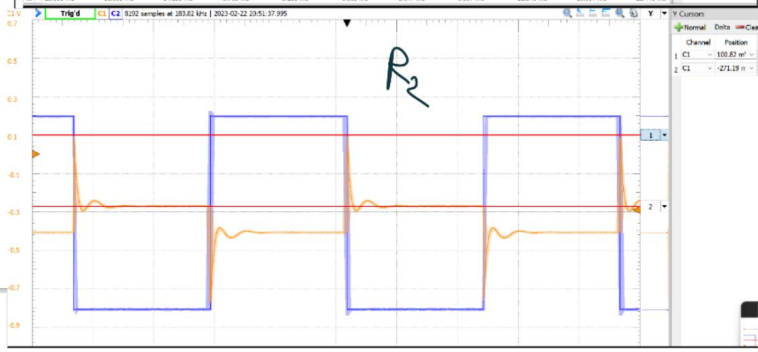

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3.2 Voltage Value Table **16 / 18**

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- 8 pts Two Major Mistakes

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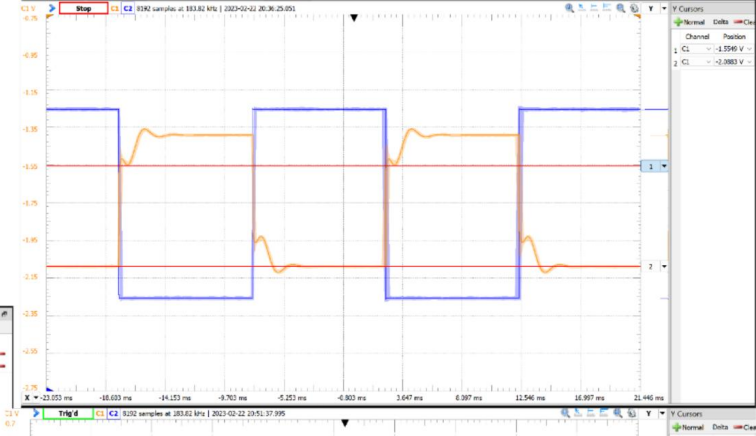

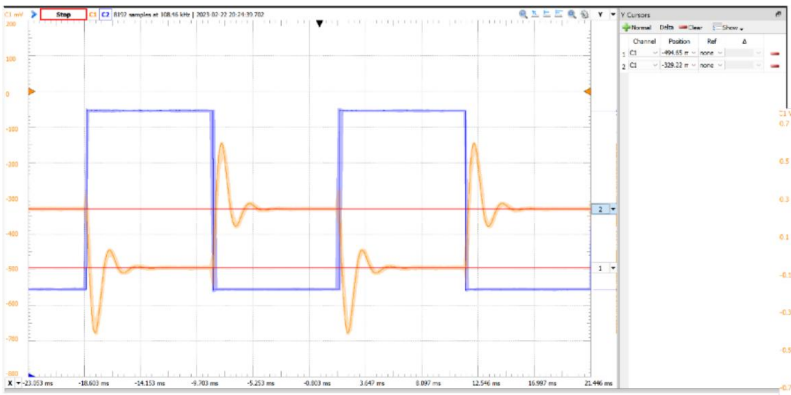

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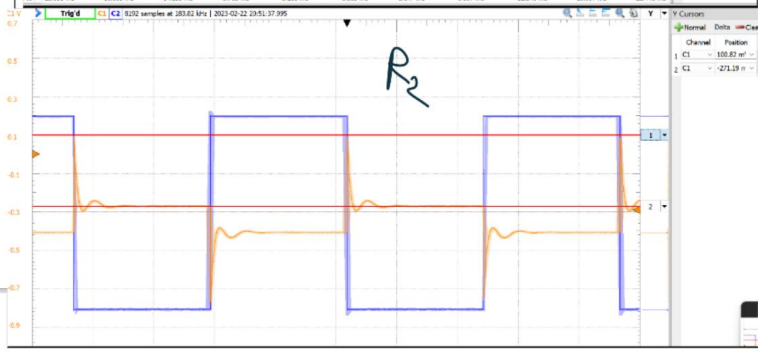

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3.3 Discussion 1 **3 / 3**

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- 3 pts Missing

- 1 pts Partial explanation

4. First Order Circuit Design

Type of Circuit (RC/RL)	Resistance Value	Capacitance Value/Inductance Value	Theoretical Time constant	Experimental Time constant
RC	$\frac{680}{2} = 340$	1000μF	.340ms	.340ms

4.1 Waveforms Image **3 / 5**

- **0 pts** Correct

✓ **- 2 pts** *Slighly Incorrect*

- **2 pts** Time Constant Measurement Incorrect

- **5 pts** Missing

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4.2 Circuit Parameter Table **4 / 10**

- **0 pts** Correct
- **2 pts** Slightly Incorrect.
- **4 pts** Incorrect

✓ **- 6 pts** *Major Mistake*

- **10 pts** Missing

University of California, Los Angeles

School of Engineering and Applied Science

Department of Electrical and Computer Engineering

Name: <>

UID: <>

Experiment 3: Transient Response of the 1st-Order Circuits

ECE11L Lab

Instructor: Sudhakar Pamarti