

Ryerson University
Department of Electrical and Computer Engineering
ELE202-Electric Circuits Analysis
Mid-term Examination
March 2, 2021 - Duration: 110 Minutes
Examiners: Dr. Mohammadi, Dr. Hossain and Dr. Jassar

I solemnly declare that I will complete this examination independently, with full compliance to the Senate Policy 60 Academic Integrity, and meeting the requirements stated in the examination.

Student Last Name: **Student First Name:**

Student Number: **Signature:** (Required)

NOTES:

1. Use Ryerson approved calculator for calculations.
2. There are 4 questions, each with subsections. Answer all questions.
3. NO QUESTIONS to be asked. If doubt exists as to the interpretation of any question, you are urged to submit with the answer, a clear statement of any logical assumptions made.

<i>Question No.</i>	<i>Mark of each question</i>	<i>Mark obtained</i>
Q1	10	
Q2	30	
Q3	40	
Q4	20	
Total (100)		

Q 1: [10 marks] The Current versus time graph is given in Figure 1. Sketch the charge versus time graph on the current versus time graph. Show all the working steps.

Use the value of the **a** as calculated below:

a = (last digit of your student number) in Ampere. If your student # is 123456789, then $a = 9$ A

If a student # is 9876543218, then $a = 8$ A

If a student # is 9876543250, then $a = 10$ A; $a \neq 0$ A

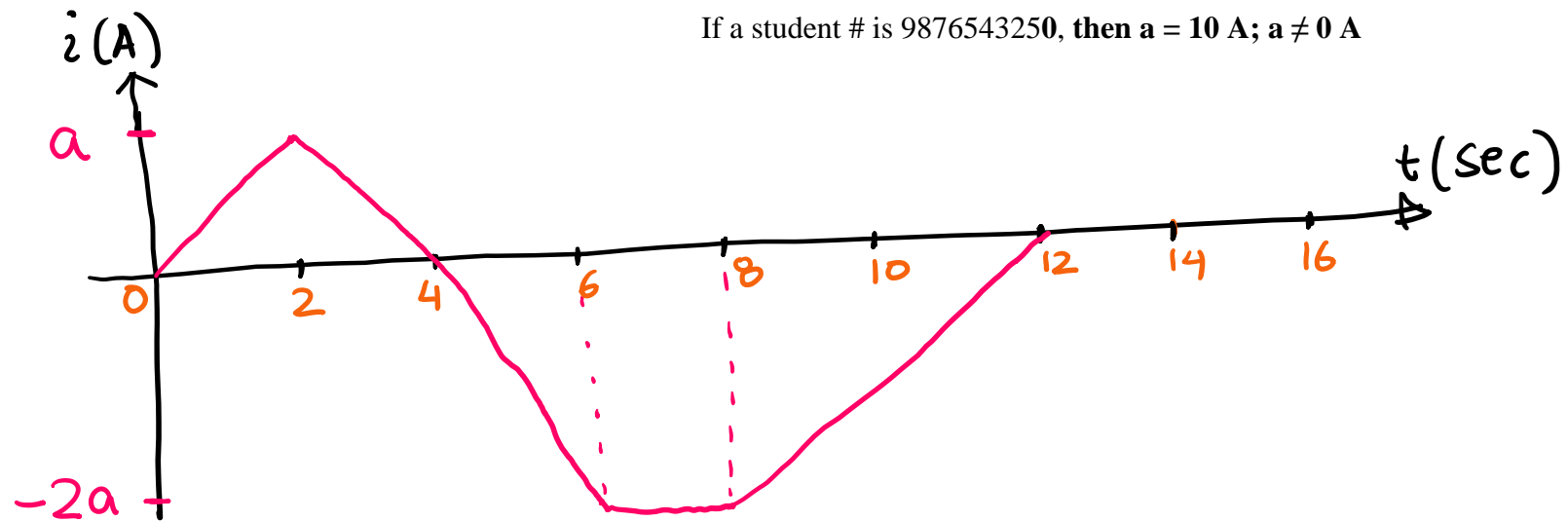


Figure 1: Current and Charge Graphs

Q 2: [30 marks] Using Circuit Reduction (Reducing the resistors to one resistor) and basic circuit laws (KVL, KCL, and Ohms Law) for the circuit shown in Figure 2, Calculate I_1 , I_2 , I_3 , V and the power supplied by the 20 V source.

Use the value of the resistor R as calculated below:

$R = (\text{last digit of your student number}) \Omega$. If your student # is 123456789, then $R = 9 \Omega$

If a student # is 9876543210, then $R = 0 \Omega$

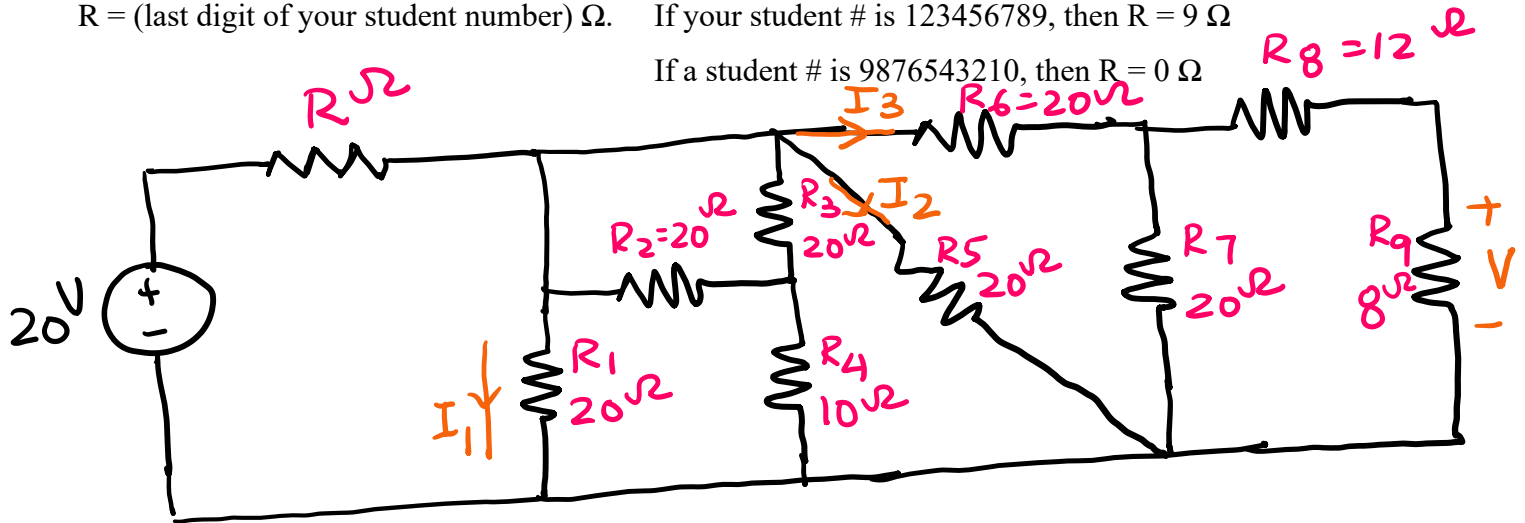


Figure 2: Circuit for Q 2

Q 3: [40 marks] Design a circuit with the specifications bellow:

1. The circuit contains at least two independent DC Current sources, One independent DC Voltage source, One dependent Current Controlled Voltage Source
2. The circuit contains at least 8 Resistors
3. One of the current sources is connected between two meshes
4. One of the current sources is connected the way that is not shared between any two meshes
5. Voltage sources should be connected in two different meshes.
6. Make sure you need to solve at least 3 equations and 3 unknowns.

After you designed the circuit:

[10 marks]

I) Solve this Circuit using Nodal Analysis

- a. Write a set of equations using Nodal analysis. Then simplify the equations. Write the equations in matrix form , then use a calculator to find the final values **[8 marks]**
- b. Express the Current through the dependent Voltage Source , in terms of node voltages (no need for numerical values) . **[2 marks]**
- c. Express the Voltage across one of the Current sources, in terms of node voltage (no need for numerical values) **[2 marks]**
- d. Express the Current through two of the resistor, in terms of node voltage (no need for numerical values) **[3 marks]**

II) Solve this Circuit using Mesh Analysis

- a. Write a set of equations using mesh analysis. Then simplify the equations. Write the equations in matrix form , then use a calculator to find the final values **[8 marks]**
- b. Express the voltage, across the independent current source, in terms of mesh currents (no need for numerical values) **[2 marks]**
- c. Express the current through the other voltage source (not the one in part I), in terms of mesh currents (no need for numerical values) **[2 marks]**
- d. Express the Voltage across the two of the resistor, in terms of mesh currents (no need for numerical values) **[3 marks]**

Q 4: [20 marks] Using superposition principle, find the current I_x in the following circuit.

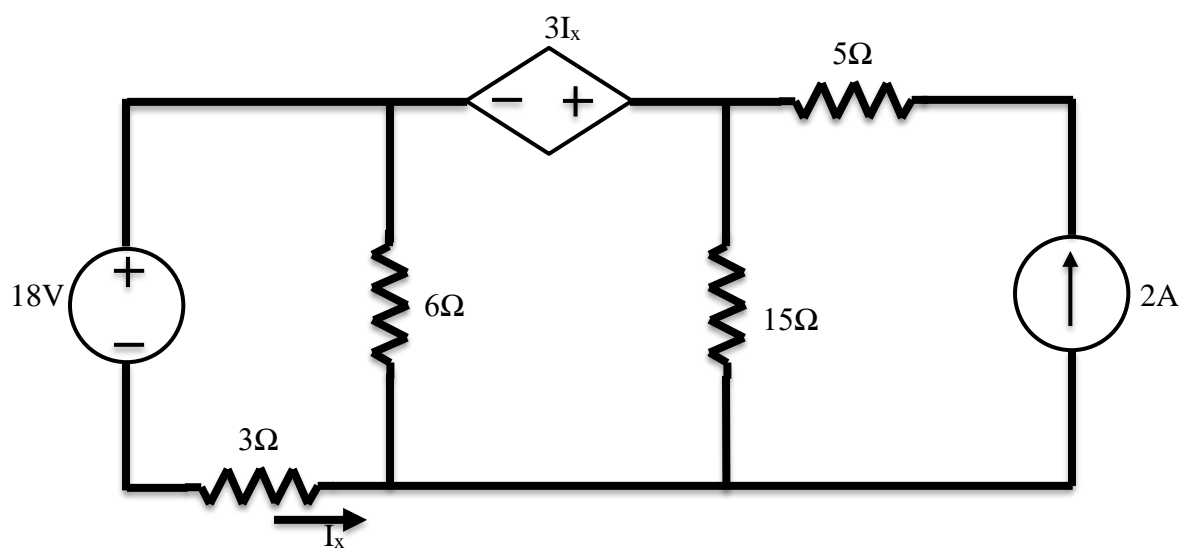


Figure 3: Circuit for Q 4 - Superposition Principle