Ryerson University
Department of Electrical and Computer Engineering
ELE202-Electric Circuits Analysis
Mid-term Examination
March 2, 2023 - Duration: 110 Minutes
Examiners: Dr. Mohammadi 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:

The test is Closed Book / Closed Notes.

There are 5 questions, each with subsections. Answer all questions.

NO QUESTIONS to be asked during the test. 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.

Question No.	***Mark of each question***	***Mark obtained***
Q 1	20	
Q 2	20	
Q 3	20	
Q 4	20	
Q 5	20	
Total (100)		

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

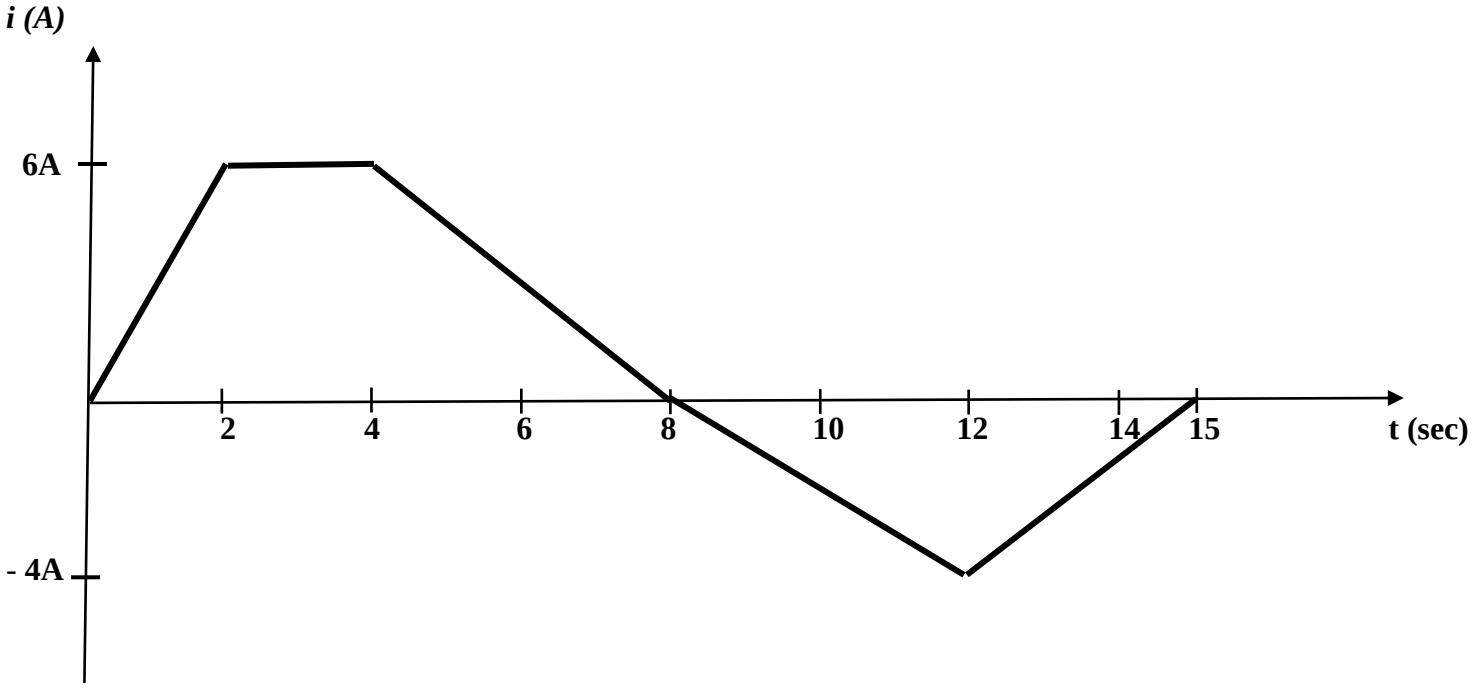

Fig. 1 a: Current versus Time Graph

Q 1 (b): [10 marks] For the circuit shown in the Fig.1 b below. Fill the table below (show the working steps):

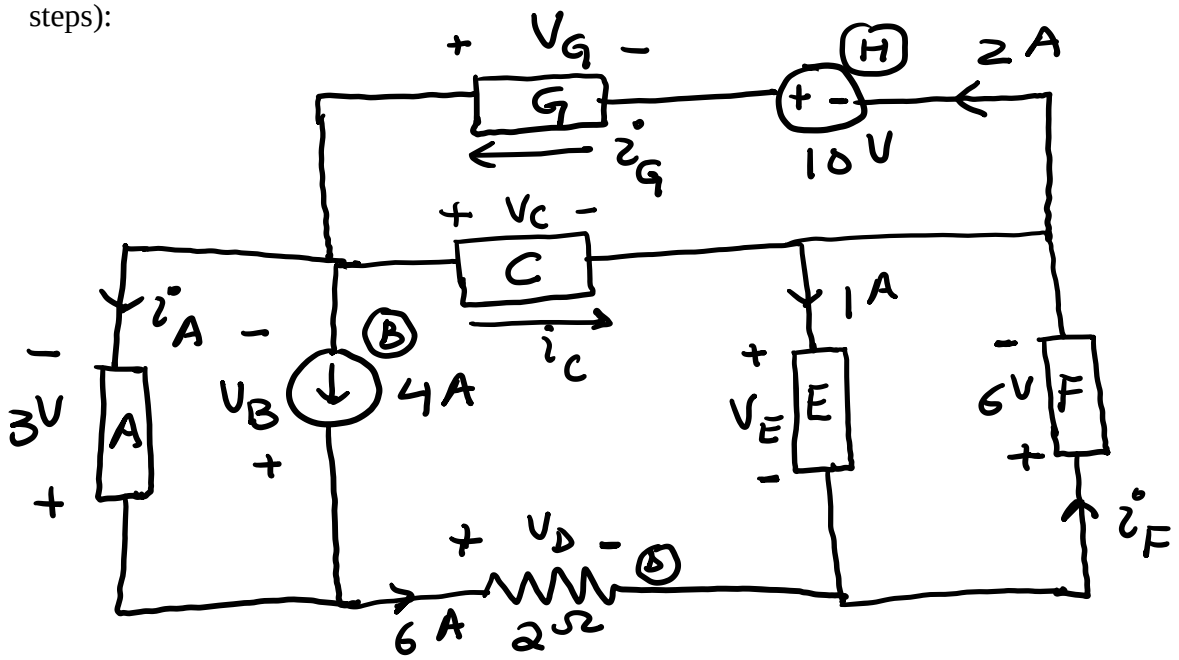

Fig. 1 b: Q1-b

Component Number	Voltage	Current	Power	Power (Absorbed or Supplied)
A	**3 V**			
B				
C				
D		**6 A**		
E		**1 A**		
F	**6 V**			
G				
H		**2 A**		

Q 2: [20 marks] Using Circuit Reduction (Reducing the resistors to one resistor) and basic circuit laws (KVL, KCL, Ohms Law, current division principle and voltage division principle) for the circuit shown in Figure 2, **Calculate** the **equivalent resistance** (total resistance) as seen from the source, $\mathbf{I_X}$, $\mathbf{I_Y}$, $\mathbf{V_X}$, and $\mathbf{V_Y}$.

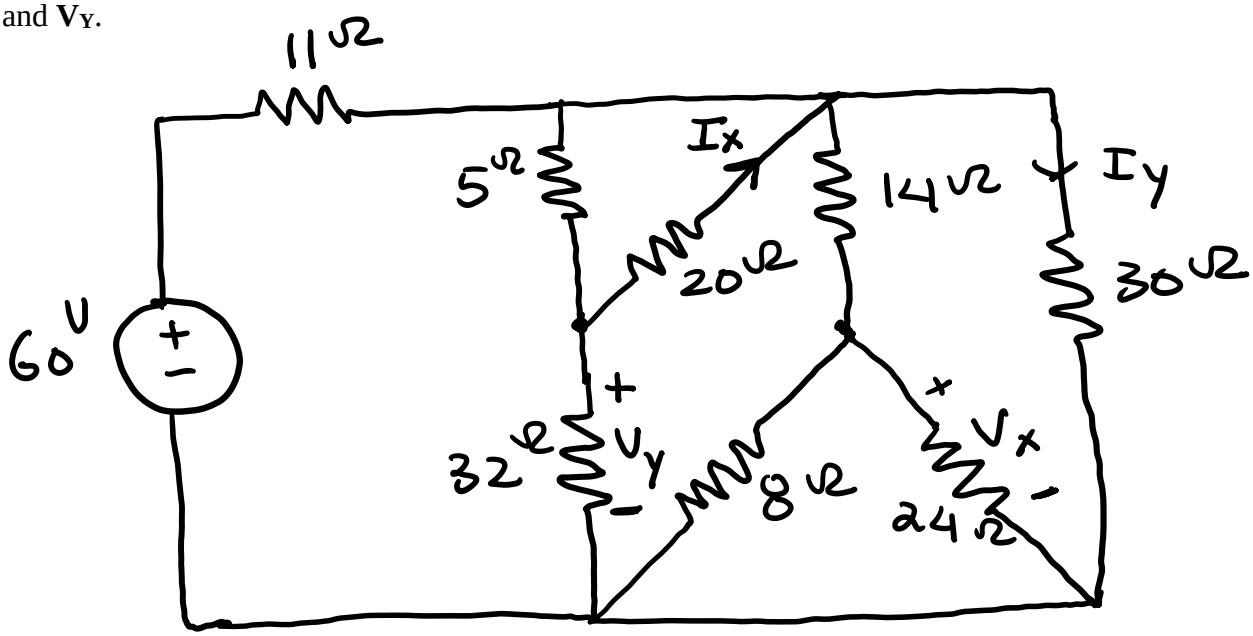

Fig.2: Circuit for Q 2

Q 3 [20 marks]: In the circuit shown in Fig. 3, Using Mesh analysis:

(A) Identify your meshes, assign *clockwise* mesh currents, and write the mesh equations for the meshes assigned. [10]

(B) Simplify the equations you wrote in part (A). [4]

(C) Solve the simplified system in part (B). Provide numerical answers of your mesh currents. [3]

(D) Express V_x and I_x in terms of mesh currents (only the expression, no numerical value required). [3]

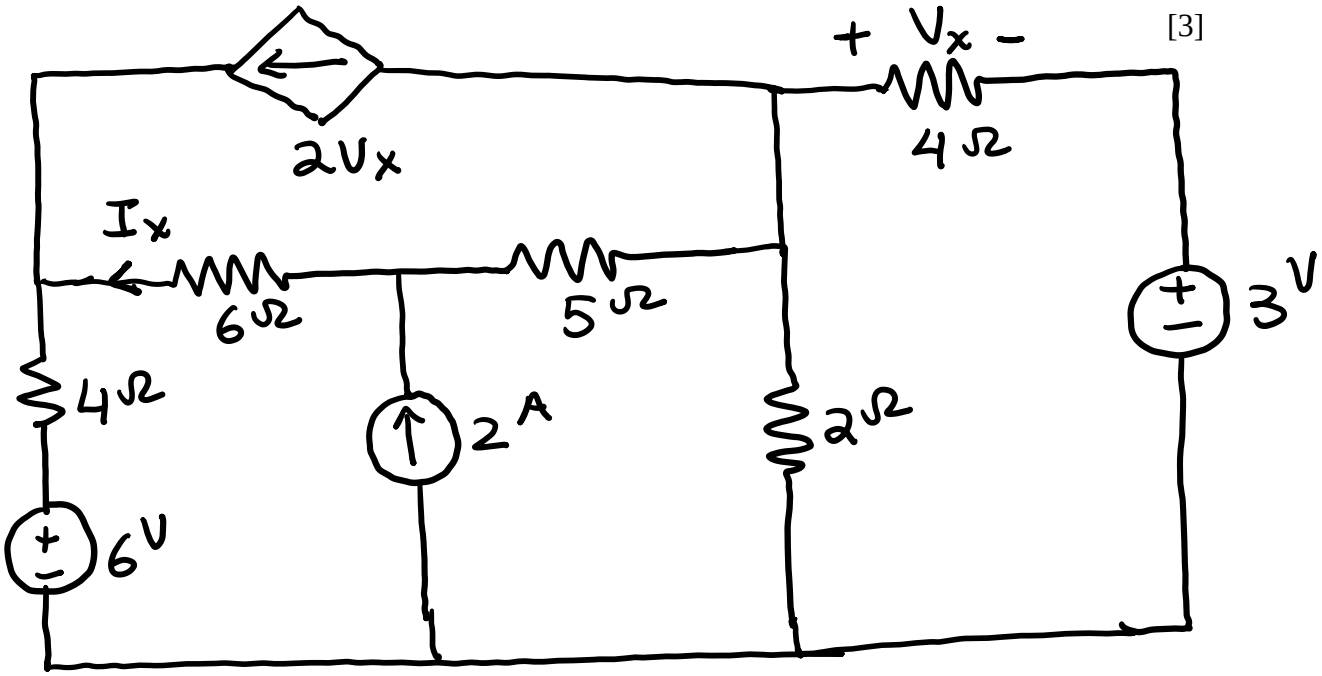

Fig. 3: Circuit for Q 3 - Mesh Analysis

Q 4 [20 marks]: In the circuit shown in Fig. 4, Use nodal analysis:

(A) Write the nodal equations for the non-reference nodes. [10]

(B) Simplify the equations you wrote in part (A). [4]

(C) Solve the simplified system in part (B). Provide numerical answers for the node voltages V_1, V_2, and V_3. [3]

(D) Express I_x and V_x in terms of node voltages (only the expression, no numerical value required). [3]

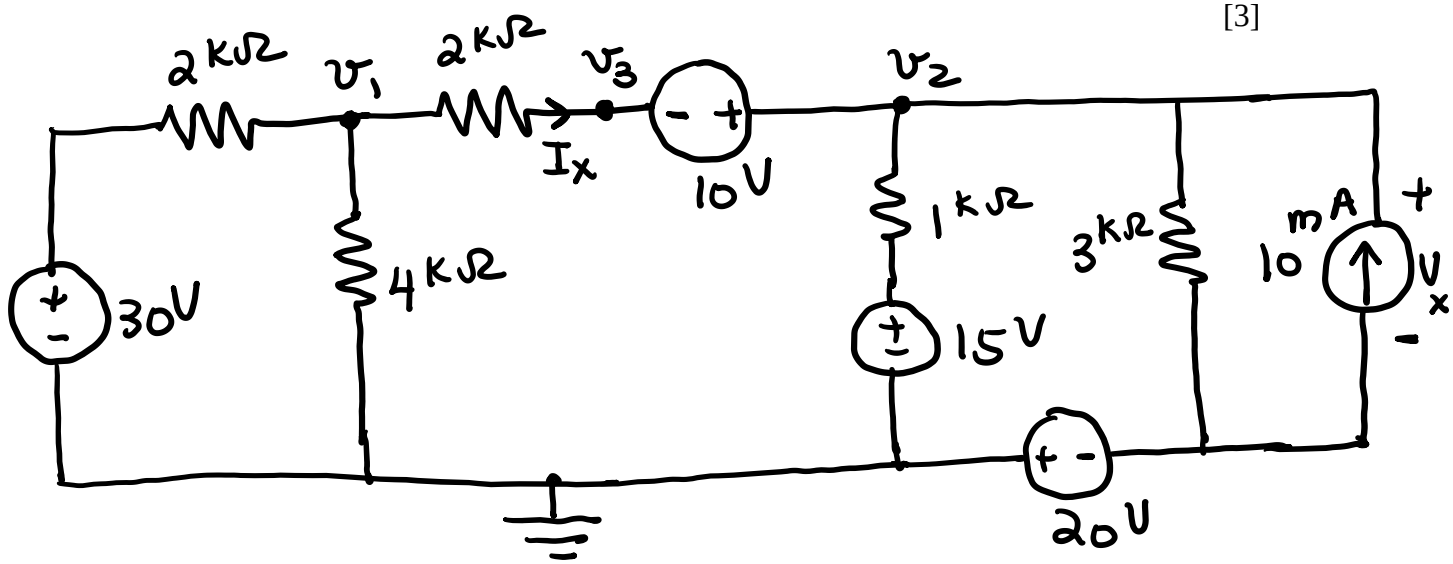

Fig. 4: Circuit for Q 4 – Nodal Analysis

Q 5: [20 marks] For the circuit shown in Fig. 5,

(A) Determine the Thevenin's Equivalent at terminals **a** and **b**. For finding **V_{TH} only use Superposition principle** (if any other circuit analysis technique is used for finding Vth, marks will not be given). For finding R_{TH} any circuit analysis method of your choice can be used. [14]

(B) Determine the value of the load resistor (R_L) for maximum power transfer to the load. [2]

(C) Determine the value of the maximum power transferred to the load. [4]

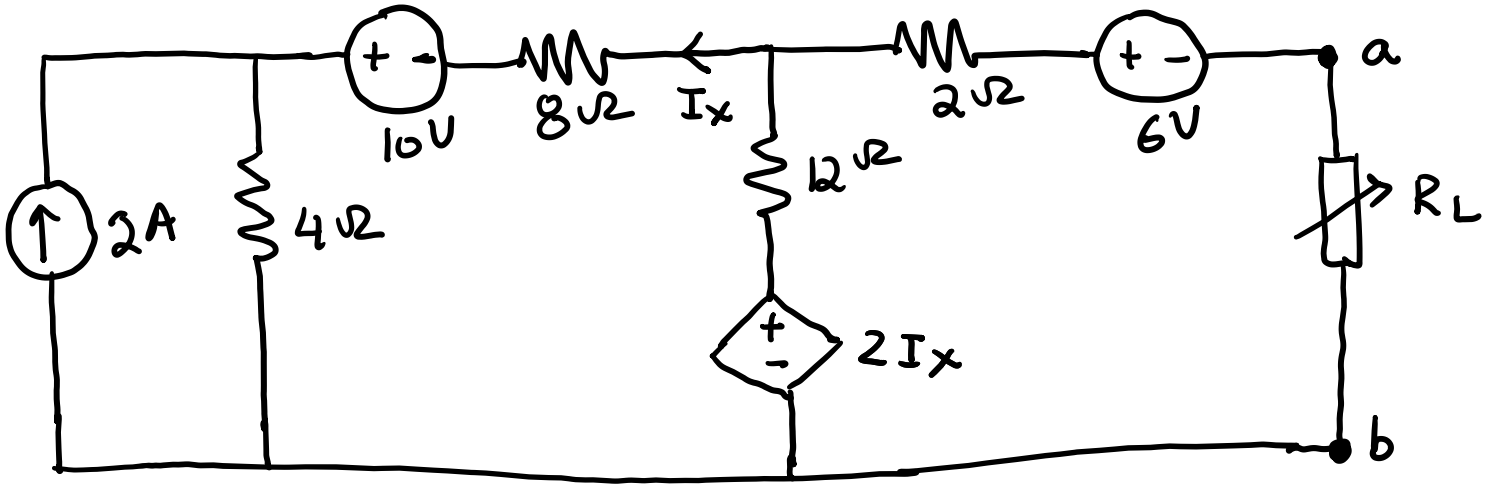

Fig. 5: Circuit for Q 5 – Thevenin's Theorem