

ID:

Name:

**Brac University**

Semester: Summer 2023

Course Code: CSE250

Circuits And Electronics

Set

B

Assessment: *Midterm*

Duration: 1 hour 40 minutes

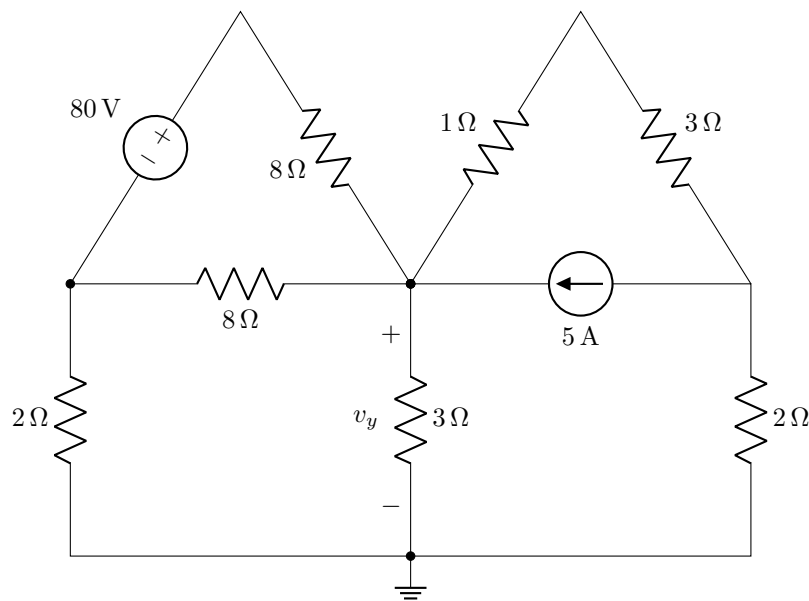
Date: August 6, 2023

Full Marks (incl. bonus 5): 55

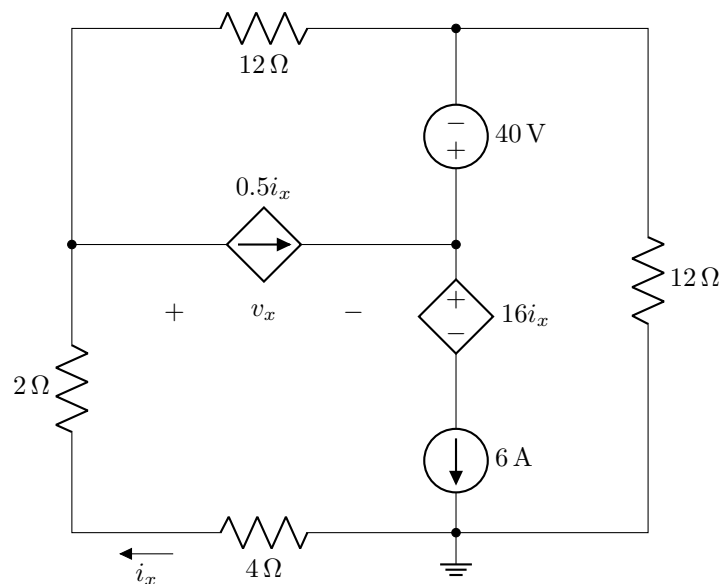
- ✓ No washroom breaks. Phones must be turned off. Using/carrying any notes during the exam is not allowed.
- ✓ At the end of the exam, both the **answer script** and the **question paper** must be returned to invigilator.
- ✓ All **4 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Answer the question 4(a)(ii) **on the question paper** using the provided grid.
- ✓ Symbols have their usual meanings.

■ Question 1 of 4 [CO2] [12 marks]

Apply **Superposition Principle** and/or **Source Transformation** to determine the voltage v_y in the following circuit.



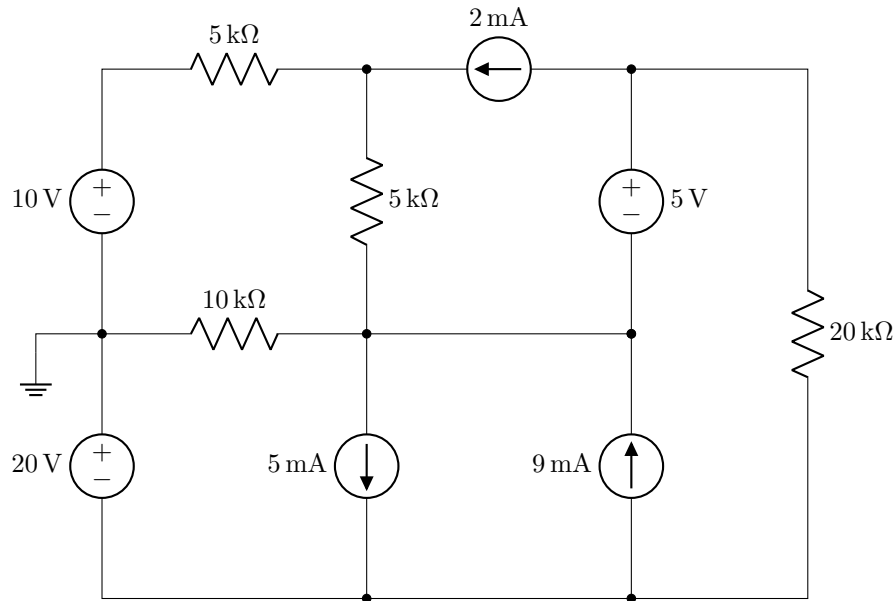
■ Question 2 of 4 [CO3] [15 marks]



Apply **Nodal/Mesh analysis** to answer the following questions:

- (a) [12 marks] Find all the node voltages/mesh currents in the circuit.
- (b) [3 marks] Find v_x , the voltage across the $2i_x$ dependent current source.

■ Question 3 of 4 [CO3] [16 marks]

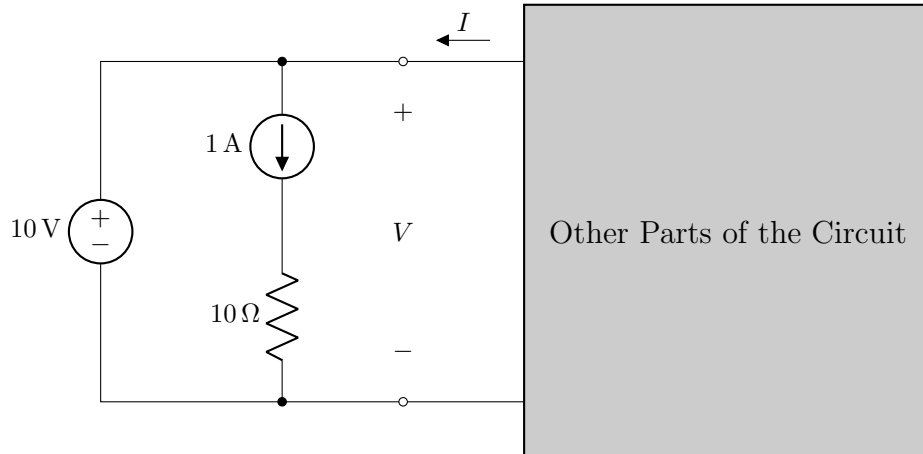


Apply Nodal/Mesh analysis to answer the following questions:

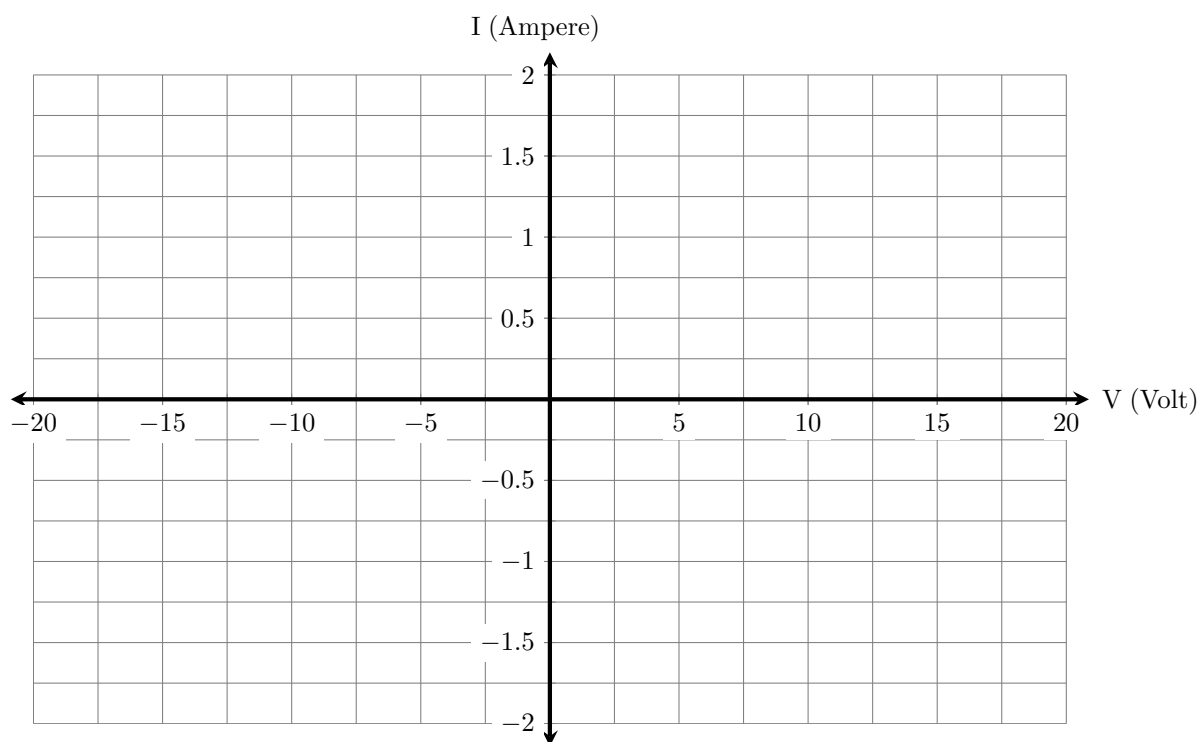
- [12 marks] Find all the node voltages/mesh currents in the circuit.
- [4 marks] Determine the power associated with the 5 V source in the circuit (with appropriate \pm sign and unit). Also, specify whether the power is being supplied/consumed.

■ Question 4 of 4 [CO3] [12 marks]

- You break open your phone charger and find the following circuit. The greyed-out part doesn't contain anything interesting, but the left part of the circuit catches your eye.



- [2 marks] **Determine** $I - V$ characteristics of the left part of the circuit. i.e. Write an equation that will always hold irrespective of what is inside the greyed-out box.
Hint: The equation cannot have any variables other than V and/or I . Everything else should just be a number.
- [2 marks] Based on your answer in (i), plot the $I - V$ characteristics of the subcircuit in the following grid.



- (b) [2 marks] You notice that the left part of the circuit can actually be replaced with one single equivalent circuit element. Redraw the **reduced equivalent circuit**.
- (c) [6 marks] Determine the equivalent resistance between terminals $a - b$ for the following circuit.

