ID:	Name:

Set **A**

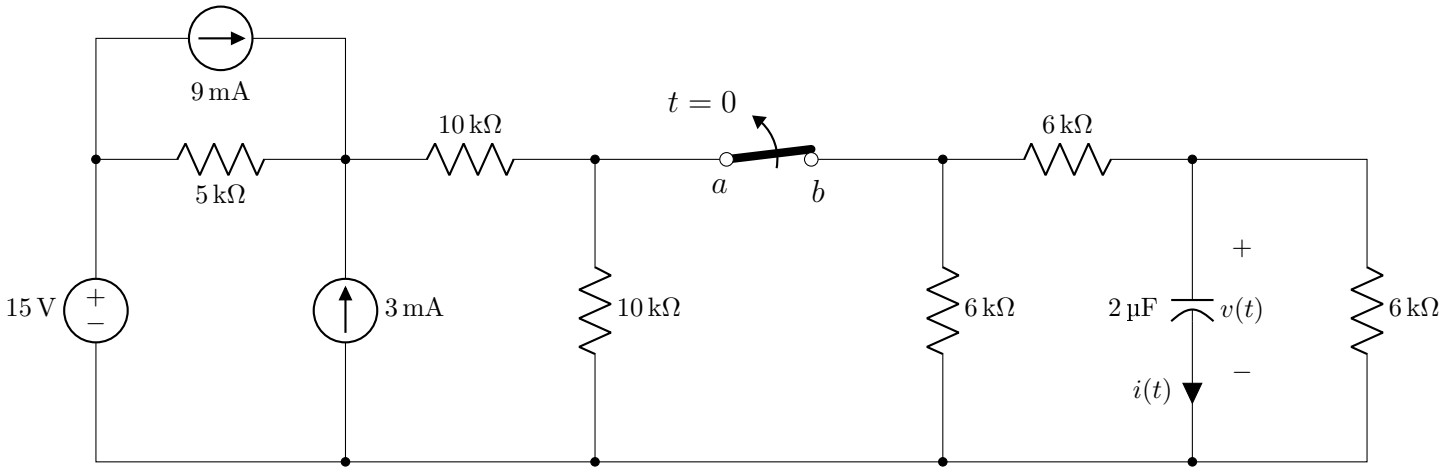
Brac University
Semester: Fall 2024
Course Code: CSE250
Circuits And Electronics

Assessment: *Final Exam*
Duration: 1 hour 40 minutes
Date: January 17, 2025
Full Marks: 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 the invigilator.
- ✓ All **4 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Draw the plots for the question **1(e)** in the grids provided on the question paper.
- ✓ Symbols have their usual meanings.

■ Question 1 of 4 *[CO3] [20 marks]*

In the circuit below, at time $t = 0$, the switch opens, disconnecting terminals a and b.



Analyze the **Transient Behavior** to answer the following questions–

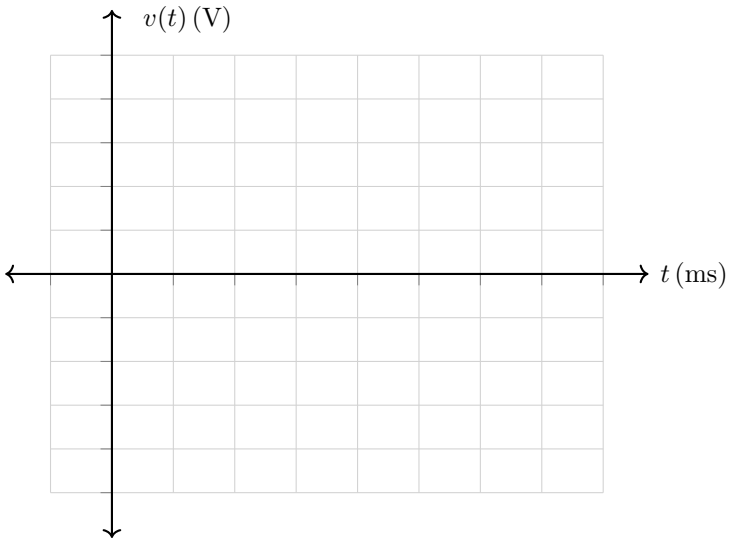
(a) ***[8 marks]*** Determine the initial and final voltages across the capacitor, respectively before and after switching.

(b) ***[4 marks]*** Determine the time constant of the circuit.

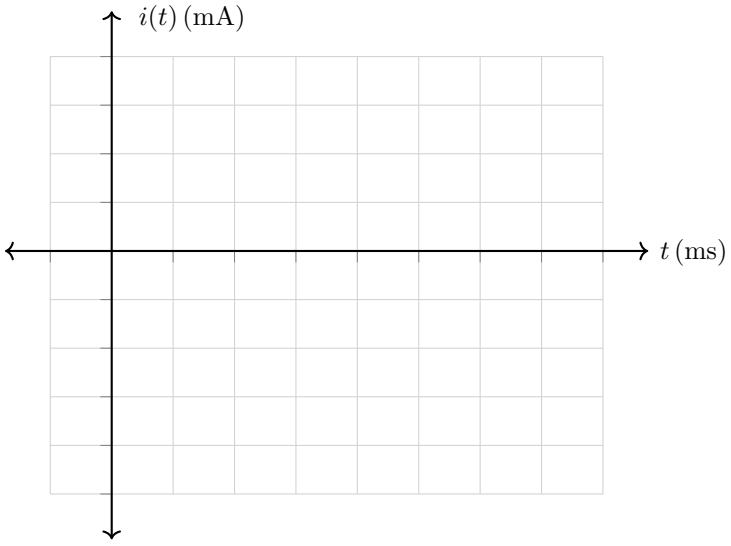
(c) ***[2 marks]*** Based on the quantities determined in (a) and (b), write an expression of the voltage $v(t)$ for $t > 0$.

(d) ***[3 marks]*** Based on the $v(t)$ found in (c), determine the current $i(t)$ through the capacitor as a function of t for $t > 0$.

(e) ***[3 marks]*** On the following grids, approximately draw the $v(t)$ and $i(t)$ found in (c) and (d), respectively. Label on the graphs the quantities found in (a) and (b).



Grid for $v(t)$



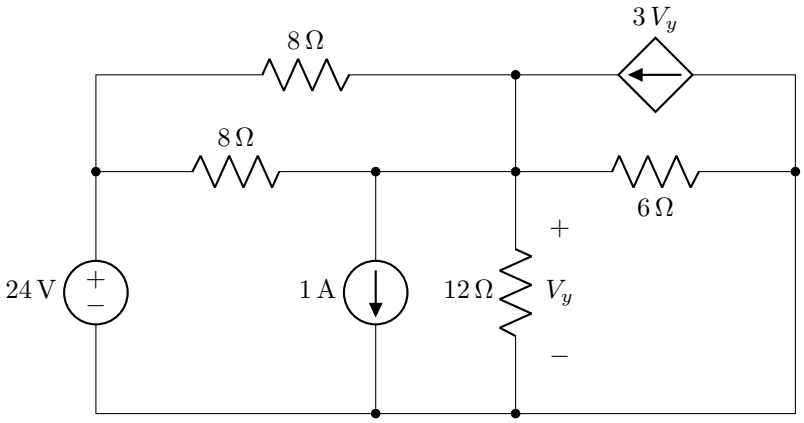
Grid for $i(t)$

■ Question 2 of 4 *[CO2] [16 marks]*

Apply Superposition Principle in the following circuit to determine the voltage V_y.

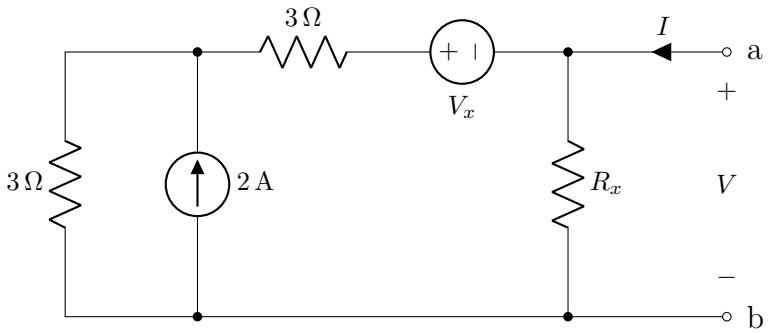
or

Apply Source Tranaformation to reduce the following circuit to a single mesh and then determine V_y.



■ Question 3 of 4 *[CO3] [10 marks]*

In the circuit below, all resistors are practical and cannot have negative values. When a voltage of $V = 2\,\text{V}$ is applied across terminals a and b, the circuit draws a current of $I = 3\,\text{A}$. However, if $-6\,\text{V}$ is applied, instead of drawing, the circuit supplies $1\,\text{A}$ to the terminal a.

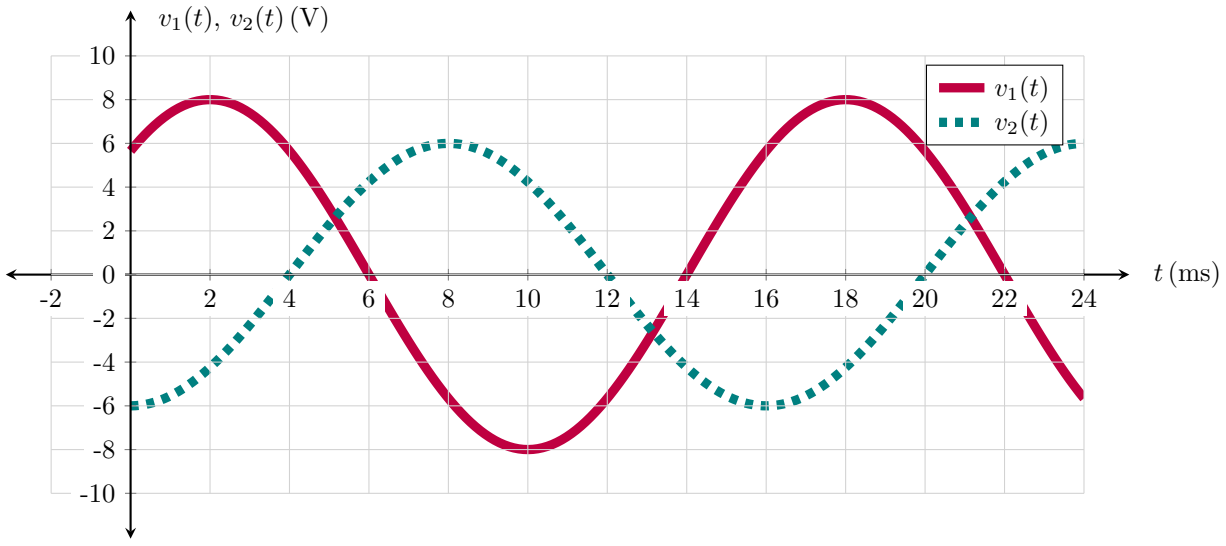


(a) ***[4 marks]*** Determine the unknown resistance R_x in the circuit.

(b) ***[6 marks]*** Find an equivalent representation of the circuit having minimum number of elements and determine V_x.

■ Question 4 of 4 *[CO3] [9 marks]*

Two voltage waveforms $v_1(t)$ and $v_2(t)$ from an ac circuit are plotted below as a function of time t.



(a) ***[4 marks]*** Determine the phase difference ($0° \le \Delta\varphi \le 180°$) between the two and identify which one is leading.

(b) ***[5 marks]*** Write analytical expressions for both $v_1(t)$ and $v_2(t)$ as a function of t with the initial phases (φ) in degrees, where $-180° \le \varphi \le 180°$.