ID:	Name:

Set **A**

Brac University
Semester: Spring 2023
Course Code: CSE250
Circuits And Electronics

Assessment: *Final*
Duration: 2 hours
Date: May 2, 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 **3 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Symbols have their usual meanings.

■ Question 1 of 3 *[CO2 CO3 CO4] [20 marks]*

Consider the following circuit with open terminals ***a*** and ***b***. Currently, no load is connected to the terminals.

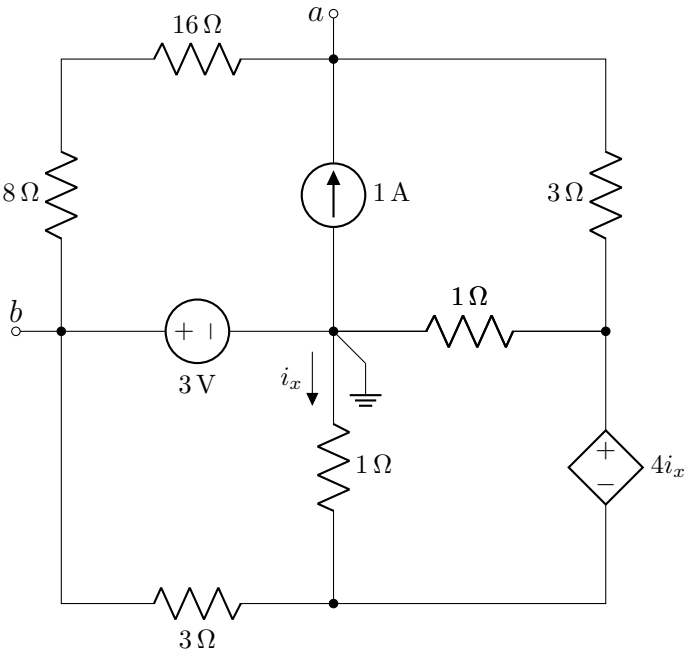
(a)

$R_L = R_{Th} = 4\Omega$

(b)

$V_{Th} = 3V$

$P_{max} = 0.5625\ W$



(a) *[12 marks]* **Determine** the value of R_L that will draw the **Maximum Power** from the circuit.

(b) *[8 marks]* **Determine** the value of the **Maximum Power**.

■ Question 2 of 3 *[CO4 CO5] [20 marks]*

(a) The $v_c(t)$ vs t plot below shows the voltage response of a capacitor (C) in a series RC circuit to a sudden change in the DC voltage applied through an equivalent resistance of **2 kΩ**.

(i) $\tau = 2ms$

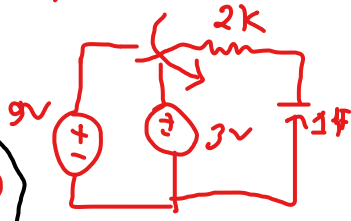
$C = 1\mu F$

(ii) $v(0) = 9V$

$v(\infty) = 3V$

$v(t) = 3 + 6e^{-t/2}$ (V)

(iii) $t = 0$

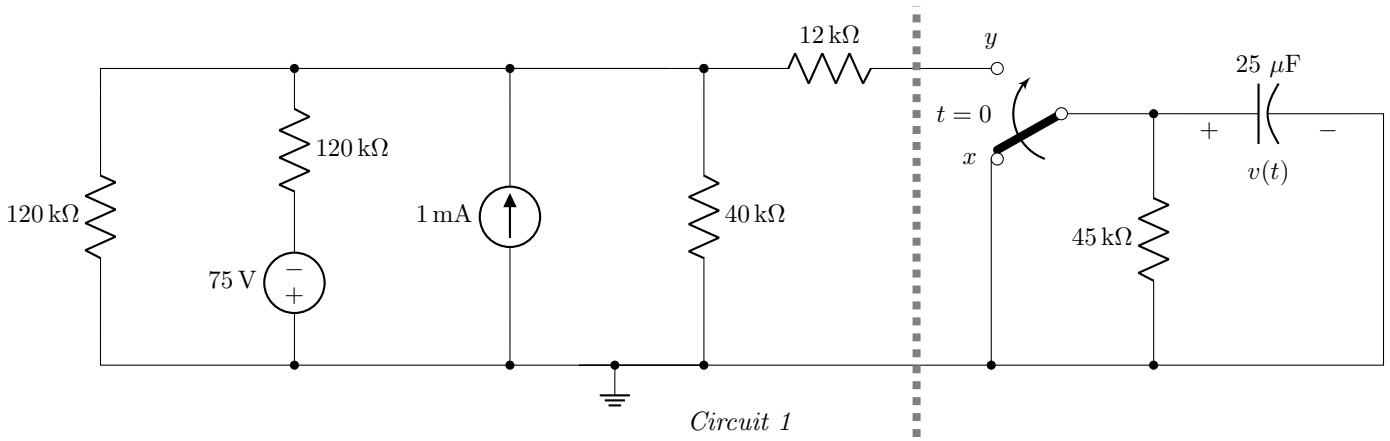


(i) *[2 marks]* **Determine** the approximate **Time Constant** from the figure. **Determine** C with appropriate unit.

(ii) *[1 mark]* Write a mathematical expression of $v_c(t)$ for $t > 0$.

(iii) *[2 marks]* Predict and draw a circuit with appropriate switching mechanism that can generate the voltage response as shown in the plot.

(b) Consider the following circuits.



Circuit 1

(i) $V_1 = 9\,V$

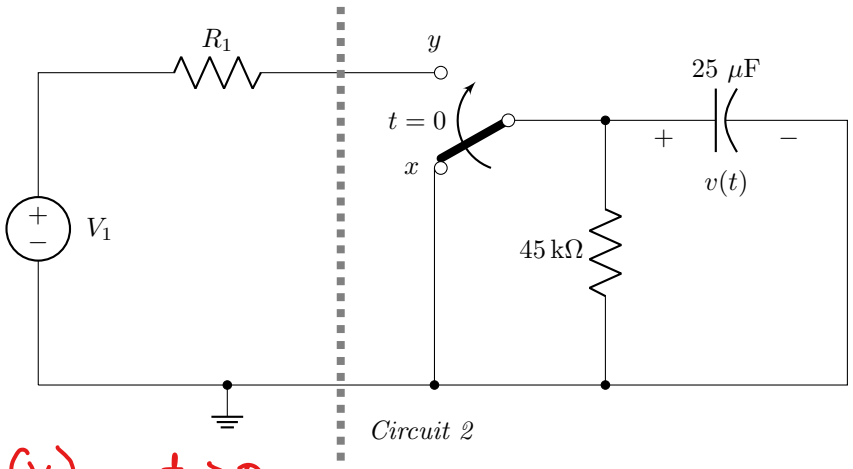
$R_1 = 36\,\Omega$

(ii) $v(0) = 0$

$v(\infty) = 5\,V$

$\tau = 0.5\,s$

$v(t) = 5 - 5e^{-2t}$ (V), $t > 0$



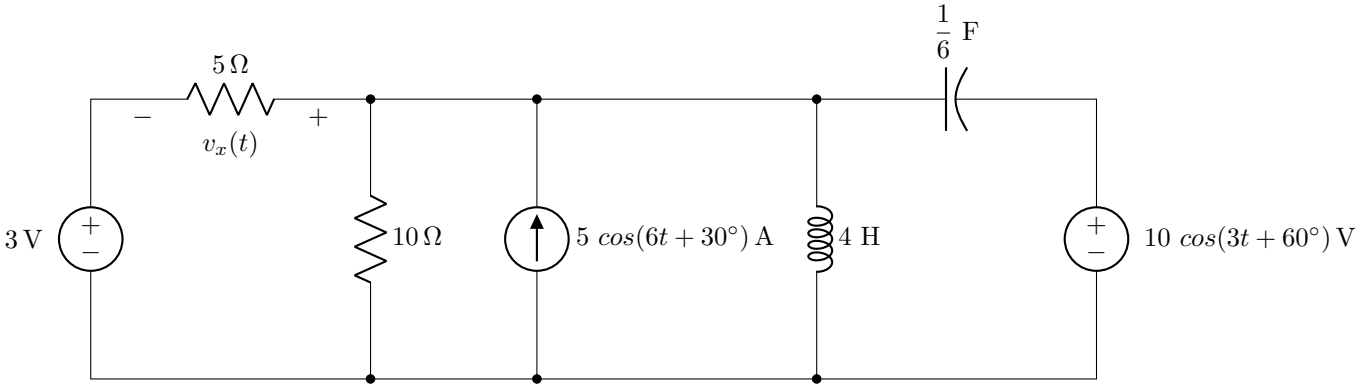
Circuit 2

(i) *[7 marks]* **Reduce** the left portion with respect to the dashed gray line of *Circuit 1* so that it takes the form of *Circuit 2* as shown. Write down the values of V_1 and R_1.

(ii) *[8 marks]* Now, **analyze** the **Transient Behavior** of the circuit assuming that the switch moves from position x to position y at $t = 0$. **Determine** $v(t)$ for $t > 0$.

■ Question 3 of 3 *[CO4 CO6] [15 marks]*

Determine $v_x(t)$ in the circuit shown below.



$v_x(t) = -3 + 4.61\cos(6t + 103.96°) + 9.74\cos(3t + 95.75°)$