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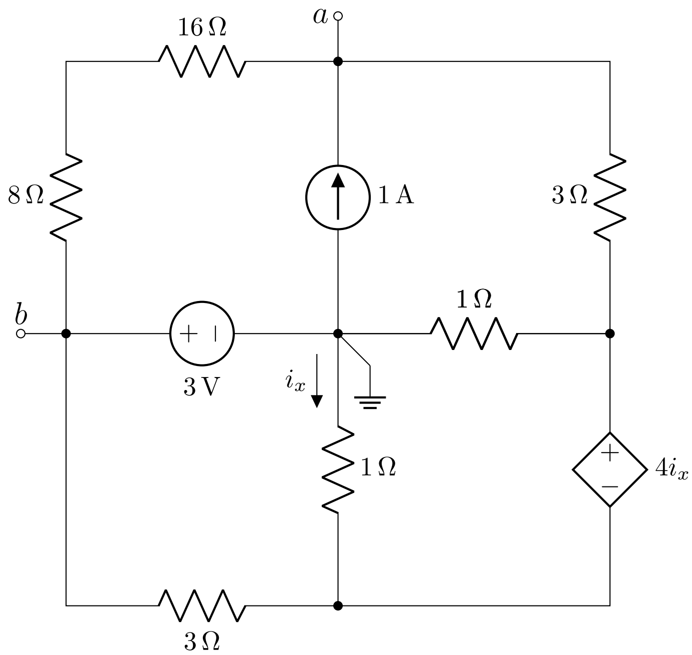
Brac University
Semester: Spring 2023
Course Code: CSE250
Circuits And Electronics

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 $\boldsymbol{a}$ and $\boldsymbol{b}$. Currently, no load is connected to the terminals.

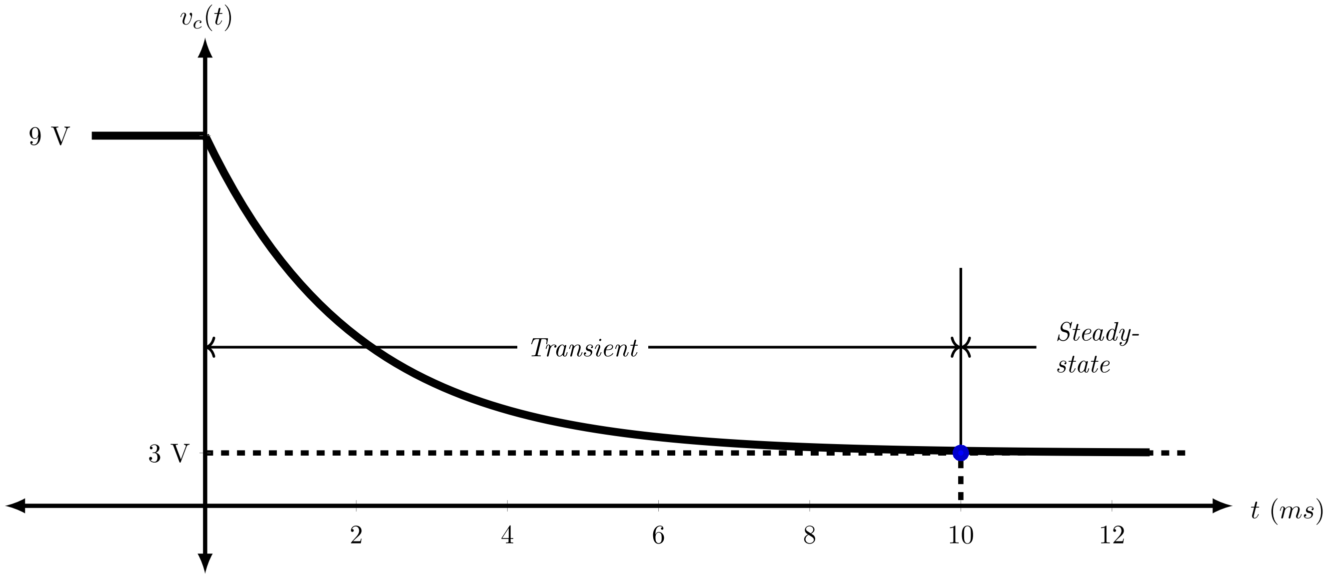


(a) *[12 marks]* **Determine** the value of $\boldsymbol{R_L}$ that will draw the **Maximum Power** from the circuit.

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

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

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

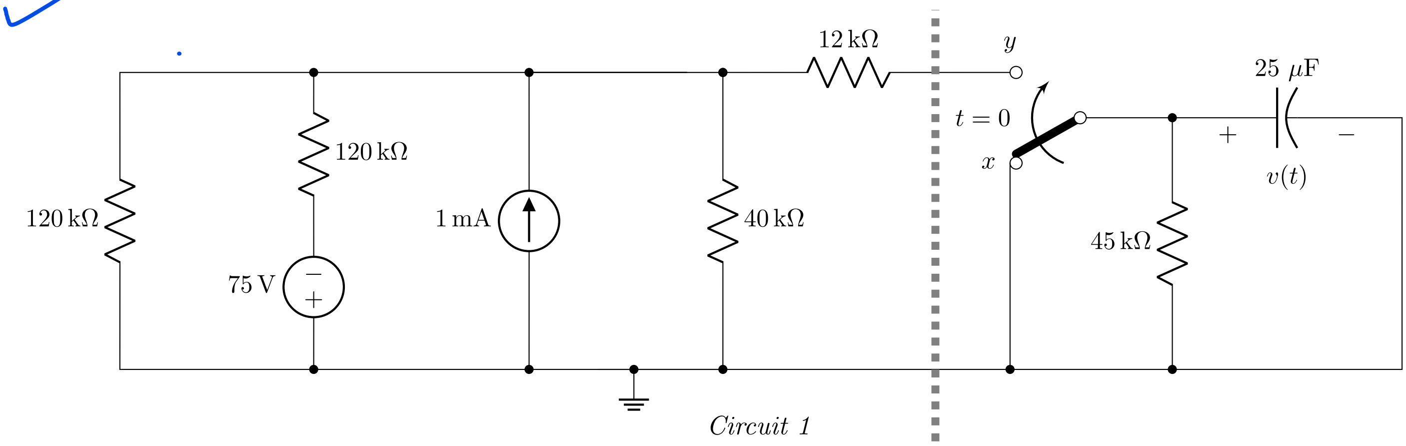


(i) *[2 marks]* **Determine** the approximate **Time Constant** from the figure. **Determine C** with appropriate unit.

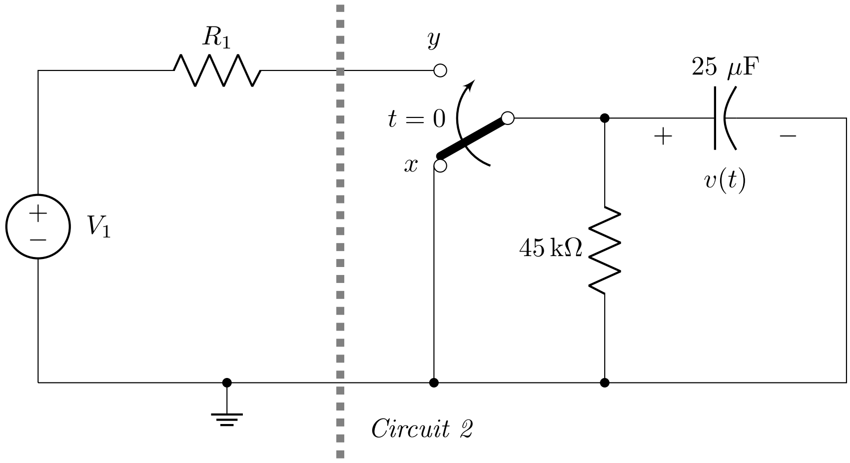
(ii) *[1 mark]* Write a mathematical expression of $v_c(t)$ for $t > 0$.

(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



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.