

ID:

Name:

**Brac University**

Semester: Summer 2023

Course Code: CSE250

Circuits And Electronics

Set

A

Assessment: *Final*

Duration: 2 hours

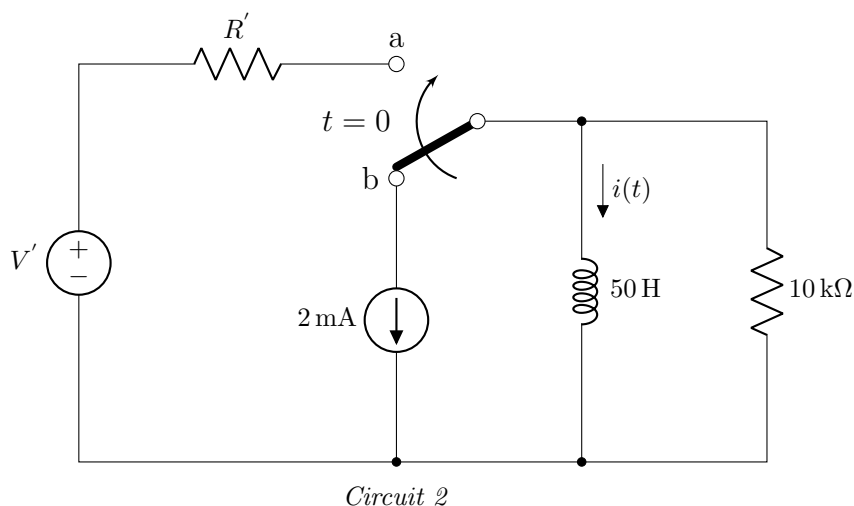
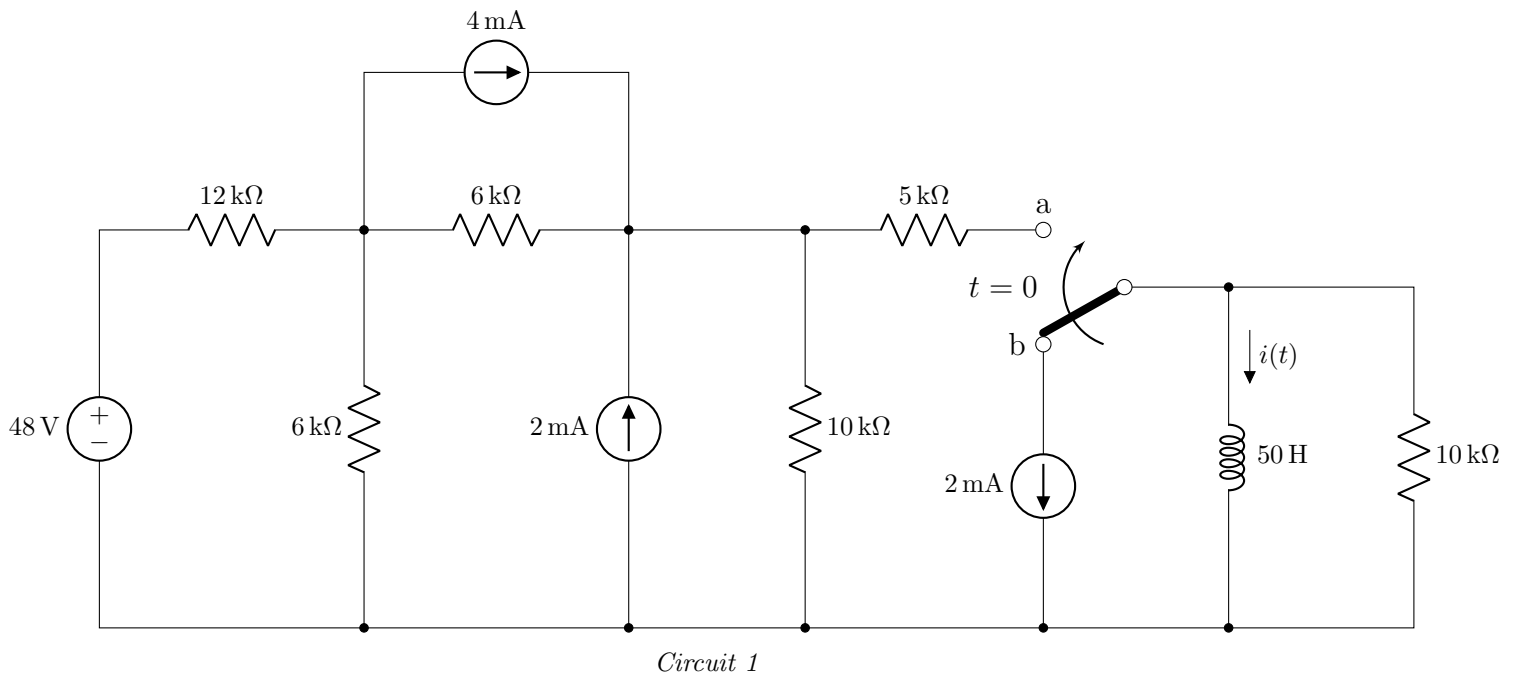
Date: September 8, 2023

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.
- ✓ Answer the question 1(c) on the **question paper** using the provided grid.
- ✓ Symbols have their usual meanings.

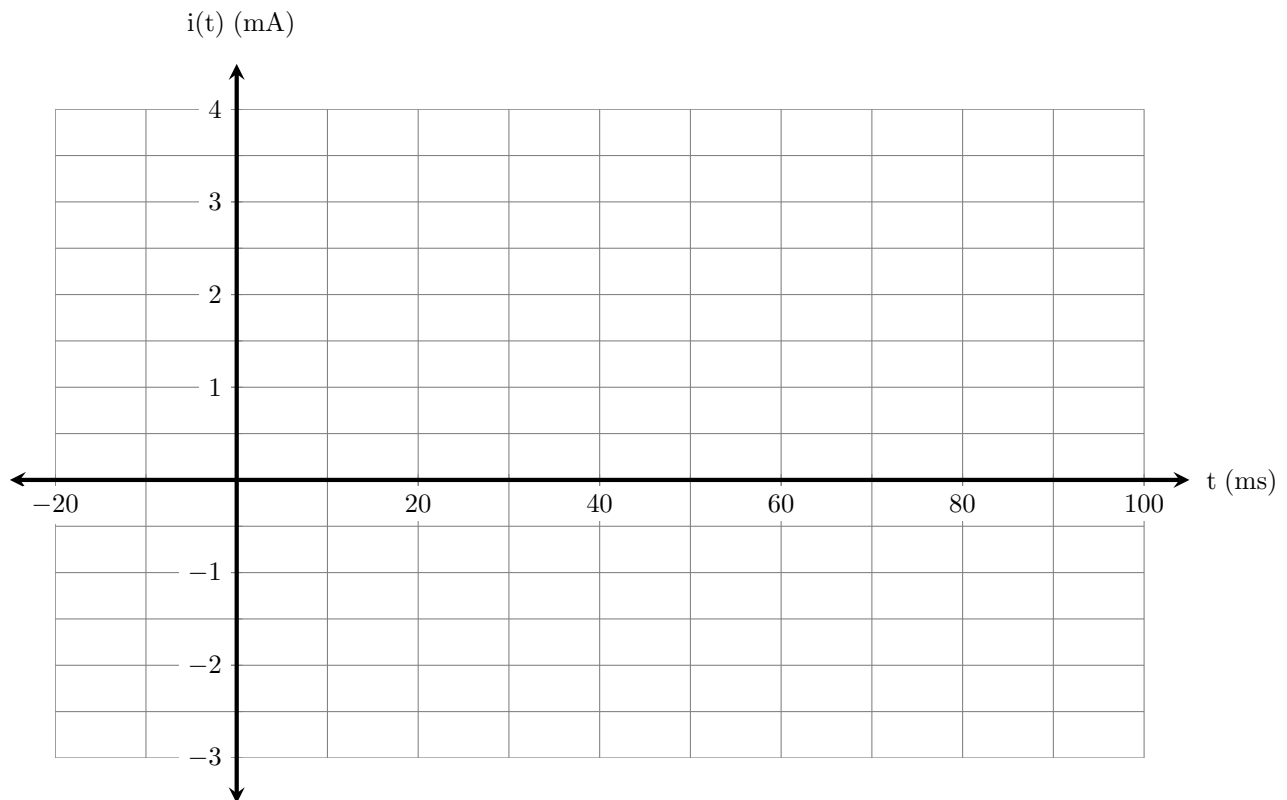
■ Question 1 of 3 [*CO2, CO3*] [20 marks]

Consider the the following circuits which are equivalent to each other.



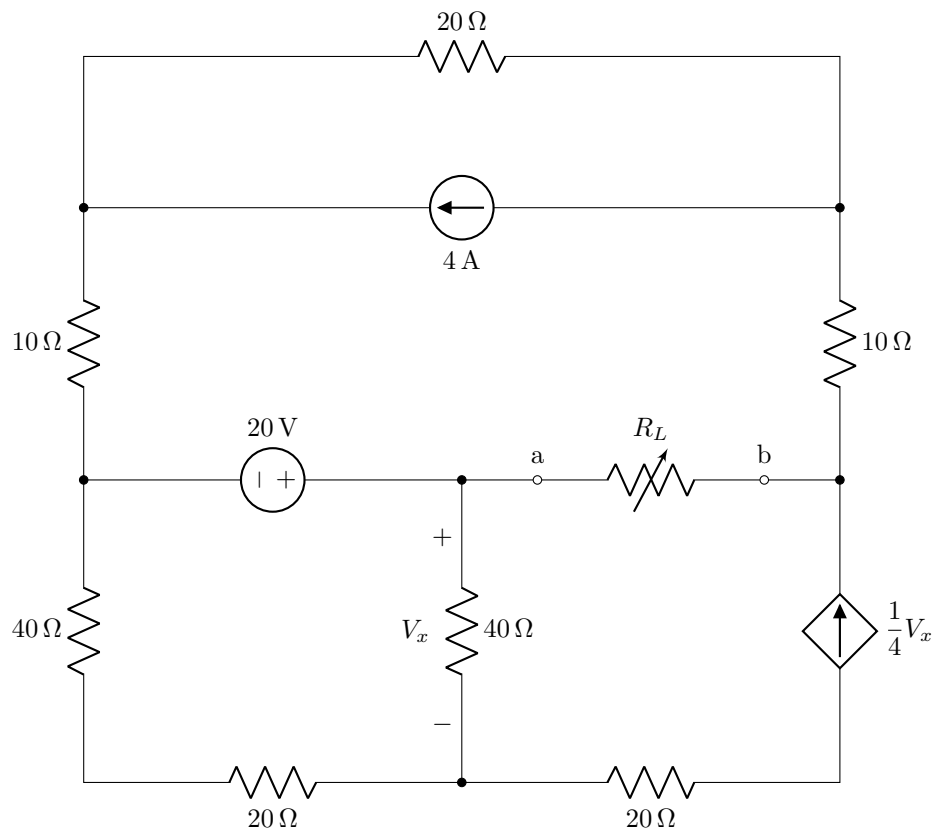
- (a) [7 marks] **Derive** *Circuit 2* from *Circuit 1*. What are the values of V' and R' ?
- (b) [9 marks] Now, **analyze** the transient behavior of the circuit assuming that the switch moves from position b to position a at $t = 0$. Determine $i(t)$ for $t > 0$.

- (c) [4 marks] Based on your answer in (b), does the inductor get charged or discharged? In the following grid, draw the current $i(t)$ found in (b) as a function of time. Mark the time where the inductor is fully charged or discharged.



■ Question 2 of 3 [CO2] [15 marks]

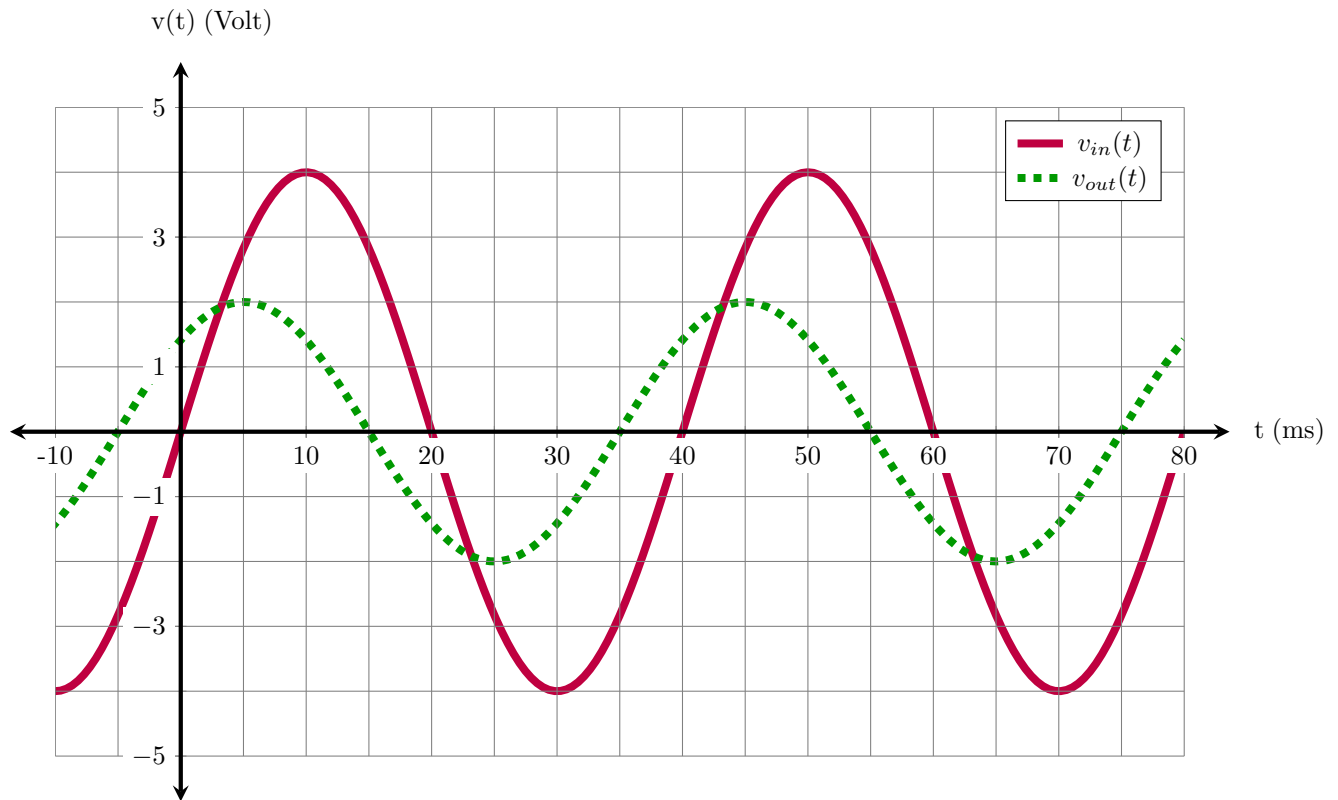
Consider the following circuit with a load R_L connected between terminals a and b.



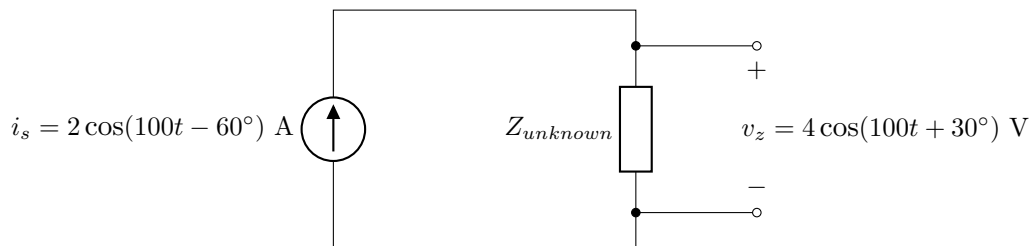
- (a) [8 marks] **Determine** the value of R_L that will draw the maximum power from the circuit.
- (b) [7 marks] **Determine** the value of the maximum power.

■ Question 3 of 3 [CO3] [20 marks]

- (a) [4 marks] The input $v_{in}(t)$ and output $v_{out}(t)$ voltage waveforms of a two terminal ac circuit are plotted as a function of time below. **Determine** mathematically the phase difference between the two and specify which one is leading.



- (b) When a current of $i_s = 2 \cos(100t - 60^\circ)$ A passes through an unknown circuit element with an impedance of $Z_{unknown}$, it causes a voltage drop of $v_z = 4 \cos(100t + 30^\circ)$ V across it as shown below.



- (i) [1 mark] Does the voltage (v_z) lead or lag the current (i_s)?
(ii) [1 mark] Determine the value of the impedance $Z_{unknown}$.
(iii) [2 marks] Based on your answer in (ii), guess the circuit element and **determine** the value of it with appropriate units.
- (c) [12 marks] For the circuit shown below, **determine** $v_o(t)$, the voltage across the capacitor.

