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

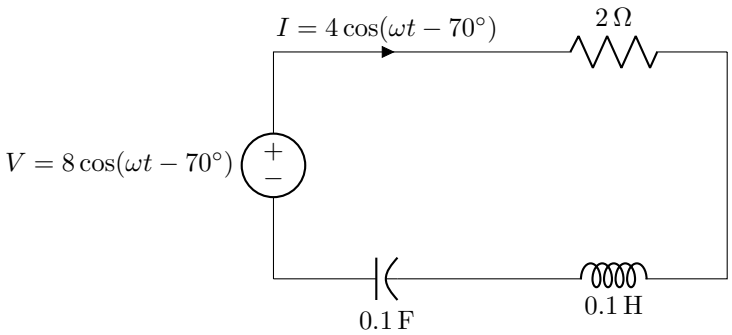
Set **B**

Assessment: *Final (Online)*
Duration: 1 hour 30 Minutes
Date: December 20, 2023
Full Marks (incl. bonus 8): 55

- ✓ No washroom breaks. Camera must be turned on throughout the quiz. Position your camera so that your face and exam script are clearly visible.
- ✓ **You are not allowed to type anything during the exam. It is recommended to use mouse if necessary.**
- ✓ All **3 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Bonus questions are indicated as "***(bonus)***" along with allotted marks.
- ✓ Specify Name, ID, and Section on the first page.
- ✓ **Submission form will be unaccessible after the designated submission time.**
- ✓ Symbols have their usual meanings.

♢ Question 1 of 3 *[CO3] [15 marks + 5 marks (bonus)]*

(a) Answer the following questions for the following circuit:

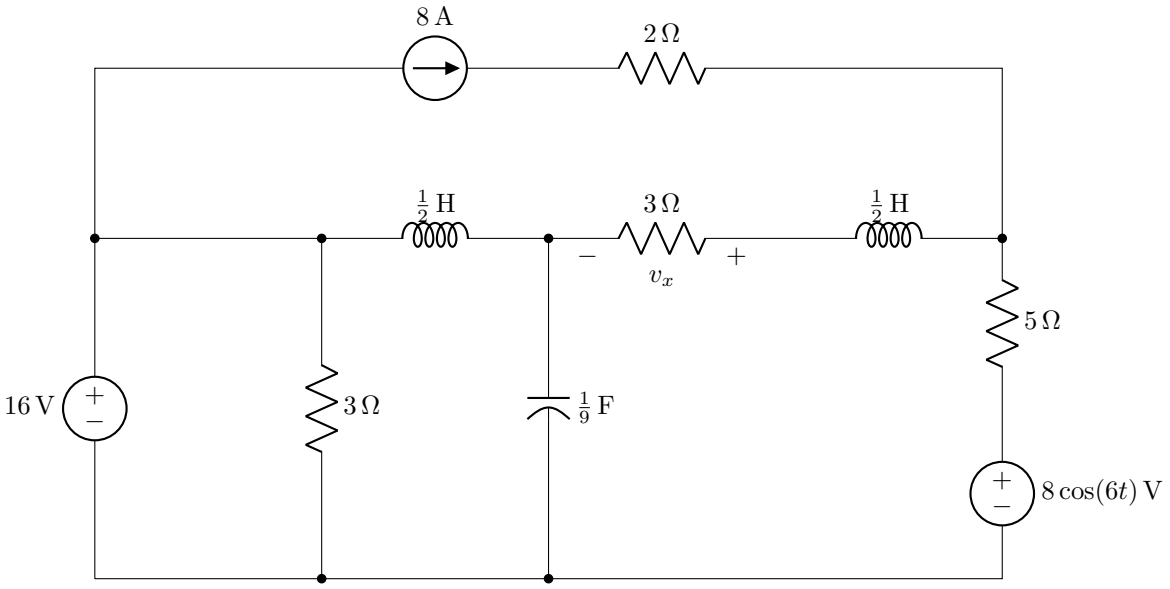


(i) ***[1 mark (bonus)]*** What is the phase difference between V and I? Is V leading/lagging or in-phase with I?

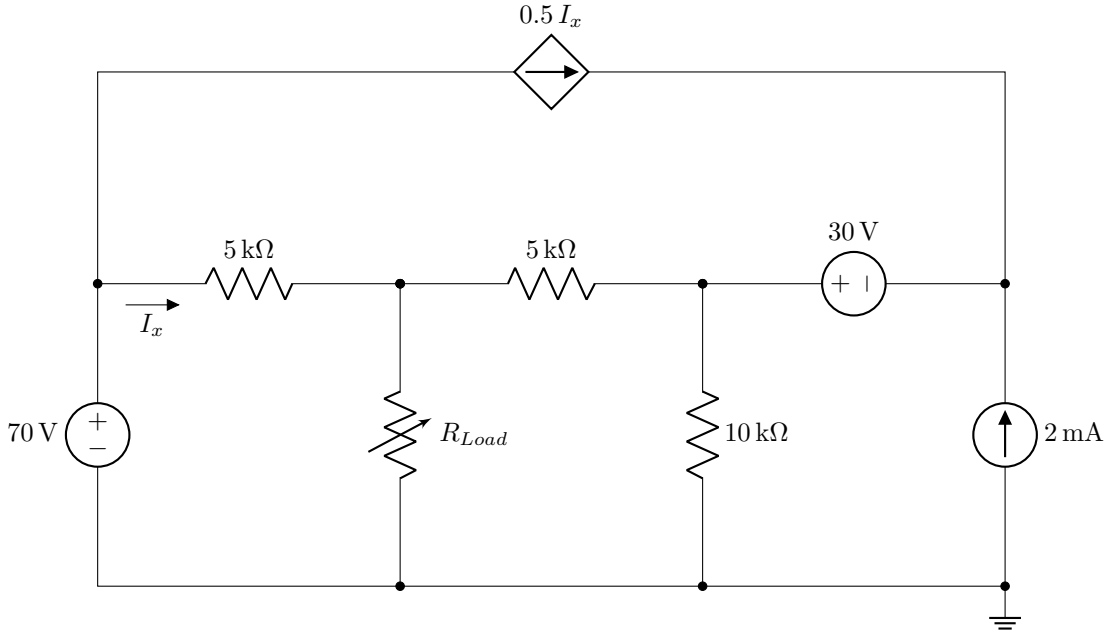
(ii) ***[1 mark (bonus)]*** What is the equivalent impedance of the circuit?
(Hint: It should be a numeric value, not anything in terms of ω.)

(iii) ***[3 marks (bonus)]*** Based on your answer in (ii), what should be the value of ω?

(b) ***[15 marks]*** **Apply AC analysis** to find the voltage difference $v_x(t)$ for the following circuit:



♢ Question 2 of 3 *[CO2] [15 marks]*



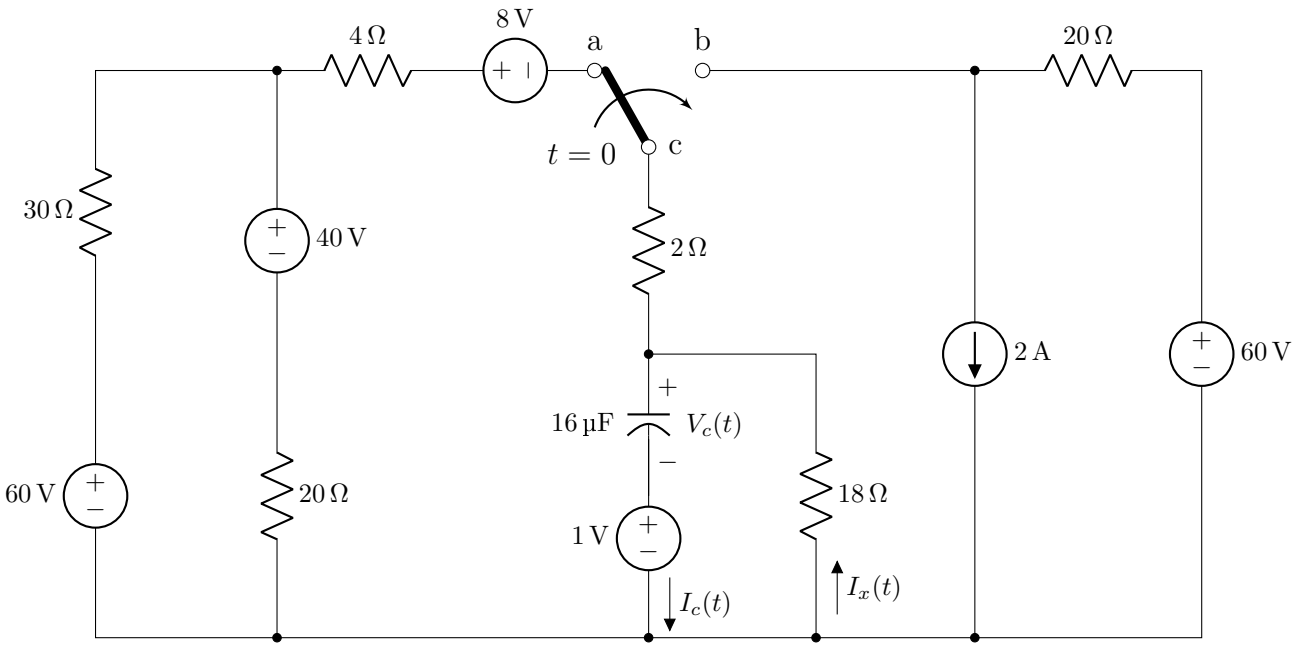
Apply Thevenin's/Norton's Theorem to answer the following queries–

(a) ***[8 marks]*** Determine the value of R_{Load} for which the circuit will deliver maximum power to it.

(b) ***[7 marks]*** Determine the value of the maximum power.

♢ Question 3 of 3 *[CO3] [17 marks + 3 marks (bonus)]*

The switch in the following circuit moves from position a to b at $t = 0$ where position c remains unchanged.



Analyze the Transient Behavior to answer the following questions–

(a) ***[12 marks]*** Determine the voltage $V_c(t)$, across the capacitor and the current $I_c(t)$, through it as a function of time for $t < 0$ and $t > 0$.

(b) ***[5 marks]*** Approximately draw, in separate plots, $V_c(t)$ and $I_c(t)$ found in (a) as a function of time for $t < 0$ and $t > 0$. For each of the plots, label the axes clearly, and indicate the following: time constant, transient and steady state segments, and fully charged/discharged point.

(c) ***[3 marks (bonus)]*** Determine the current $I_x(t)$ at $t = 0.1\,s$.