United International University **(UIU)**

Dept. of Computer Science & Engineering **(CSE)**

Final Exam, Trimester: Fall 2024

Course Code: CSE 113/EEE 2113**; Course Title:** Electrical Circuits; **Total Marks:** 40**; Duration:** 2 hour

Any examinee found adopting unfair means would be expelled from the trimester/ program as per UIU disciplinary rules.

Question 1: Answer all the questions. (10 Marks)

Rahim and Karim are two friends who are both fascinated by circuits. They have built a circuit as shown in **Figure 1.** During a discussion, Rahim claims that the present condition at terminal **a-b** will ensure maximum power transfer. However, Karim disagrees, stating that the resistance between terminals **a-b** should equal the Thevenin equivalent resistance of the circuit for maximum power transfer. Answer the following questions: [6+4] CO3

i) **Determine** the Thevenin equivalent circuit and current through the 8Ω resistor.

ii) **Explain** who is correct between Rahim and Karim. Also, **determine** the maximum power.

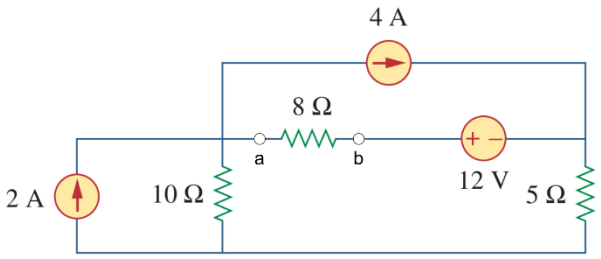

Figure 1

Question 2: Answer all the questions. (10 Marks)

Use the superposition theorem to find the voltage **V**x in the circuit shown in **Figure 2**. [10] CO3

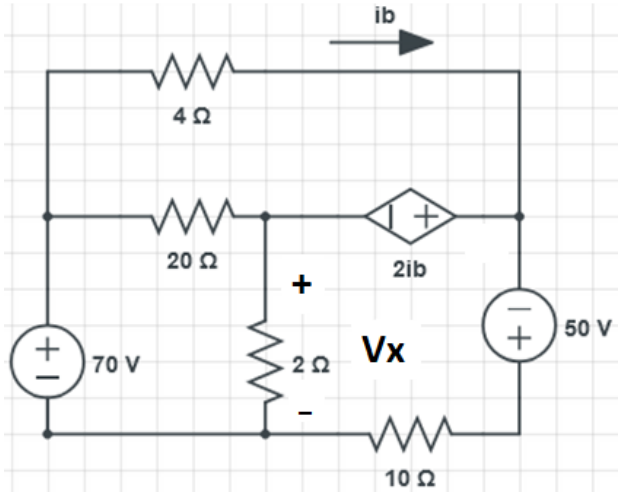

Figure 2

Question 3: Answer all the questions (12 Marks)

In **'Figure 3'**, the current of the current source is $\mathbf{i_S(t) = 10\cos(4t + 30°)\ A}$ and the other marked current is $\mathbf{i(t) = 4.53\cos(4t - 102.1°)\ A}$. In the circuit, **Z** is an unknown impedance. Observe the circuit shown in **Figure 3** and answer the following questions: [4+4+2+2] CO4

i) **Determine** the voltage across the capacitor 0.125F and then determine current

through it.

ii) **Determine** the current through the **'Z'** using KCL at node **'a'**.

iii) Keeping in mind that **'Z'** is parallel to 0.125F capacitor, **determine** the value of **'Z'** using ohm's law.

iv) **Find** the equivalent impedance, $\mathbf{Z_{eq}}$, with respect to the terminals **'a'** and **'b'**.

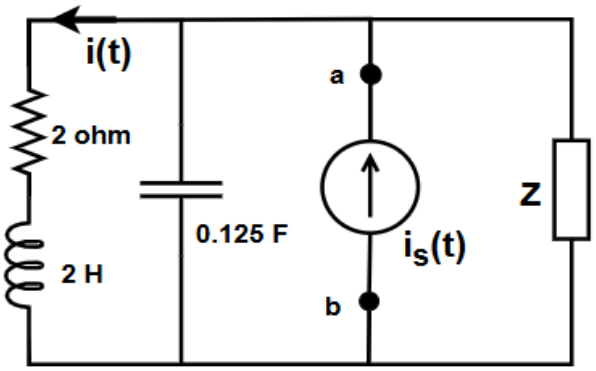

Figure 3

Question 4: Answer all the questions. (8 Marks)

i) **Find** the RMS value, I_{RMS} of the current waveform shown in **Figure 4(a)**. [4+4] CO4

ii) **Use** the RMS value from (i) as the maximum amplitude of the sinusoidal current source in the circuit shown in **Figure 4(b)**. **Determine** $\mathbf{i_o}$ and the **average real power** absorbed by the 3-ohm resistor using the Current Division Rule (CDR), assuming an angular frequency of 100 rad/s.

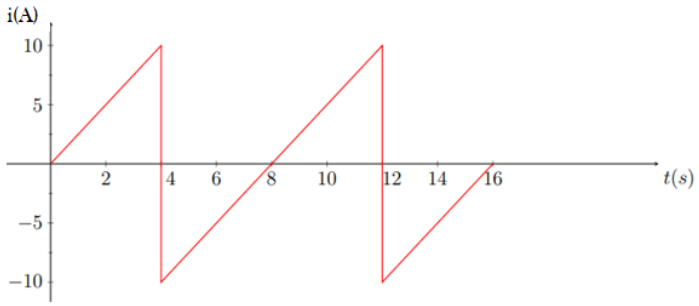

Figure 4(a)

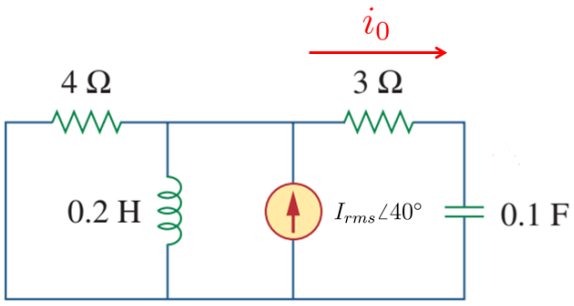

Figure 4(b)