Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ELECTRIC CIRCUIT I
COURSE CODE	:	BEJ 10303
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS 2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) It is assumed that a 12 V automotive battery is completely discharged and at some reference time $t = 0$, is connected to a battery charger for the next eight (8) hours. It is also assumed that the charging rate is given as follows.

$$i(t) = \begin{cases} 8e^{-t/3600}\ A & 0 \leq t \leq 8hours \\ 0 & otherwise \end{cases}$$

For these eight (8) hours time intervals, compute the total charge delivered to the battery and the total energy supplied.

(12 marks)

(b) Determine the power absorbed by the voltage-controlled voltage source (VCVS),Vd shown in **Figure Q1(b).**

(6 marks)

Q2 (a) Apply Kirchoff voltage law (KVL) to determine the voltage between two (2) points, $a - e$ (V_{a-e}) and $e - c$ (V_{e-c}), for the circuit in**Figure Q2(a).**

(10 marks)

(b) For the circuit in **Figure Q2(b)**, prove that the value of $i_s = 1.2\ mA$

(12 marks)

Q3 (a) With nodal analysis, formulate the matrix equation for the node voltages of v_1 and v_2 in **Figure Q3(a)**.

(12 marks)

(b) For the circuit in **Figure Q3(b)**, calculate the value of V_o using mesh analysis.

(16 marks)

Q4 (a) Find the current measured by the ammeter in **Figure Q4(a)** using the superposition theorem.

(11 marks)

(b) Find the value of R_{LOAD} for maximum power transfer in the circuit of **Figure Q4(b)** and the maximum power that can be transferred to this load.

(12 marks)

Q5 (a) Clarify instantaneous power, $p(t)$ absorbed by an element.

(3 marks)

(b) Based on the trigonometric identity,

$$\cos A \cos B = \frac{1}{2}[\cos(A+B) + \cos(A-B)],$$

find the instantaneous power and the average power absorbed if,

$$v(t) = 120\cos(377t + 45^o) \text{ and } i(t) = 10\cos(377t - 10^o)$$

(6 marks)

END OF QUESTIONS

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2022/2023
COURSE NAME : ELECTRIC CIRCUIT 1
PROGRAMME CODE : BEJ
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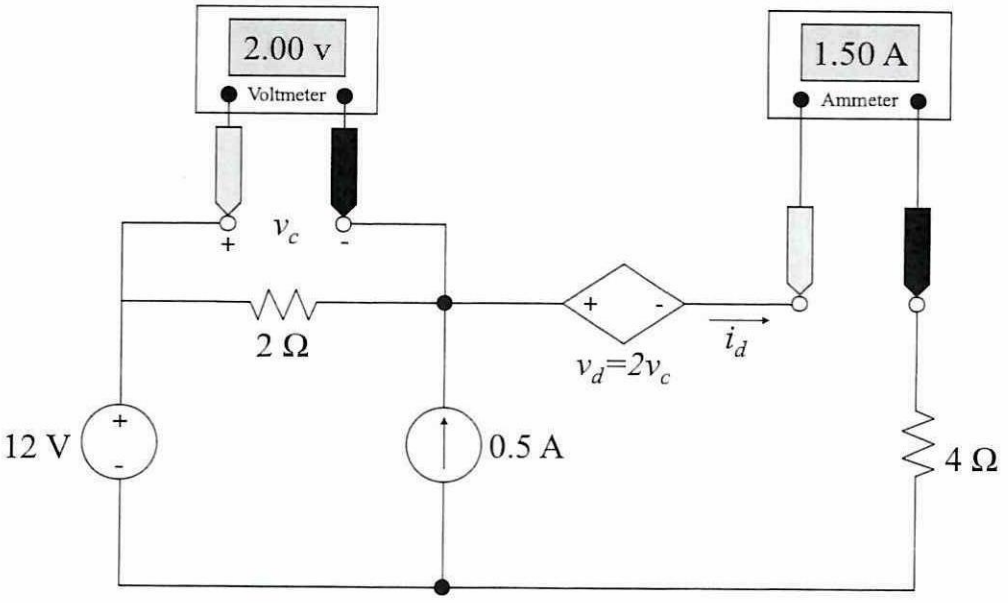

Figure Q1(b)

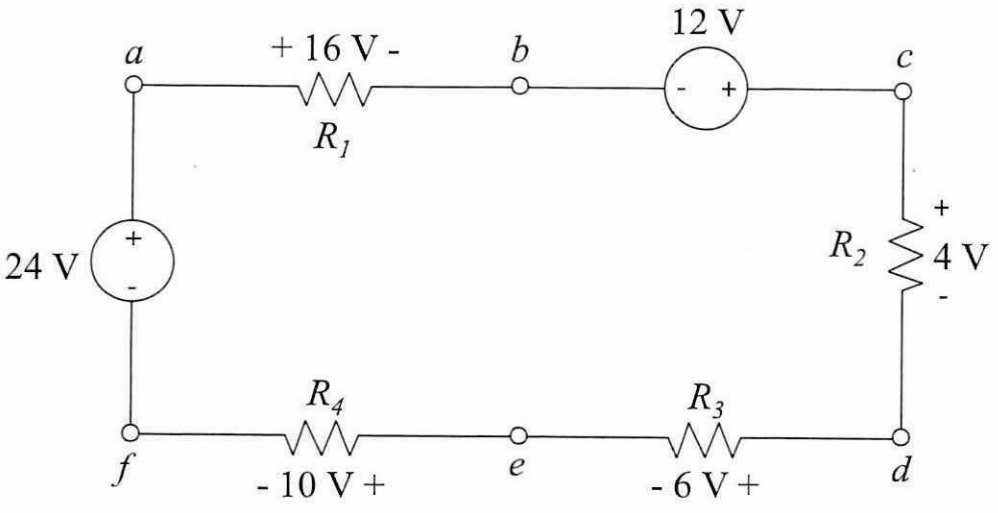

Figure Q2(a)

FINAL EXAMINATION

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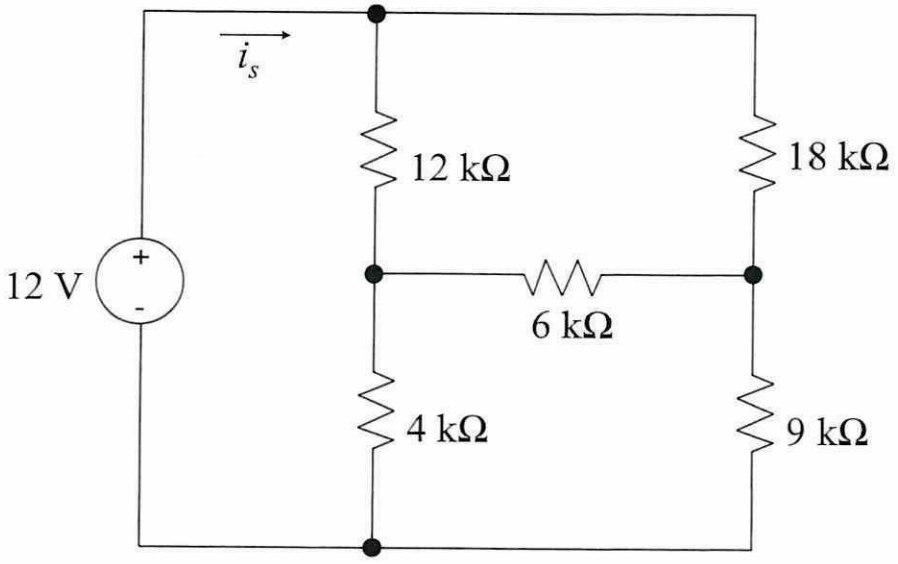

Figure Q2(b)

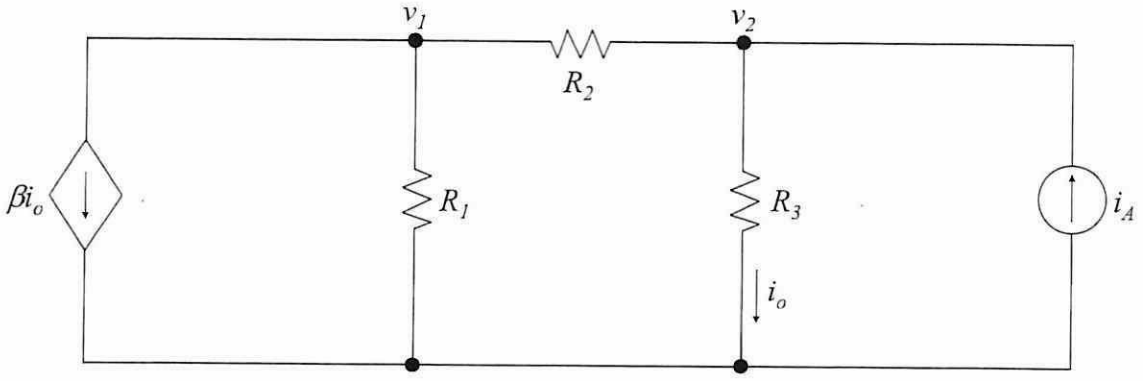

Figure Q3(a)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2022/2023
COURSE NAME : ELECTRIC CIRCUIT 1
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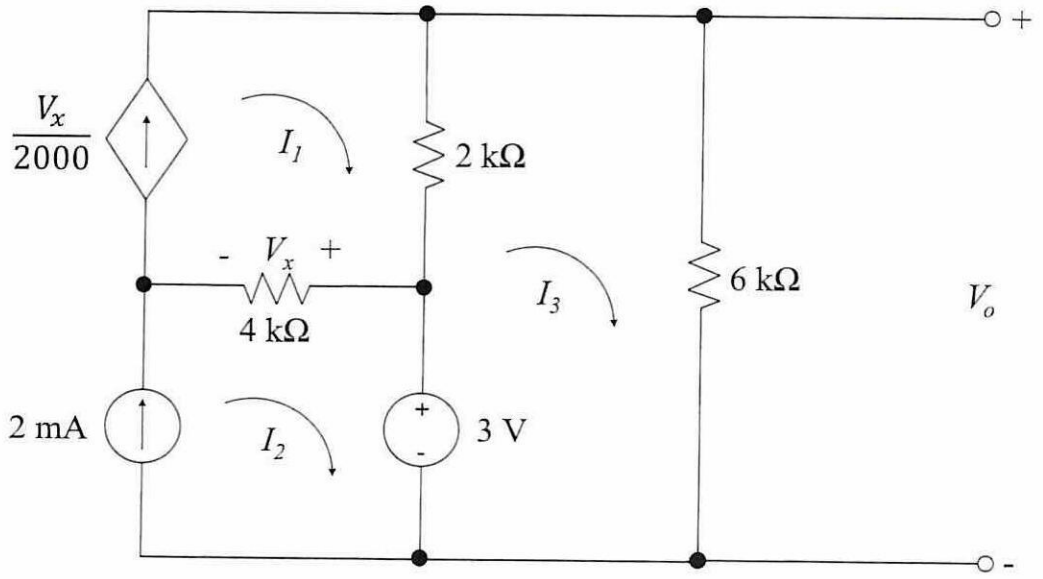

Figure Q3(b)

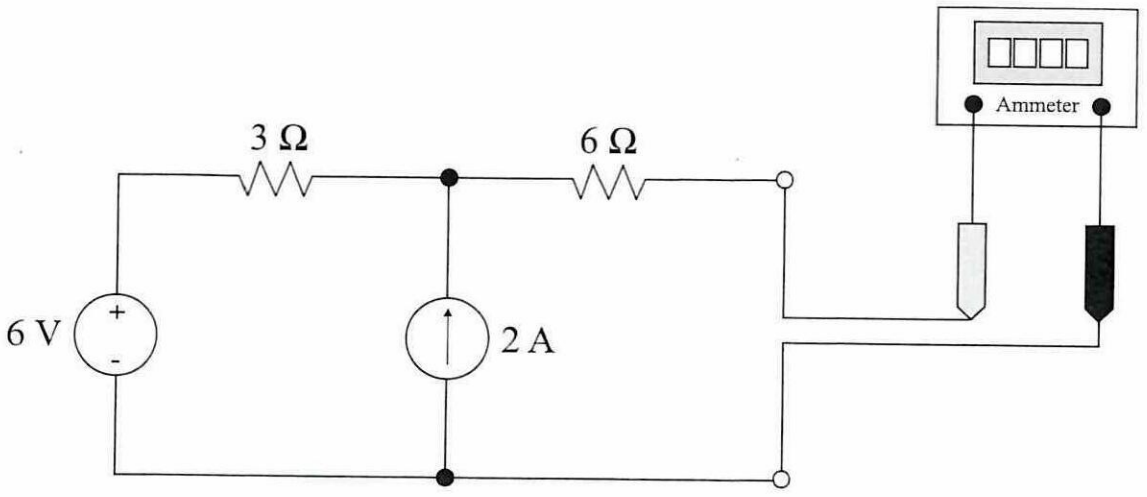

Figure Q4(a)

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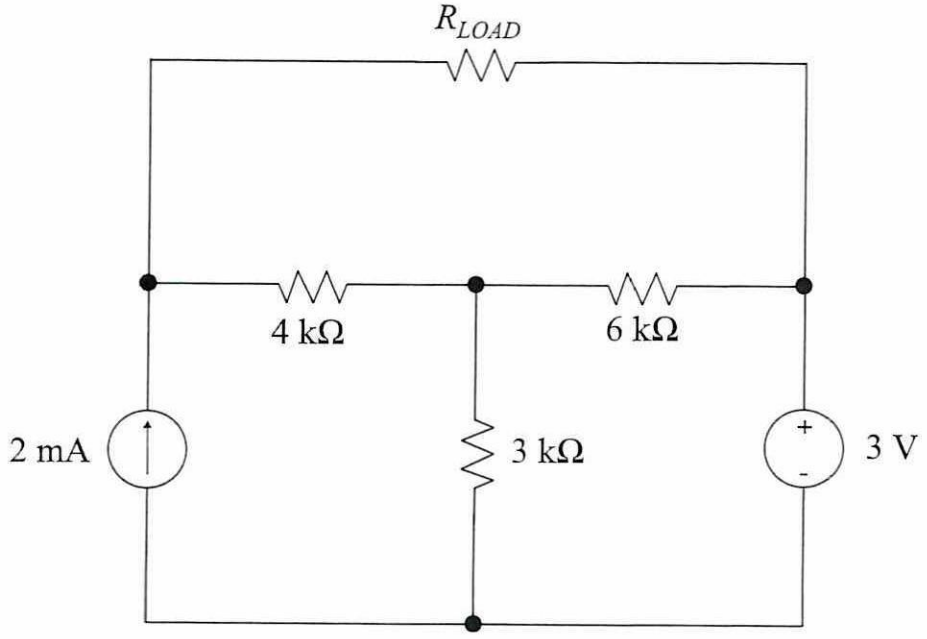

Figure Q4(b)