Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	CIRCUIT THEORY
COURSE CODE	:	DAE 11103
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	PART A ANSWER **ALL** QUESTIONS PART B ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

PART A

Q1 (a) Define briefly Kirchhoff's Voltage Law.

(2 marks)

(b) The current of a device is $i(t) = 5e^{-4t}$ A and the voltage is $v(t) = 10\ di/dt\ V$. Determine the energy absorbed in 3 s.

(6 marks)

(c) Compute the power absorbed or supplied by each component of the circuit in **Figure Q1(c)**.

(6 marks)

(d) Use Ohm's law and Kirchhoff's laws to find the value of R in the circuit shown in **Figure Q1(d)**.

(6 marks)

Q2 (a) Given the following circuit configuration of **Figure Q2(a)**. Calculate the voltage v_o using nodal analysis.

(10 marks)

(b) In the circuit of **Figure Q2 (b)**, find the voltage V_x using mesh analysis.

(10 marks)

Q3 (a) Use the superposition theorem to find i_2 in the circuit shown in **Figure Q3(a).**

(7 marks)

(b) Find the Thévenin equivalent circuit for the network external to the resistor R in **Figure Q3(b).**

(7 marks)

(c) Find the Norton equivalent circuit for the network external to the resistor R in **Figure Q3(c).**

(6 marks)

PART B

Q4 (a) Three capacitors, $C_1 = 5\mu F$, $C_2 = 10\mu F$ and $C_3 = 20\mu F$, are connected in parallel across a 150V d.c. source. Determine:

(i) the total capacitance.

(3 marks)

(ii) the charge on each capacitor.

(3 marks)

(iii) the total energy stored in the parallel combination of the capacitors.

(3 marks)

(b) Switch S_1 in **Figure Q4(b)** has been closed for a long time. At $t = 0$ s, S_1 is opened at the same instant that S_2 is closed to avoid an interruption in current through the coil.

(i) Find the initial current through the coil, $i_{L(0)}$.

(3 marks)

(ii) Find the mathematical expression for the current i_L following the closing of switch S_2.

(8 marks)

Q5 (a) In a linear circuit, the voltage source is $v_s = 12\ sin\ (10^3\ t + 24^o)$ V.

(i) What is the angular frequency of the voltage?

(1 mark)

(ii) What is the frequency of the source?

(2 marks)

(iii) Find the period of the voltage.

(2 marks)

(iv) Express v_s in cosine form.

(2 marks)

(v) Determine v_s at $t = 2.5$ ms.

(3 marks)

(b) For the circuit shown in **Figure Q5(b)** :

(i) Find the total impedance Z_T.

(3 marks)

(ii) Determine the current I_S.

(2 marks)

(iii) Calculate V_R and V_C.

(3 marks)

(iv) Find I_C.

(2 marks)

Q6 (a) The voltage across a load is $v(t) = 160 \cos 377t$ V and the current through the element in the direction of the voltage drop is $i(t) = 4 \cos (377t + 45^\circ)$ A.

Find :

(i) complex power.

(4 marks)

(ii) apparent power.

(2 marks)

(iii) real / average power.

(2 marks)

(iv) reactive power.

(2 marks)

(v) power factor and specify whether it is leading or lagging.

(2 marks)

(b) A 50 kW load operates from a 60 Hz, 10 kV_{rms} line with a power factor of 60% lagging. Compute the capacitance that must be placed in parallel with the load to achieve a 90% lagging power factor.

(8 marks)

- END OF QUESTION -

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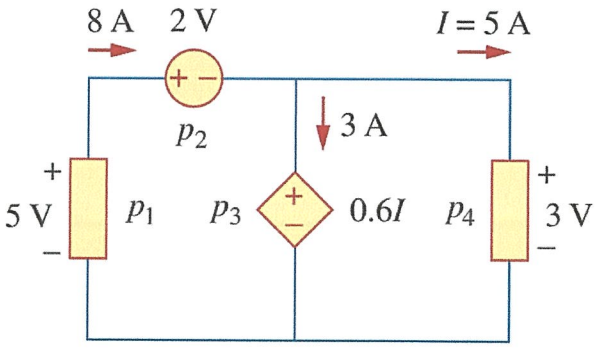

Figure Q1(c)

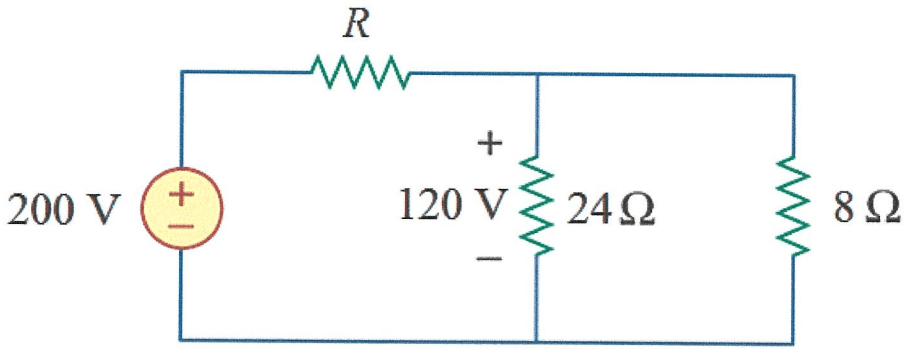

Figure Q1(d)

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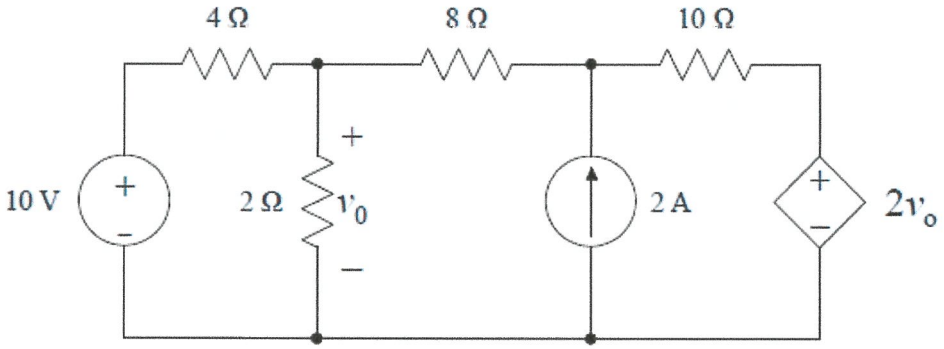

Figure Q2(a)

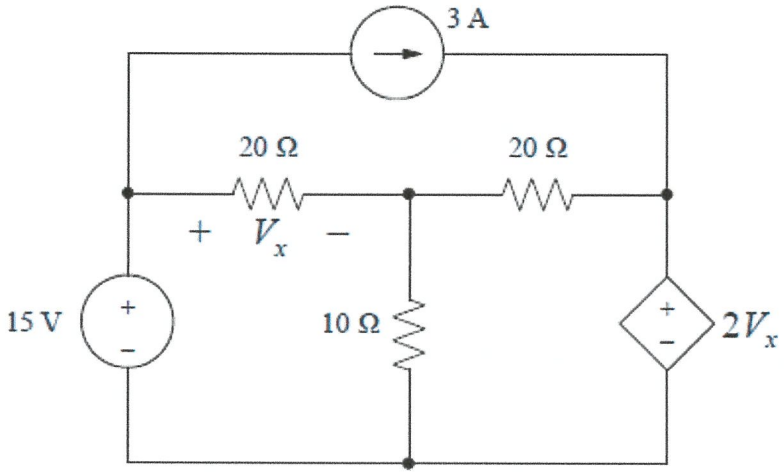

Figure Q2(b)

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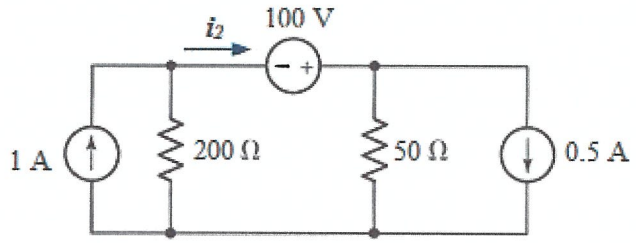

Figure Q3(a)

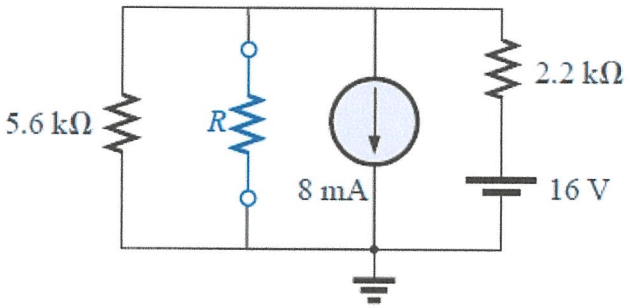

Figure Q3(b)

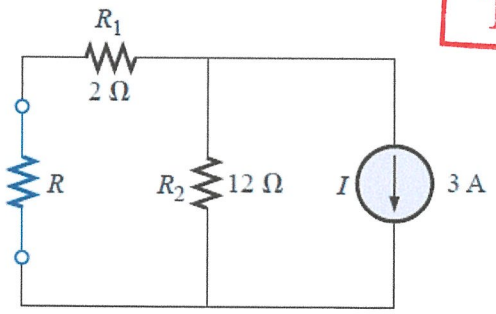

Figure Q3(c)

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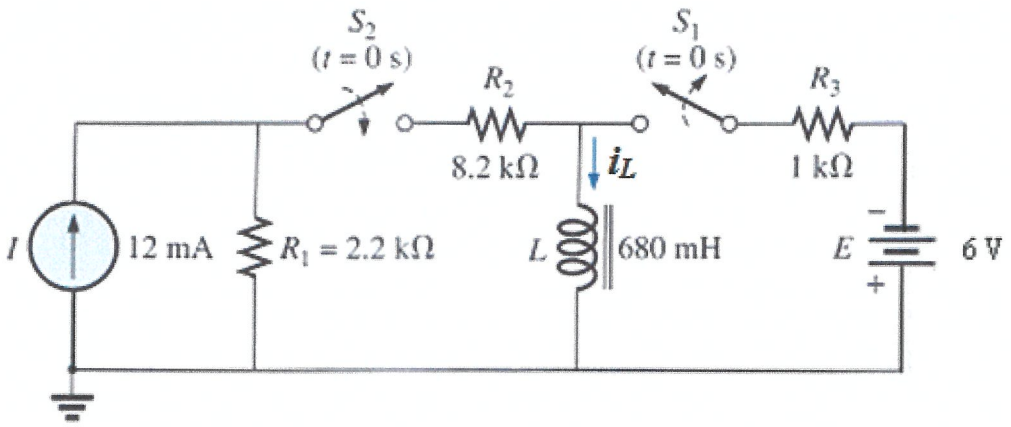

Figure Q4(b)

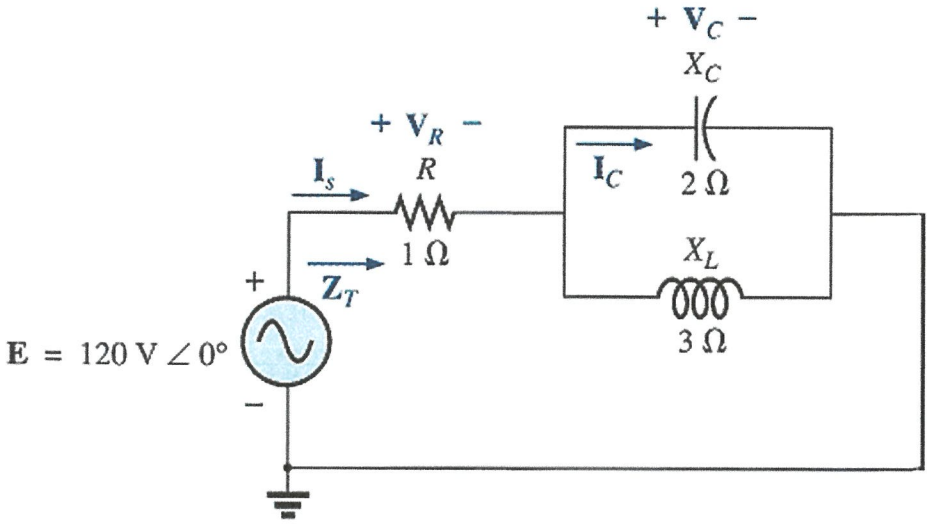

Figure Q5(b)