UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	ELECTRIC CIRCUIT II
COURSE CODE	:	BEJ 10403
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. SHOW ALL CALCULATIONS

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

Q1 (a) Explain the method to store energy in capacitor.

(2 marks)

(b) The voltage across a 5 μF capacitor is shown in **Figure Q1(b)**.

(i) Draw the current waveform through the capacitor.

(6 marks)

(ii) Calculate the energy is stored in the capacitor at $t = 4$ ms.

(2 marks)

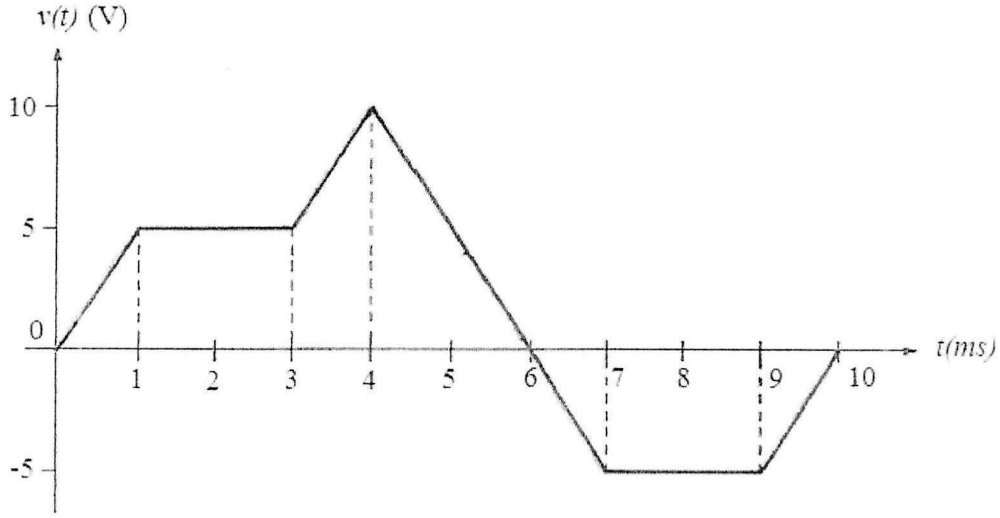

Figure Q1 (b)

(c) The circuit in **Figure Q1(c)** has reached steady state at $t = 0^-$ (switch at position a). At $t = 0$ s, the switch is moved to position b.

(i) Determine the current across inductor, $i(t)$ for $t > 0$ s.

(6 marks)

(ii) Sketch the complete current response, $i(t)$ from initial value to final value.

(4 marks)

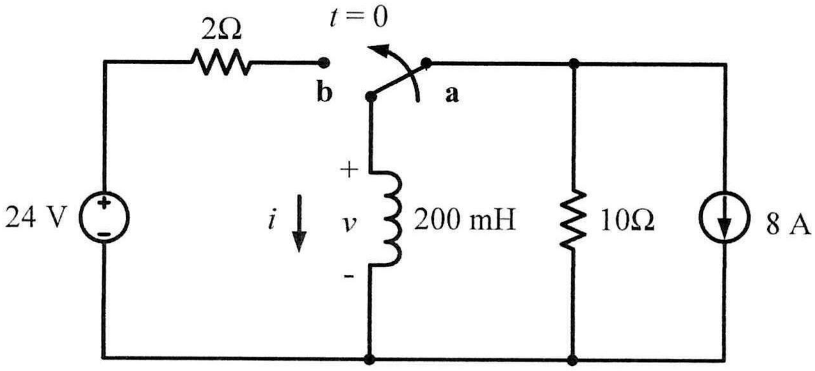

Figure Q1(c)

Q2 (a) The switch in **Figure Q2(a)** was opened for a long time but closed at $t = 0$ s. Determine the following:

(i) $i(0^+)$ and $v(0^+)$

(3 marks)

(ii) $\frac{di(0^+)}{dt}$ and $\frac{dv(0^+)}{dt}$

(4 marks)

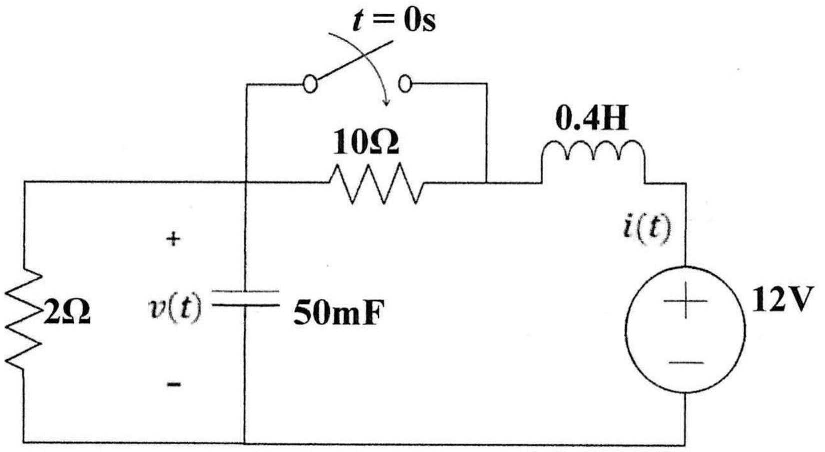

Figure Q2(a)

(b) The switch in **Figure Q2(b)** has been opened for a long time, and it is closed at $t = 0$ s.

(i) Determine the roots of the characteristic equation and the type of damping response.

(5 marks)

(ii) Find current response, $i(t)$ for $t > 0s$.

(8 marks)

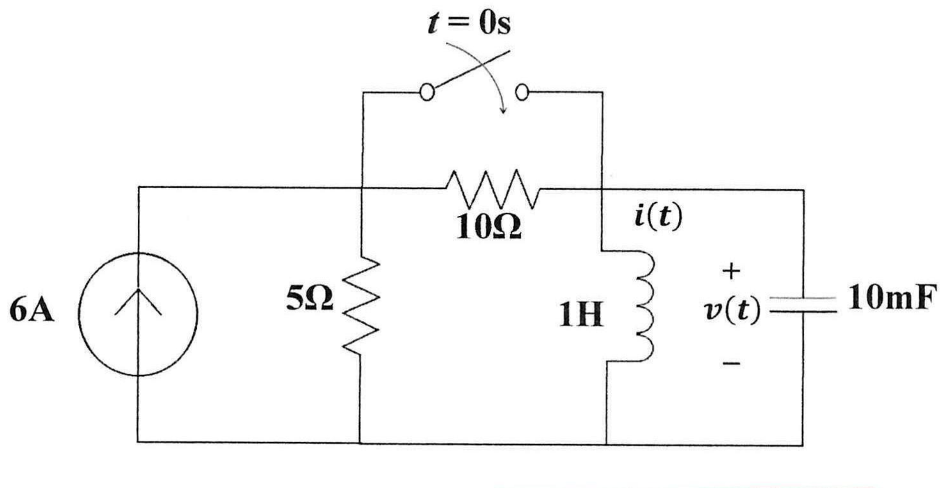

Figure Q2(b)

Q3 (a) Source transformation methods are used for circuit simplification to modify the complex circuits by transforming independent current sources into independent voltage sources and vice-versa.

(i) Illustrate the conversion of voltage source into current source using the source transformation method.

(3 marks)

(ii) In **Figure Q3(a)**, given that the voltage across the resistor 10 Ω, $V_o = 5.519\angle -28°$ V. Find the impedance, Z.

(8 marks)

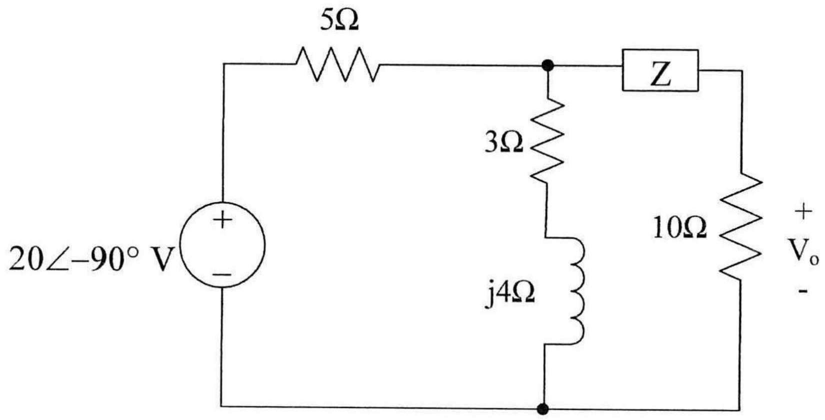

Figure Q3(a)

(b) For the circuit in **Figure Q3(b)**,

(i) draw the Thevenin equivalent circuit at terminal a-b.

(1 mark)

(ii) determine the Thevenin Voltage, V_{TH}.

(4 marks)

(iii) determine the Thevenin Impedance, Z_{TH}.

(4 marks)

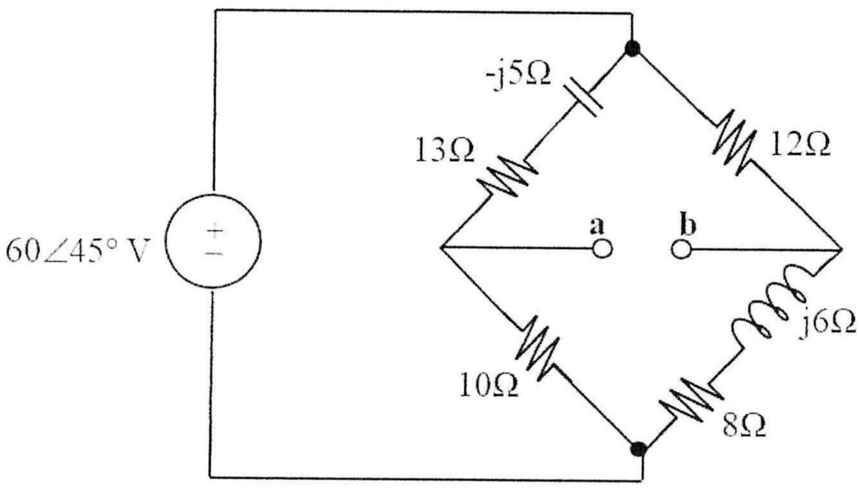

Figure Q3(b)

Q4 (a) Power is the most important quantity in electric utilities, electronic, and communication systems. Such systems involve transmission of power from one point to another. Given a circuit shown in **Figure Q4(a)**,

(i) describe the technique to achieve maximum power transfer.

(2 marks)

(ii) determine the impedance R_L for maximum average power transfer.

(4 marks)

(iii) find the value of the maximum average power absorbed by the load.

(4 marks)

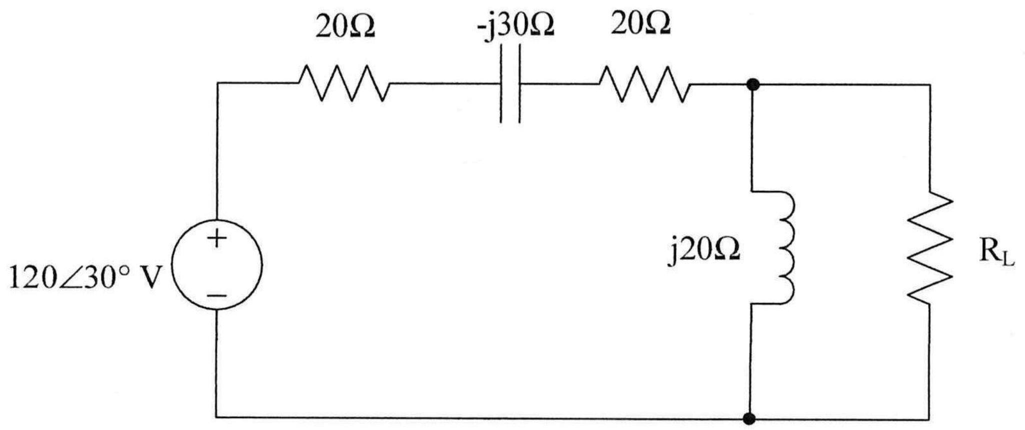

Figure Q4(a)

(b) A small industrial plant with a supply of 1000 V at 60 Hz has a 20 kVA inductive load due to a bank of induction motors. The induction motors have a lagging power factor, *pf* of 0.7.

(i) Determine the capacitive element, X_C required to raise the power factor, *pf* to 0.95.

(5 marks)

(ii) Based on part **Q4(b)(i)**, compare the levels of current drawn from the supply at $pf = 0.95$ and $pf = 0.7$.

(3 marks)

(iii) Sketch the power triangle.

(2 marks)

Q5 (a) Differentiate between one port network and two port network by defining and drawing those two networks respectively.

(4 marks)

(b) For **Figure Q5(b),** obtain the impedance parameter of the circuit.

(8 marks)

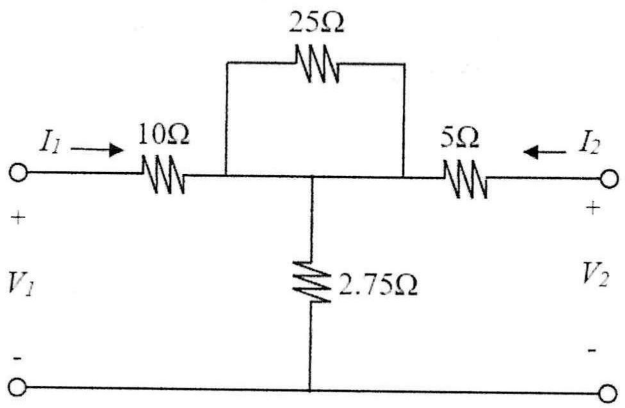

Figure Q5(b)

(c) By using **Figure Q5(c),** calculate the admittance parameter of the circuit.

(8 marks)

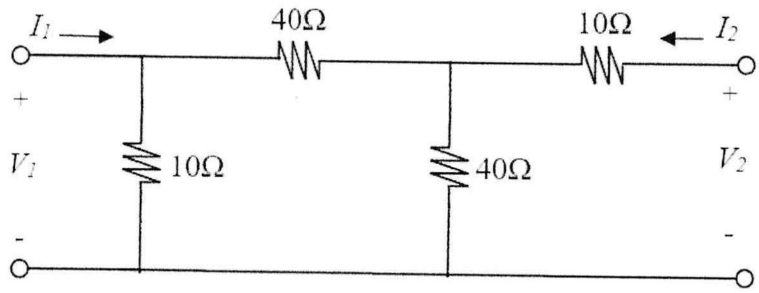

Figure Q5(c)

~END OF QUESTIONS~

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APPENDIX A

TRIGONOMETRIC EQUATIONS

$$\sin(x) = -\sin(x)$$

$$cos(-x) = \cos(x)$$

$$\tan(-x) = -\tan(x)$$

$$\sec x = \frac{1}{\cos x}, \qquad \csc x = \frac{1}{\sin x}$$

$$\tan x = \frac{\sin x}{\cos x}, \qquad \cot x = \frac{1}{\tan x}$$

$$\sin 2x + \cos 2x = 1$$

$$\sin(2x) = 2 \sin x \cos x$$

$$\cos(2x) = \cos 2x - \sin 2x$$

$$\cos(2x) = 2 \cos 2x \ - 1 = 1 - 2 \sin 2x$$

$$sin(x \pm 90°) = \pm \cos x$$

$$cos(x \pm 90°) = \mp \sin x$$

$$sin(x \pm 180°) = \mp sin$$

$$cos(x \pm 180°) = \mp \cos x$$

$$cos^2 x + sin^2 x = 1$$

$$\sin(x \pm y) = \sin x \ cos\ y \ \pm \cos x \ sin\ y$$

$$\cos(x \pm y) = \cos x \ cos\ y \ \mp \sin x \ sin\ y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

$$2 \sin x \sin y = \cos(x - y) - \cos(x + y)$$

$$2 \sin x \cos y = \sin(x + y) + \sin(x - y)$$

$$2 \cos\ x \cos y = \cos(x + y) + cos(x - y)$$

$$\cos\ x \cos y = \frac{1}{2}[\cos(x + y) + cos(x - y)]$$