UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	ELECTRIC CIRCUIT ANALYSIS II
COURSE CODE	:	BEF 12503
PROGRAMME	:	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) With the help of appropriate illustration, explain the working principle of capacitor.

(4 marks)

(b) Based on the circuit in **Figure Q1(b)**, where C_1 = 12 μF, C_2 = 6 μF, and C_3 = 30 μF, determine:

i) the total capacitance.

(2 marks)

ii) the charge on C_1.

(2 marks)

iii) the voltage across each capacitor.

(3 marks)

(c) The waveform of charging current $i(t)$ flowing through a 5 μF capacitor is shown in **Figure Q1(c)**. Sketch voltage waveform, $v(t)$ across the capacitor and assume capacitor C is no charge at time, t = 0.

(9 marks)

Q2 (a) A 100 V dc supply is connected to a no charged 5 μF capacitor in series with 500 Ω resistor is connected at time $t = 0$ as shown in **Figure Q2(a).**

i) Evaluate using first principle an expression for the subsequent current in the circuit as a function of time, t.

(15 marks)

ii) Determine the energy stored in the capacitor at the instant $t = 2\tau$ where τ is the time constant of the circuit.

(5 marks)

Q3 (a) Current and voltage in a circuit can be represented by a phasor diagram. With the help of phasor diagram for capacitor and inductor, state the behaviour of voltage and current under leading or lagging conditions.

(4 marks)

(b) Derive an expression for $i(t)$ for the circuit shown in **Figure Q3(b)**. Assume $v(t) = 8\cos(\omega t + 50^\circ)$ and f=50 Hz

(6 marks)

(c) A single-phase sinusoidal AC supply voltage is defined as v(t) = 240 cos(314t - 20°) and connected in series with a pure AC capacitance of 200μF.

(i) Sketch the single-phase circuit with proper value

(3 marks)

(ii) Determine the value of the current flowing through the capacitor

(4 marks)

(iii) Illustrate the phasor diagram based on the results obtained in **Q3(c)(ii)**

(3 marks)

Q4 (a) A series circuit consists of a resistance of 50 Ω, an inductance of 0.4 H, and a capacitance of 100 μF is connected to a 240 V, 50 Hz single-phase supply.

(i) Sketch the phasor domain circuit

(4 marks)

(ii) Analyze the the impedance, Z of the circuit

(3 marks)

(iii) Point out the Vs, V_R, V_L and V_C of the circuit.

(8 marks)

(iv) Construct the phase angle of the circuit

(3 marks)

(v) Conclude the relationship of phasor current with phasor voltage supply based on the results obtained in **Q4(iv)**.

(2 marks)

Q5 (a) The Wheatstone Bridge Circuit as shown in **Figure Q5(a)** is connected to a 30V voltage input. Change and calculate the delta connection shown in **Figure Q5(a)** into a star connection.

(6 marks)

(b) For the circuit shown in **Figure 5(a)**:

(i) Determine the total impedance, Z_T of the circuit.

(9 marks)

(ii) Analyze the total current I_T, I_1 and I_2 of the circuit.

(5 marks)

- END OF QUESTIONS –

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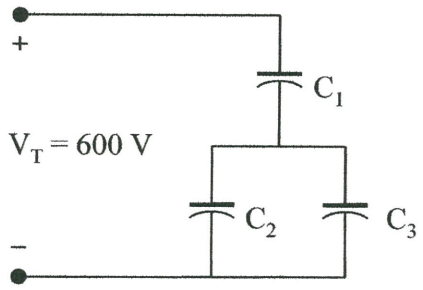

FIGURE Q1(b)

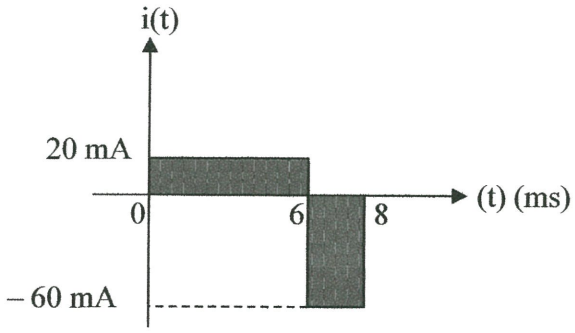

FIGURE Q1(c)

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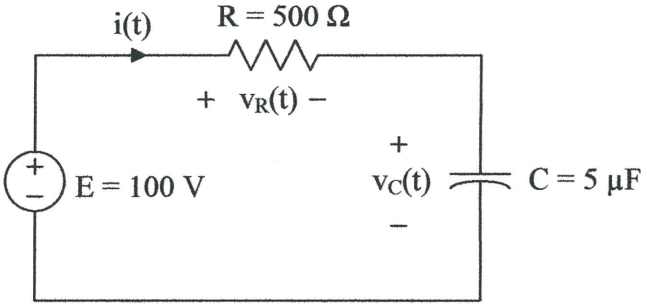

FIGURE Q2(a)

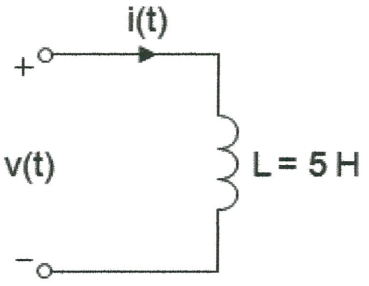

FIGURE Q3(a)

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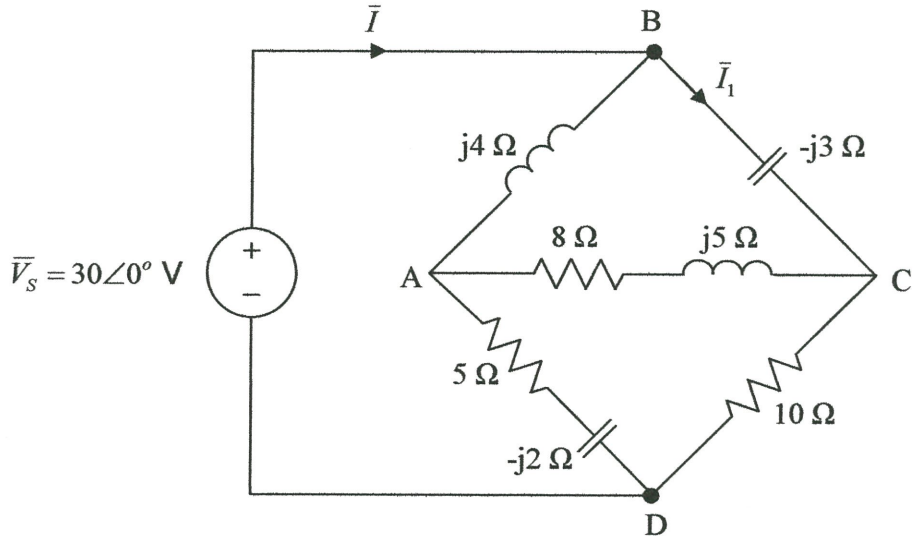

FIGURE Q5(a)

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Appendix A

The formulae to transform a delta-connected circuit into a star-connected circuit are as follows:

$$Z_1 = \frac{Z_A Z_B}{Z_A + Z_B + Z_C}$$

$$Z_2 = \frac{Z_B Z_C}{Z_A + Z_B + Z_C}$$

$$Z_3 = \frac{Z_A Z_C}{Z_A + Z_B + Z_C}$$

The formulae to transform a star-connected circuit into a delta-connected circuit are as follows:

$$Z_A = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1}{Z_3}$$

$$Z_B = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1}{Z_1}$$

$$Z_C = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1}{Z_2}$$