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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	ELECTRICAL AND ELECTRONIC TECHNOLOGY
COURSE CODE	:	BDA 14303
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JUNE/JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	PART A: ANSWER **ONE(1)** QUESTION **ONLY** PART B: ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **THIRTEEN (13)** PAGES

PART A:

Q1 (a) Explain the function of the following component:

(i) Digital multi-meter

(2 marks)

(ii) Variable resistors

(2 marks)

(b) In a closed loop series circuit, it consists of voltage sources 12V, three (3) resistors: R1 (1200mΩ), R2 (550Ω) and R3 (1.2kΩ). Determine the current (I), and the power in R1, R2 and R3.

(5 marks)

(c) Referring to **Figure Q1(c)**, calculate the total resistance (R_T) of the circuit.

(6 marks)

(d) Given **Figure Q1(d)**, using Wye-Delta Transformation to determine the total resistance, R_T and the current I, if the given voltage in this circuit is 15V.

(10 marks)

Q2 (a) Define the Norton Theorem.

(4 marks)

(b) Referring to **Figure Q2(b)**, solve the Norton equivalent circuit for the circuit at terminal a-b.

(6 marks)

(c) Evaluate the v_o in the circuit of **Figure Q2(c)** using source transformation.

(5 marks)

(d) Use the nodal analysis to find the voltage at node 1, 2 and 3 in the circuit of **Figure Q2(d)**.

(10 marks)

PART B:

Q3 (a) Both the capacitor and inductor are passive elements. Explain the difference between a capacitor and an inductor.

(4 marks)

(b) Calculate the equivalent capacitance and inductance by simplifying the circuit in **Figure Q3(b)** to a single capacitor and a single inductor.

(5 marks)

(c) Determine V_c, i_L and the energy stored in the capacitor and inductor in the circuit shown in **Figure Q3(c)** under DC condition.

(8 marks)

(d) The switch in the circuit in **Figure Q3(d)** has been closed for a long time. It is opened at $t = 0$. Calculate the capacitor voltage $v(t)$ for $t > 0$.

(8 marks)

Q4 (a) Illustrate the following AC fundamental terms below using a voltage waveform as function of time.

(i) Peak to peak value

(2 marks)

(ii) Peak amplitude

(2 marks)

(b) Calculate the RMS value and the average value of the voltage wave shown in **Figure Q4(b).**

(5 marks)

(c) As shown in **Figure Q4(c)**, a 150 Ω resistor (R), a 0.5 H inductor (L) and a 100 μF capacitor (C) are connected in series to a 50 Hz source (V). The RMS current, I_{RMS} in the circuit is 10 A.

(i) Determine the RMS voltage across the resistor, inductor and capacitor

(6 marks)

(ii) Determine the RMS voltage across the RLC combination

(4 marks)

(iii) Sketch the phasor diagram for this circuit

(6 marks)

Q5 (a) Sketch a basic transformer structure. Identify and label the core, primary winding and secondary winding.

(4 marks)

(b) An ideal transformer is rated at 2400/120V, 9.6kVa, and has 100 turns on the secondary side. Calculate:

(i) The turn ratio

(2 marks)

(ii) The number of turns on the primary side

(2 marks)

(iii) The current rating for the primary and secondary winding

(2 marks)

(c) In digital system, different gates are connected to perform different functions. Such circuits are called combinational logic circuit. **Figure Q5(c)** shows a combinational logic circuit.

(i) Obtain the complete Boolean expression for X

(6 marks)

(ii) Using Boolean expression in **Q5(c)(i)**, derive a truth table for the function X.

(6 marks)

(iii) Identify and draw the logic circuit for the simplified Boolean expression by using only a single logic gate that can be applied to replace the whole circuit.

(3 marks)

-END OF QUESTIONS –

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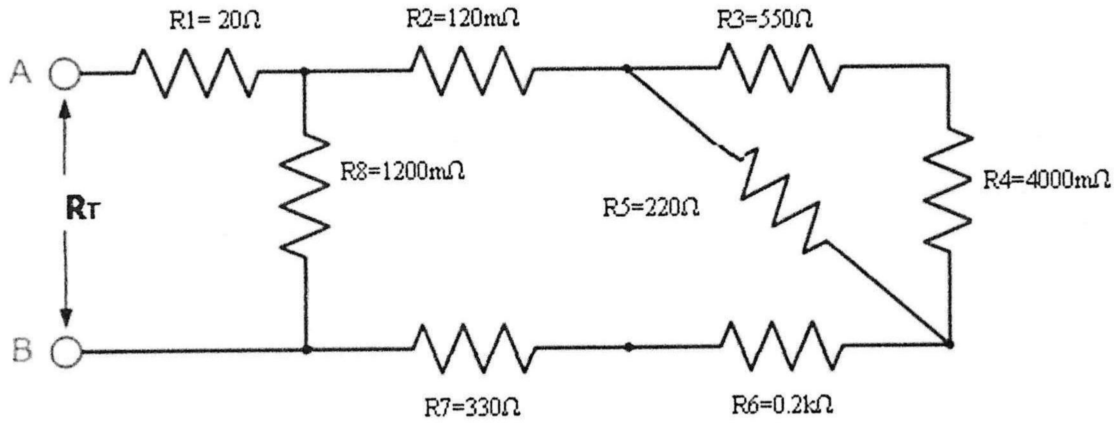

Figure Q1(c)

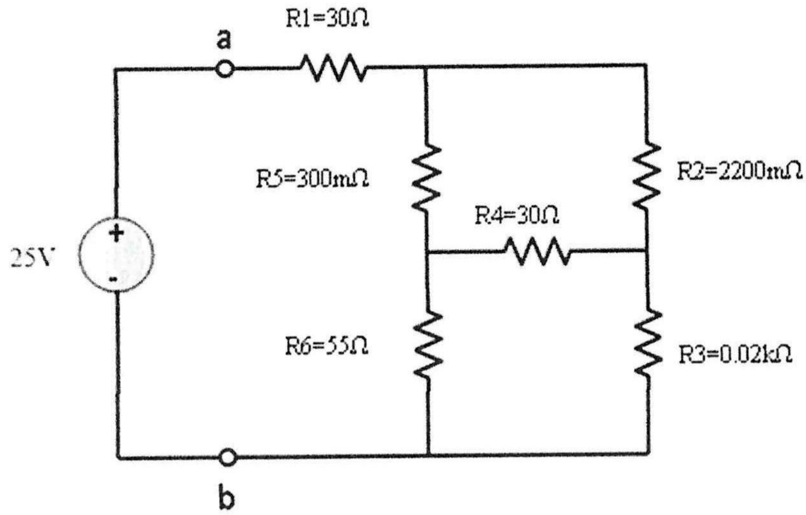

Figure Q1(d)

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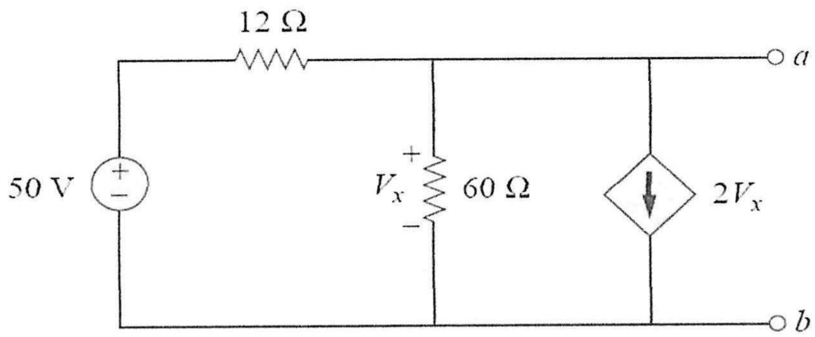

Figure Q2(b)

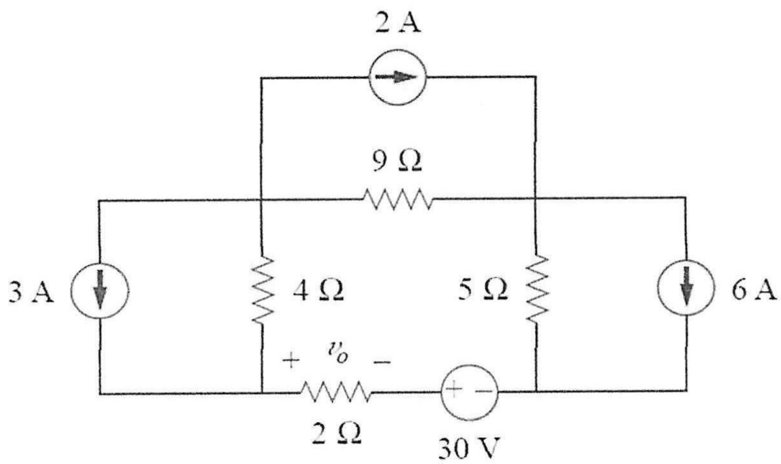

Figure Q2(c)

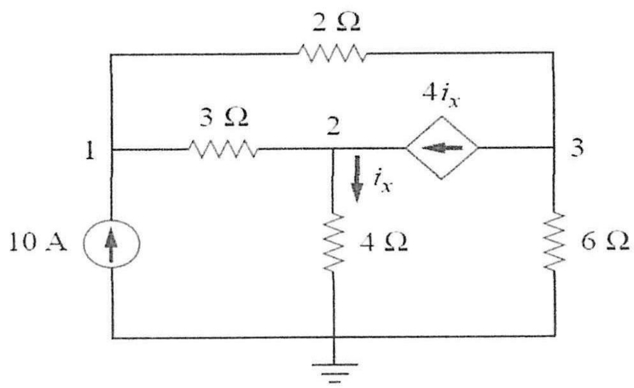

Figure Q2(d)

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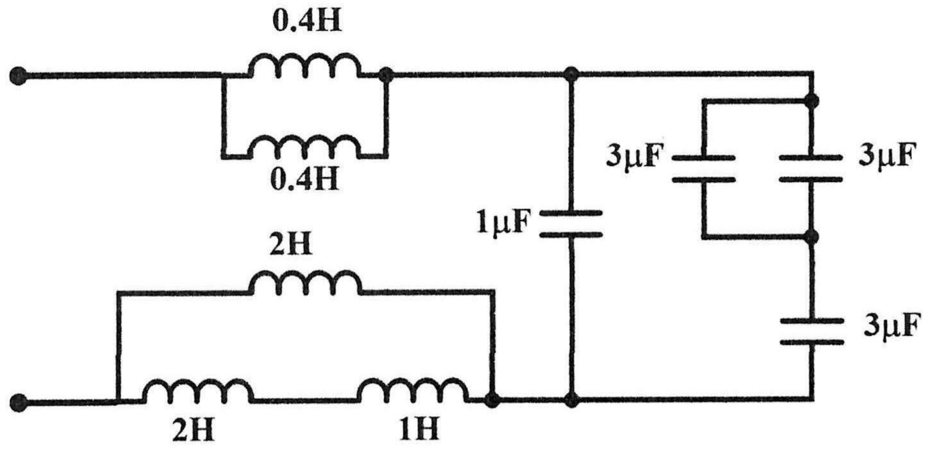

Figure Q3(b)

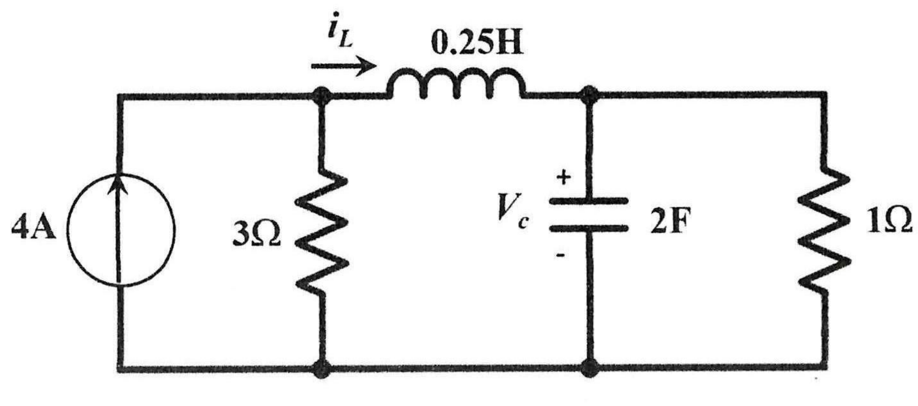

Figure Q3(c)

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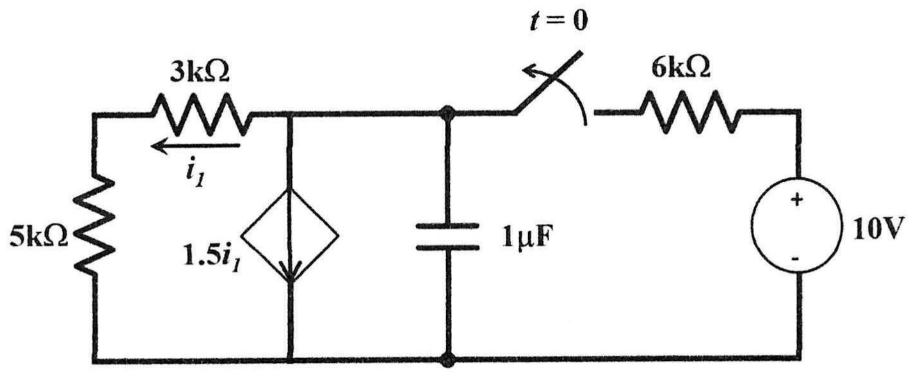

Figure Q3(d)

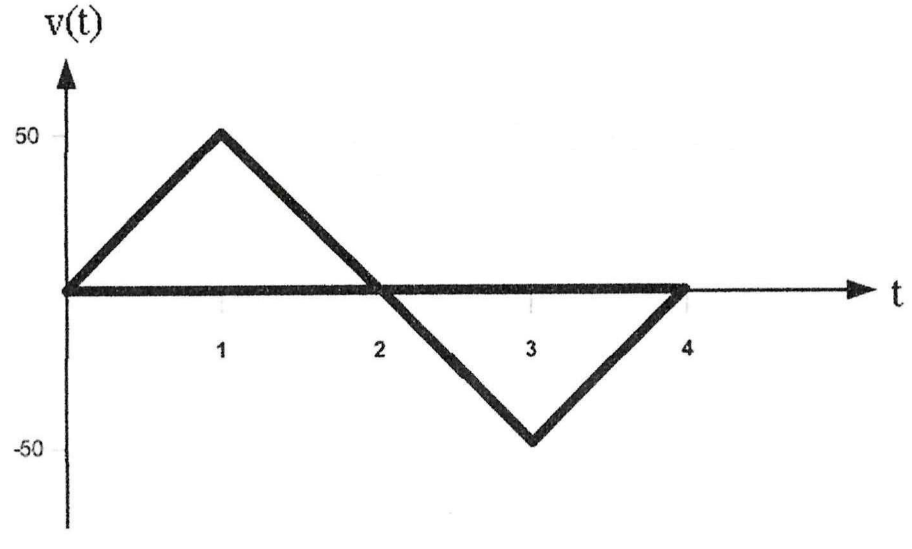

Figure Q4(b)

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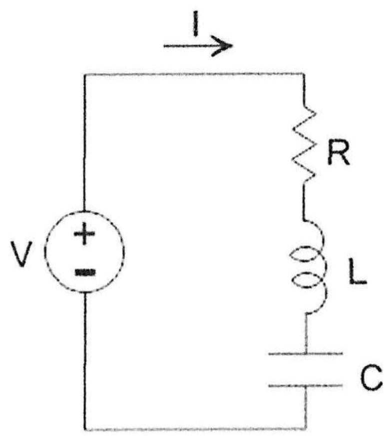

Figure Q4(c)

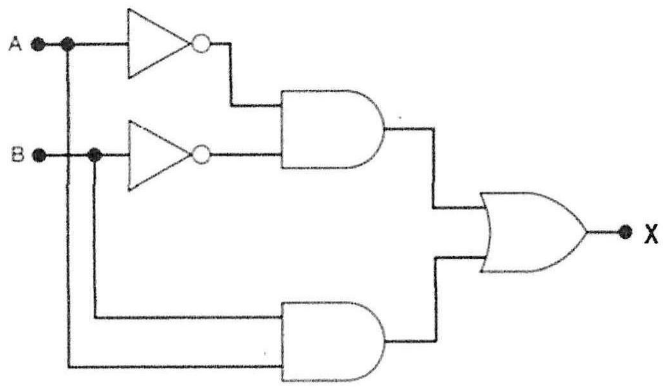

Figure Q5(c)

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LIST OF FORMULA

OHMS LAW

$$V = IR$$

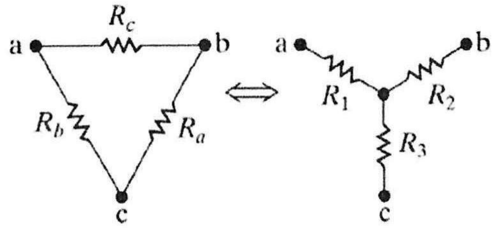
JOULE'S LAW

$$P = IV$$

KIRCHHOFF LAW

$$\sum_{k=1}^{n} i_k = 0 \qquad \sum_{v=1}^{n} v_k = 0$$

WYE-DELTA TRANSFORMATION

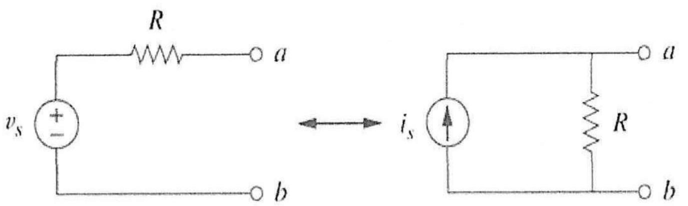


$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1} \qquad R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2} \qquad R_2 = \frac{R_cR_a}{R_a + R_b + R_c}$$

$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3} \qquad R_1 = \frac{R_aR_b}{R_a + R_b + R_c}$$

SOURCE TRANSFORMATION



$$V_S = I_s R$$

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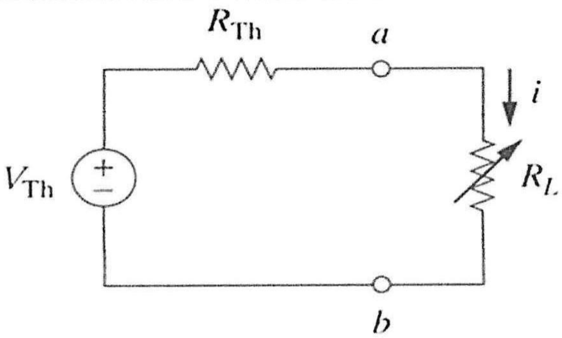
THEVENIN AND NORTON EQUIVALENT CIRCUIT

$$R_{TH} = R_N \qquad I_N = \frac{V_{TH}}{R_{TH}}$$

$$P = i^2 R_L = \left(\frac{V_{TH}}{R_{TH} + R_L}\right)^2 R_L$$ When $R_L \neq R_{TH}$

$$P_{\max} = \frac{V_{TH}^{\;2}}{4R_{TH}}$$ When $R_L = R_{TH}$

MAXIMUM POWER TRANSFER



$$P = i^2 R_L = \left(\frac{V_{TH}}{R_{TH} + R_L}\right)^2 R_L$$

CAPACITOR AND INDUCTOR

$$C = \frac{\varepsilon A}{d} \qquad v(t) = \frac{1}{C}\int_{-\infty}^{t} i(t)dt + v(t_0)$$

$$i = C\frac{dv}{dt} \qquad w = \frac{1}{2}Cv^2$$

$$L = \frac{N^2 \mu A}{l} \qquad v = L\frac{di}{dt}$$

$$i = \frac{1}{L}\int_{t_0}^{t} v(t)dt + i(t_0) \qquad w = \frac{1}{2}Li^2$$

$$\tau = RC \qquad \tau = \frac{L}{R}$$

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PHASOR REALTIONSHIP

$$v(t+T) = v(t)$$

$$f = \frac{1}{T}$$

$$z = x + jy = r\angle\phi = r(\cos\phi + j\sin\phi)$$

ALTERNATING CURRENT POWER CALCULATION

$$P(t) = v(t)i(t)$$ Instantaneous power

$$P = \frac{1}{2}\text{Re}[VI^*] = \frac{1}{2}V_m I_m \cos(\theta_v - \theta_i)$$ Average power

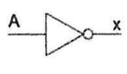
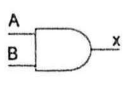
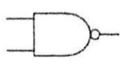
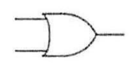
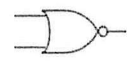
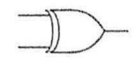
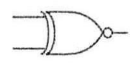
$$i_{RMS} = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$

$$P_{RMS} = I_{RMS}{}^2 R = \frac{V_{RMS}{}^2}{R}$$

TRANSFORMERS

$$\frac{V_P}{V_S} = \frac{N_P}{N_S}$$

LOGIC GATES

Name	NOT	AND	NAND	OR	NOR	XOR	XNOR
Alg. Expr.	$\overline{A}$	AB	$\overline{AB}$	$A+B$	$\overline{A+B}$	$A\oplus B$	$\overline{A\oplus B}$
Symbol							
Truth Table	A X 0 1 1 0	B A X 0 0 0 0 1 0 1 0 0 1 1 1	B A X 0 0 1 0 1 1 1 0 1 1 1 0	B A X 0 0 0 0 1 1 1 0 1 1 1 1	B A X 0 0 1 0 1 0 1 0 0 1 1 0	B A X 0 0 0 0 1 1 1 0 1 1 1 0	B A X 0 0 1 0 1 0 1 0 0 1 1 1