UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	ELECTRIC AND ELECTRONIC TECHNOLOGY
COURSE CODE	:	BDA 14303
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
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) Identify the v, i_x and power dissipated in resistor of 12Ω in the circuit of **Figure Q1(a).**

(5 marks)

(b) Calculate the current I_x and I_y as show in **Figure Q1(b)** using mesh analysis

(10 marks)

(c) Solve the value of v in the circuit using superposition theorem.

(10 marks)

Q2 (a) Identify the v_1 through v_3 in the circuit of **Figure Q2(a).**

(6 marks)

(a) Calculate the voltage, V_1 and V_2 in the circuit shown in **Figure Q2(b).**

(10 marks)

(b) Solve the circuit as shown in **Figure Q2 (c)** to obtain the Norton equivalent at the terminals a-b.

(9 marks)

PART B:

Q3 (a) Solve the equivalent inductance of the circuit in **Figure Q3(a)**. Assume all inductors are 10 mH.

(4 marks)

(b) Examine the value of R in **Figure Q3(b)** that will make the energy stored in the capacitor the same as that stored in the inductor under dc condition.

(6 marks)

(c) **Figure Q3(c)** shows a source-free RL circuit. Solve the i_o for $t > 0$.

(5 marks)

(d) Solve the values of the i_o, v_o and i for all time as shown in **Figure Q3(d)**, assuming that the switch was opened for a long time. Then sketch $i(t)$ for all time.

(10 marks)

Q4 (a) Explain what is meant by the RMS value of an alternating current and explain why the RMS value is usually more important than either the maximum or the mean value of the current.

(5 marks)

(b) Referring to **Figure Q4 (b)**, the RMS value for the saw-tooth voltage of peak value V_0 from t=0 to t=2T is xV_0. Solve the value of x.

(5 marks)

(c) Given a XX Ω resistor (R), a Y H inductor (L) and a 10 μF capacitor (C) are connected in series to a 5 Hz source (V). The RMS current, I_{RMS} in the circuit is 2A.
(Use XX = your 1st two digit of student number, Y = your last digit of student number (use 1 if your number is 0)
(For example if your student ID : EZ190040; XX is **19** and Y is **1**)

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

(4 marks)

(ii) Sketch the phasor diagram for this circuit

(4 marks)

(d) Calculate the RMS value of the current wave shown in **Figure Q4(d).** If the current is passed through a 10 Ω resistor, find the average power absorbed by the resistor.
(Use A – your last number of your identification number/ passport number (use 5 if your number is 0)
(For example if your number is 991030-03-5344 : A is 4)

(7marks)

Q5 (a) Explain the working principles of DC motor with simple sketches.

(5 marks)

(b) **Figure Q5(b)** shows the schematic of electronics components on the breadboard. The 9V battery is connected to the horizontal lines, the transistor and resistors are connected in the vertical lines).

(i) State the function of all components (3 marks)

(ii) Illustrate the schematic diagram of the circuit (5 marks)

(c) Identify and draw the simplified logic circuit for **Figure Q5(c)** by using only a single (1) logic gate that can be applied to replace the whole circuit.

(5 marks)

(d) In digital system, different gates are connected to perform different functions. Such circuits are called combinational logic circuit. Analyze the logic circuit in **Figure Q5(d)** and obtain:

(i) The Boolean expression for Z. (2 marks)

(ii) The truth table for the logic circuit (5 marks)

-END OF QUESTIONS –

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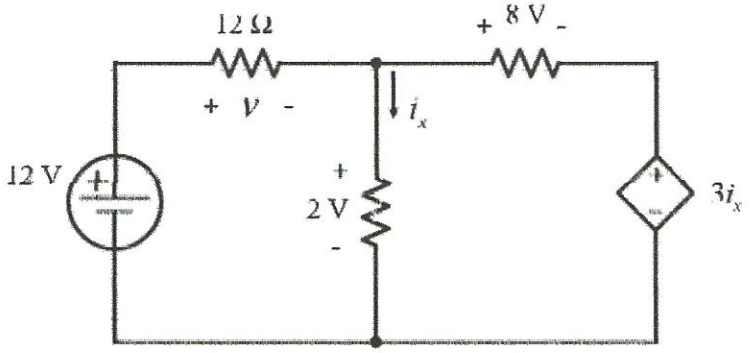

Figure 1(a)

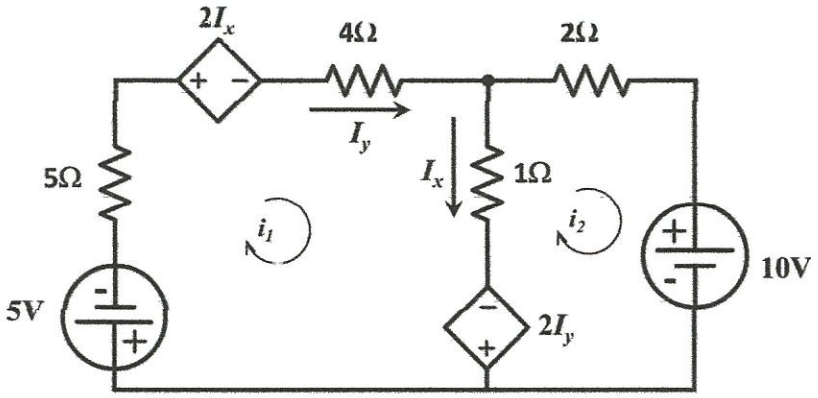

Figure 1(b)

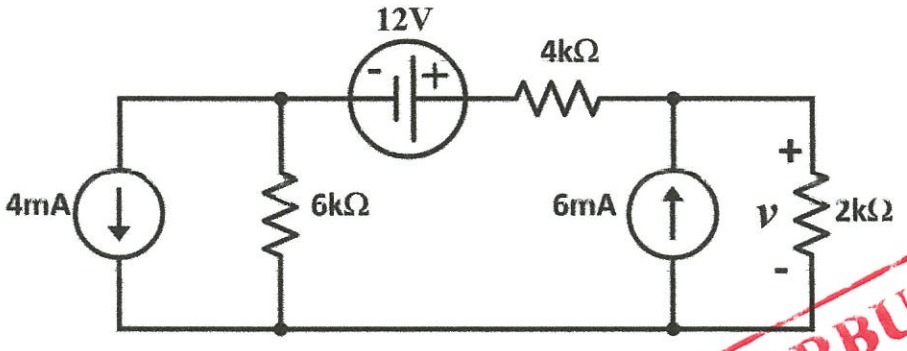

Figure 1(c)

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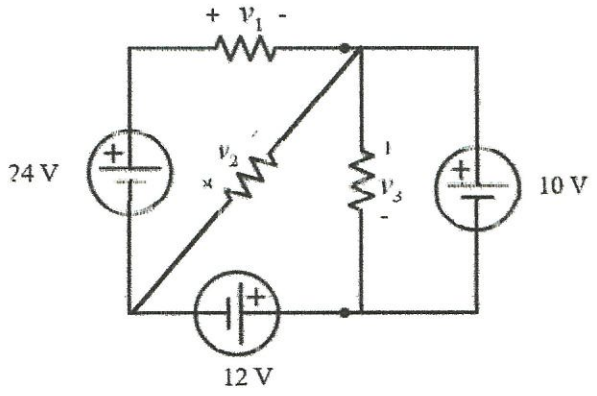

Figure 2(a)

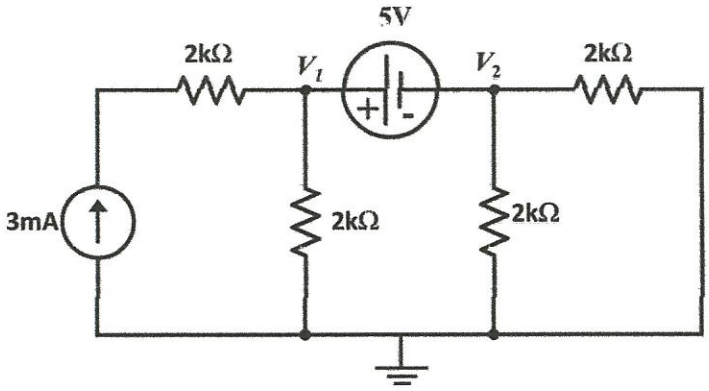

Figure 2(b)

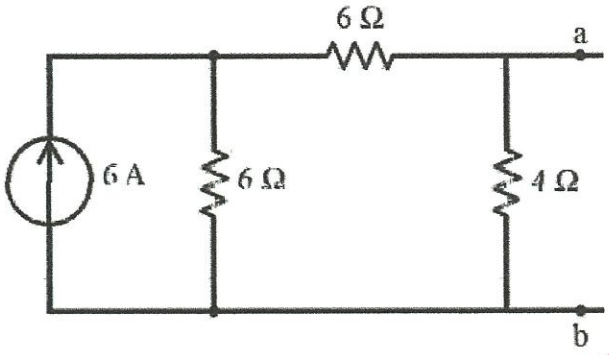

Figure 2(c)

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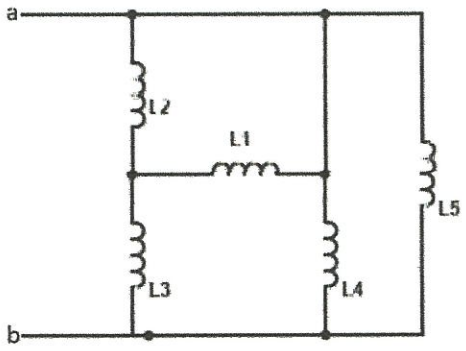

Figure Q3(a)

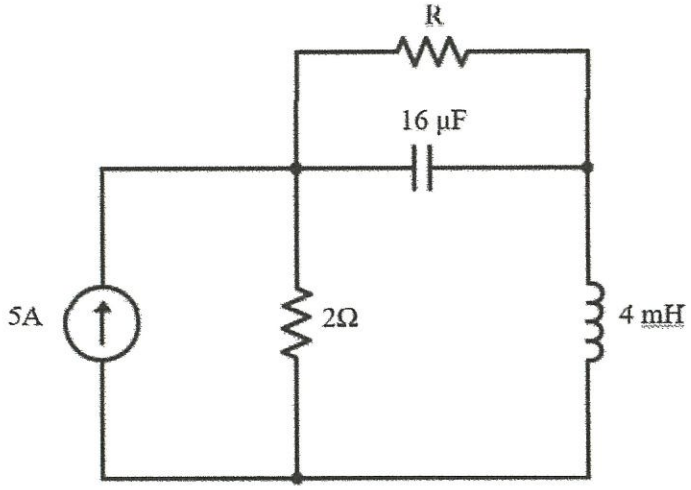

Figure Q3(b)

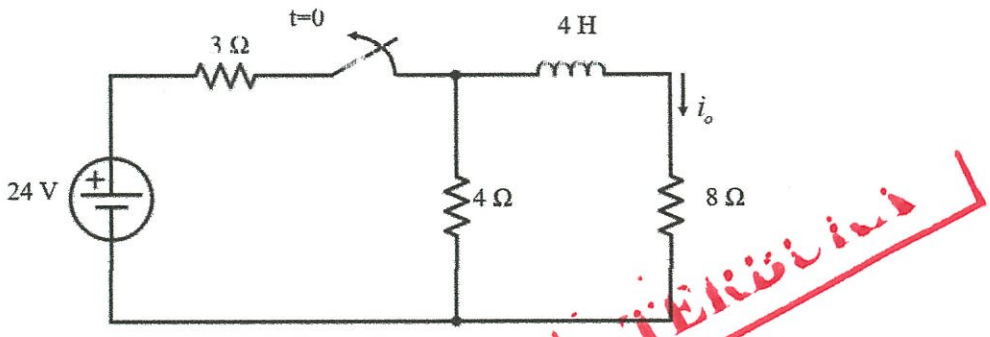

Figure Q3(c)

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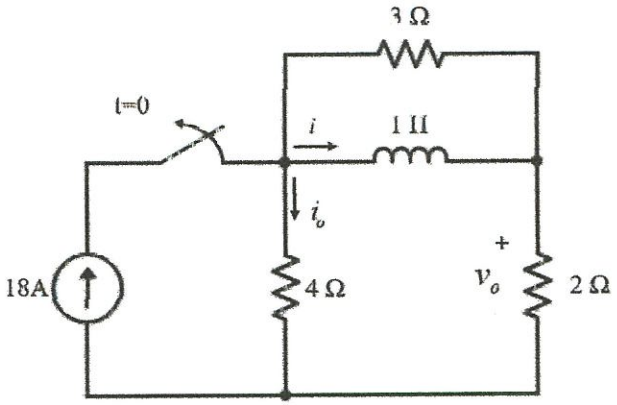

Figure Q3(d)

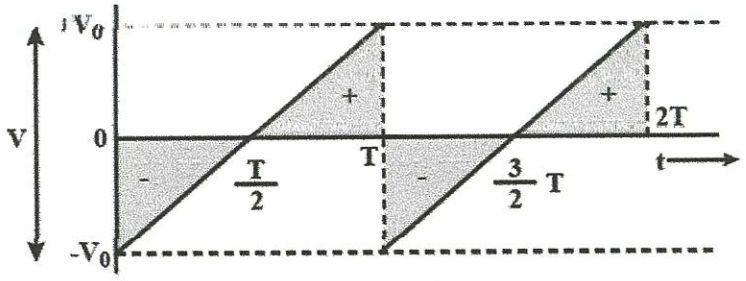

Figure Q4(b)

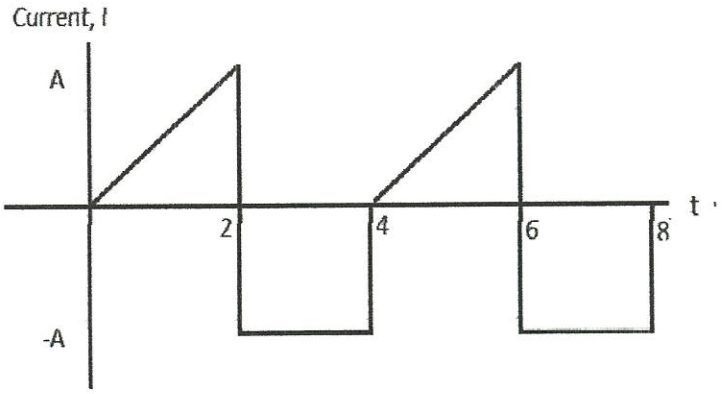

Figure Q4(d)

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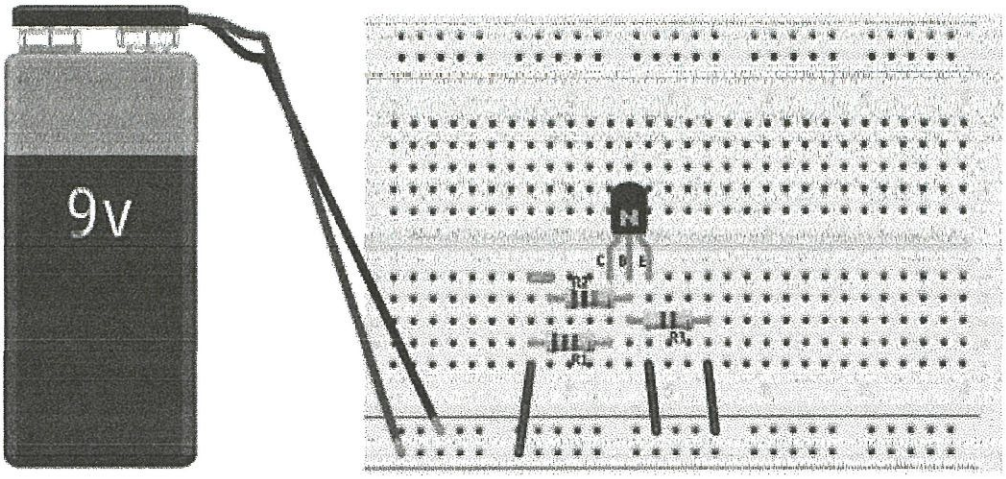

Figure Q5(b)

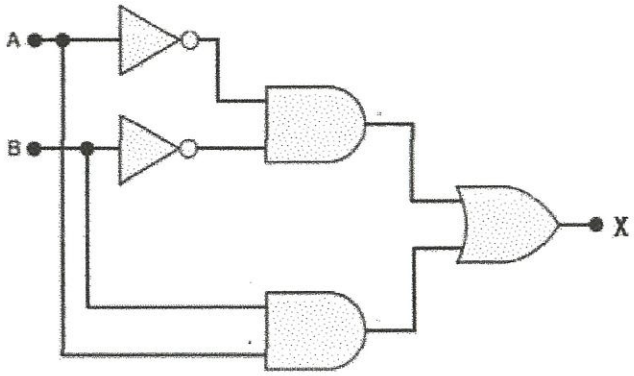

Figure Q5(c)

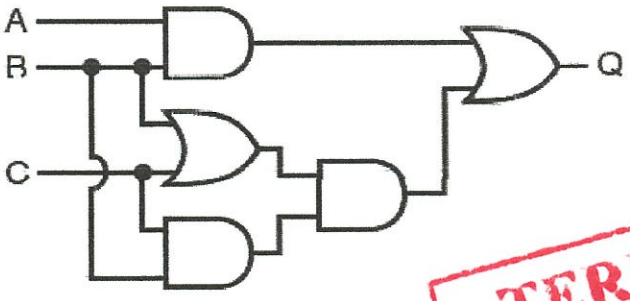

Figure Q5(d)

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LIST OF FORMULA

OHMS LAW

$$V = IR$$

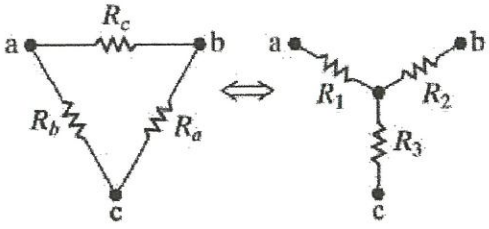
JOULE'S LAW

$$P = IV$$

KIRCHHOFF LAW

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

WYE-DELTA TRANSFORMATION

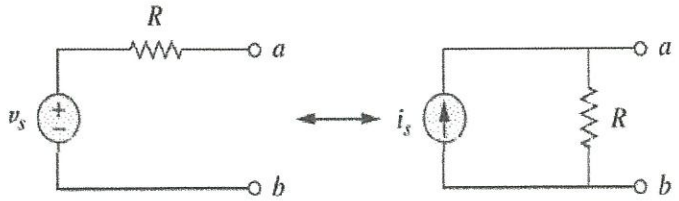


$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1} \qquad R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

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

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

SOURCE TRANSFORMATION



$$V_S = I_sR$$

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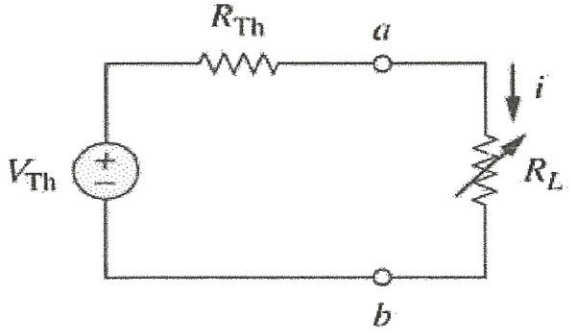
THEVENIN AND NORTON EQUIVALENT CIRCUIT

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

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

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

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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ALTERNATING CURRENT POWER CALCULATION

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

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

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

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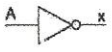
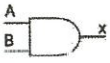
STANDARD RESISTOR VALUES AND COLOR

Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

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