CONFIDENTIAL

Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER II
## SESSION 2022/2023

| | | |
|---|---|---|
| COURSE NAME | : | ELECTRIC AND ELECTRONIC TECHNOLOGY |
| COURSE CODE | : | BDA 14303 |
| PROGRAMME CODE | : | BDD |
| EXAMINATION DATE | : | JULY/AUGUST 2023 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | 1. PART A: ANSWER **ONE(1)** QUESTION **ONLY**.<br>PART B: ANSWER **ALL** QUESTIONS.<br>2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.<br>3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK. |

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

## PART A

**Q1** (a) Nodal analysis is a technique to find currents and voltage between nodes in a circuit. Kindly explain the steps to conduct nodal analysis.

(4 marks)

(b) Calculate the value of $V_1$, $V_2$ and power dissipated in the 8Ω resistor as shown in **Figure Q1(b)** using nodal analysis method.

(8 marks)

(c) Given a circuit in **Figure Q1(c)**, using Thevenin Theorem to analyse $V_{th}$, $R_{th}$ at AB point. Then, determine the value of current $I_{R4}$.

(13 marks)

**Q2** (a) With the assistance of a diagram, explain what is Norton Theorem?.

(5 marks)

(b) Find the Norton equivalent with respect to terminals a-b in the circuit shown in **Figure Q2(b)**.

(10 marks)

(c) As shown in **Figure Q2(c),** use mesh analysis to determine $I_b$ and the current through resistor of 50Ω.

(10 marks)

## PART B

**Q3** (a) Find the equivalent inductance of the circuit at **Figure Q3(a)**, in which, L1 = L2 = 10mH, L3 = L4 = 20mH, and L5 = 5mH.

(8 marks)

(b) Find the equivalent capacitance of the circuit at **Figure Q3(b)**.

(7 marks)

(c) Obtain the energy stored in the capacitor C1 and the inductor L1 of circuit showed in **Figure Q3(c)** when Vs = 6V.

(10 marks)

**Q4** A series RLC circuit containing a resistance of 15Ω, an inductance of 0.2H and a capacitor of 50μF are connected in series across alternative power supply, $V_s = 100\sin(50\pi t)$.

(a) Calculate

(i) the frequency of the power supply. (2 marks)

(ii) the total circuit impedance. (6 marks)

(iii) the total effective current, $I_{rms}$. (4 marks)

(iv) the power factor. (3 marks)

(b) Sketch the voltage phasor diagram. (8 marks)

(c) Explain the relationship between the total current and the voltage supply. (2 marks)

**Q5** (a) (i) Compare the difference between AC Motor and DC Motor. (5 marks)

(ii) **Figure Q5(a)** shows a transformer. The primary coil of transformer has 8000 turns is connected to the 240 V mains supply and has current of 0.050 A. The secondary coil supplies 6.0 V to a lamp. Calculate the number of turns in the secondary coil, output current and power from the transformer to the lamp. (5 marks)

(b) Explain briefly **1 (ONE)** advantage and **1 (ONE)** limitation of digital system compared to analog system. (4 marks)

(c) Analyze the logic circuit in **Figure Q5(c)** and obtain:

(i) The Boolean expression for X (3 marks)

(ii) The truth table for the logic circuit (8 marks)

**-END OF QUESTIONS –**

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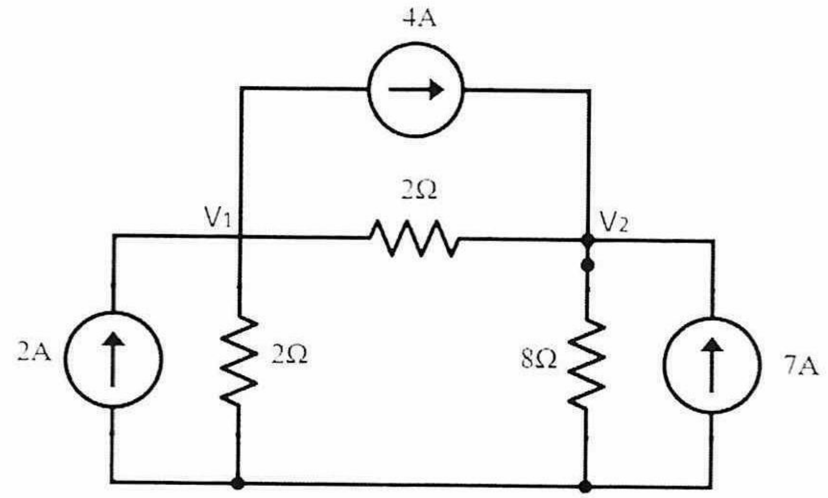


**Figure Q1(b)**

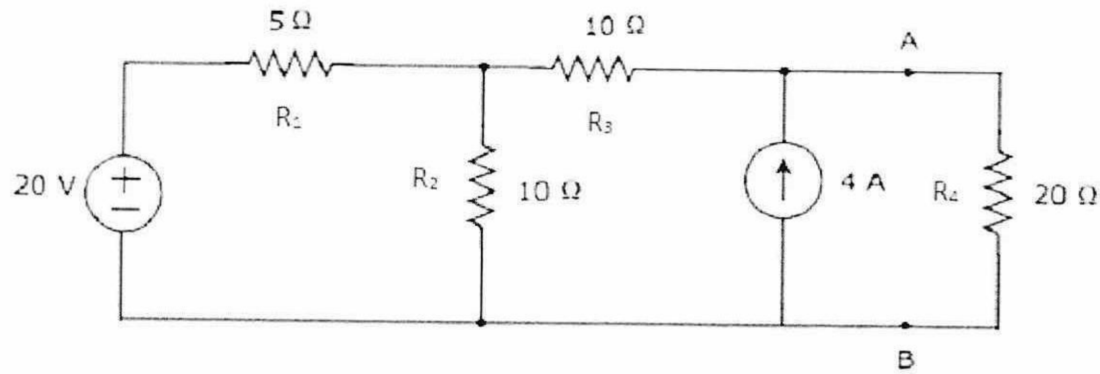


**Figure Q1(c)**

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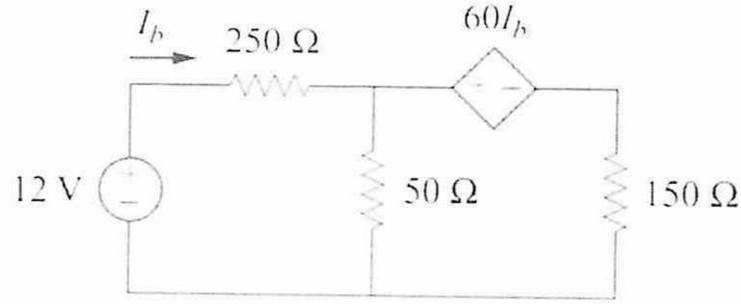


**Figure Q2(b)**

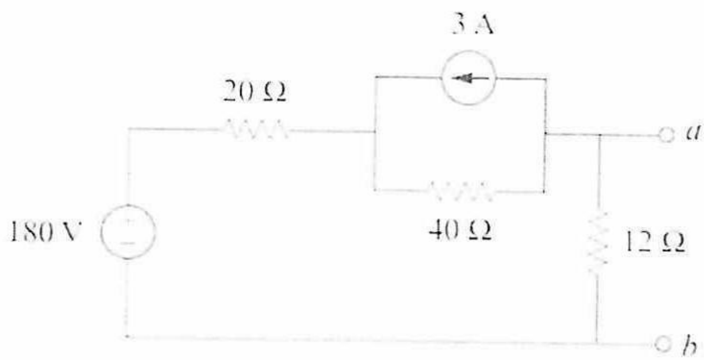


**Figure Q2(c)**

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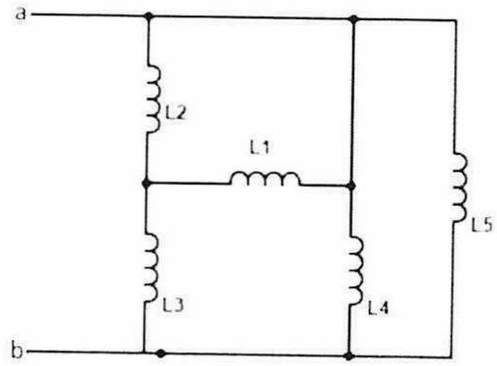


**Figure Q3(a)**

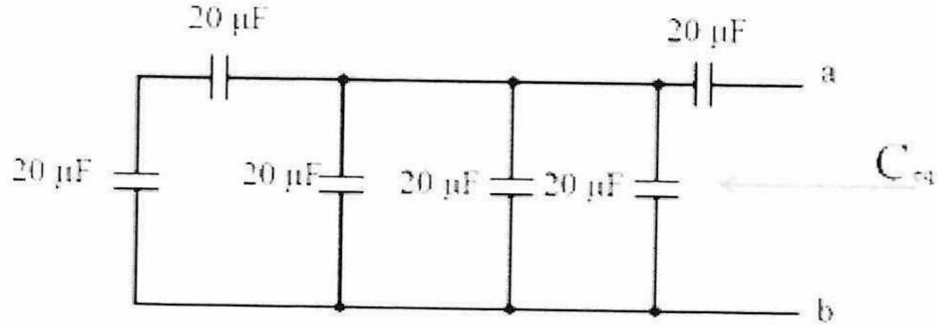


**Figure Q3(b)**

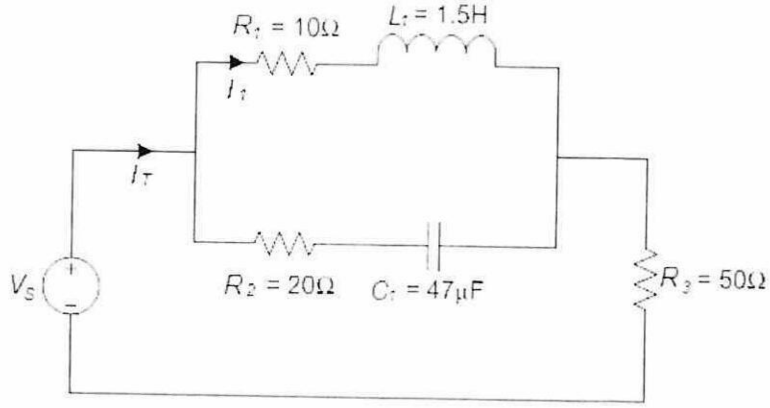


**Figure Q3(c)**

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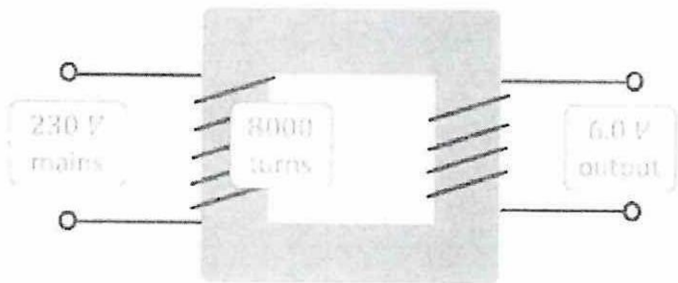


**Figure Q5(a)**

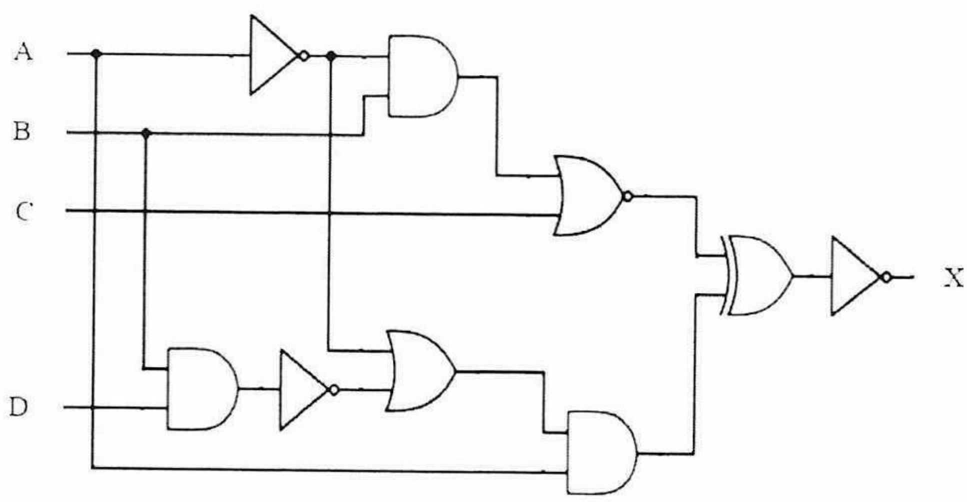


**Figure Q5(c)**

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**LIST OF FORMULA**

**OHMS LAW**

$$V = IR$$

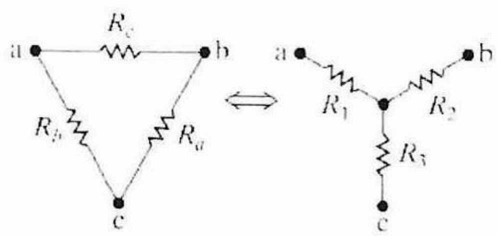
**JOULE'S LAW**

$$P = IV$$

**KIRCHHOFF LAW**

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

**WYE-DELTA TRANSFORMATION**

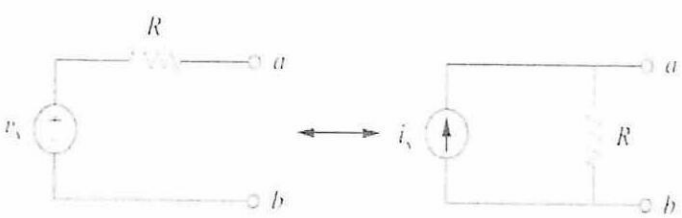



$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1} \qquad R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

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

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

**SOURCE TRANSFORMATION**




$$V_S = I_sR$$

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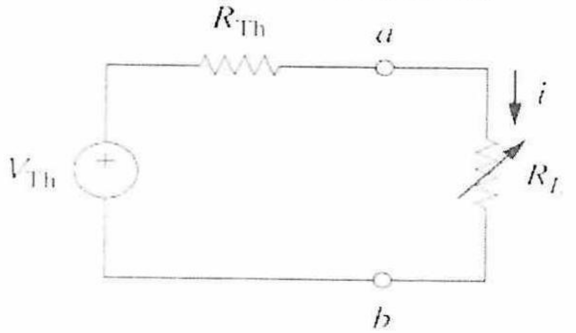
## THEVENIN AND NORTON EQUIVALENT CIRCUIT

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

$$P = i^2 R_L = \left( \frac{V_{TH}}{R_{TH} + R_L} \right)^2 R_L$$ 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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## ALTERNATING CURRENT POWER CALCULATION

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

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

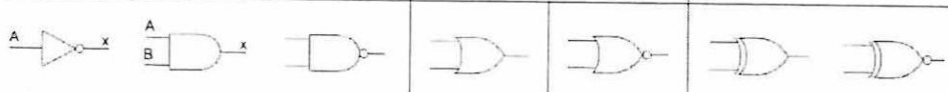
$$i_{RMS} = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$

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

## 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<br>0 1<br>1 0 | B A X<br>0 0 0<br>0 1 0<br>1 0 0<br>1 1 1 | B A X<br>0 0 1<br>0 1 1<br>1 0 1<br>1 1 0 | B A X<br>0 0 0<br>0 1 1<br>1 0 1<br>1 1 1 | B A X<br>0 0 1<br>0 1 0<br>1 0 0<br>1 1 0 | B A X<br>0 0 0<br>0 1 1<br>1 0 1<br>1 1 0 | B A X<br>0 0 1<br>0 1 0<br>1 0 0<br>1 1 1 |

TERBUKA