



Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

Complete, fold and seal
(see note 2 below)

SURNAME: Williams

FORENAME(S): James Robert

1	Student Number	W117831767
2	Title of Examination Paper	Electrical and Electronic Principles
3	Module Code	GOEE 4003
4	Date and Time of Examination	16/05/2022 9:30 AM
5	Examination Venue	W2
6	Seat Number	7
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Question 1	
Question 2	
Question 3	
Question 4	
Q1	18
Q2	9
Q3	25
Q4	12
Total	64/100

64%
Kut.



$$V_{R_1} = \frac{V_{CC}}{R_1 + R_2} \times R_1$$

$$V_{R_2} = \frac{R_2}{R_1 + R_2} \times V_{CC}$$

Question One

$$i) R_{34} = \frac{12 \times 8}{12 + 8} = 4.8 \Omega$$

$$R_{34} = \frac{R_4 R_3}{R_4 + R_3}$$

$$R_{346} = R_{34} + R_6$$

$$= 4.8 + 10$$

$$= 14.8 \Omega$$

$$R_{3456} = \frac{R_{346} R_5}{R_{346} + R_5}$$

$$= \frac{14.8 \times 10}{14.8 + 10}$$

$$= 5.97 \Omega$$

$$R_{34567} = R_{3456} + R_7$$

$$= 5.97 + 2$$

$$R_{34567} = 7.97 \Omega$$

$$ii) V = IR$$

$$V = I_{\text{Total}} \cdot R_{34567}$$

$$I = 8 - 5$$

$$= 3A$$

$$V = 3 \times 7.97$$

$$V = 23.91V$$

$$iii) P = I^2 R$$

$$= 3^2 \cdot 7.97$$

$$= 71.73W$$

$$iv) I_1 = \frac{V}{R}$$

$$= \frac{23.91}{10}$$

$$I_1 = 2.391A$$

$$I_2 = \frac{V}{R_{346}}$$

$$= \frac{23.91}{14.8}$$

$$I_2 = 1.616A$$



$$\begin{aligned} \text{i) } X_L &= 2\pi fL \quad \checkmark \\ &= 2\pi \times 50 \times 0.3 \quad \checkmark \\ &= 94.25\Omega \quad \checkmark \quad \underline{\underline{3}} \end{aligned}$$

$$\begin{aligned} \text{ii) } X_C &= \frac{1}{2\pi fC} \quad \checkmark \\ &= \frac{1}{2 \times \pi \times 50 \times 15 \times 10^{-6}} \quad \checkmark \\ &= 212.21\Omega \quad \checkmark \quad \underline{\underline{3}} \end{aligned}$$

$$\begin{aligned} \text{iii) } Z &= \sqrt{R^2 + (X_L - X_C)^2} \quad \checkmark \\ &= \sqrt{50^2 + (94.25 - 212.21)^2} \quad \checkmark \\ &= 128.12\Omega \quad \checkmark \quad \underline{\underline{3}} \end{aligned}$$

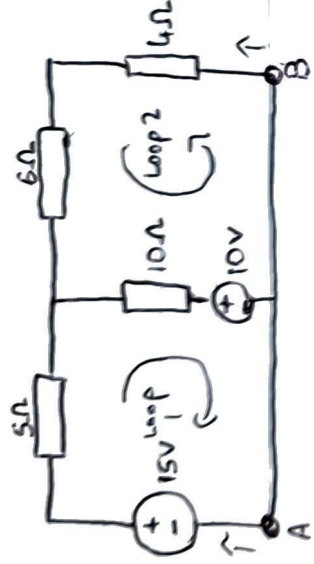
$$\begin{aligned} \text{iv) } I &= \frac{V}{R} \quad X_L + X_C + R = \quad \checkmark \quad \underline{\underline{0}} \\ &= \frac{25V}{356.46\Omega} \quad \checkmark \\ &= 0.0701A \quad \checkmark \quad \underline{\underline{0}} \\ &= 70.13mA \quad \checkmark \quad \underline{\underline{0}} \end{aligned}$$

$$\begin{aligned} \text{v) } \phi &= \frac{25V}{70.13mA} \quad \checkmark \\ &= 356.46^\circ \quad \checkmark \end{aligned}$$

Q2a

9/15

a)



Loop 1

$$-15 + 5I_1 + 10(I_1 - I_2) + 10 = 0$$

$$-15 + 5I_1 + 10I_1 - 10I_2 + 10 = 0$$

$$-5 + 15I_1 - 10I_2 = 0$$

$$15I_1 - 10I_2 = 5$$

Loop 2

$$4I_2 + 6I_2 + 10(I_2 - I_1) + 10 = 0$$

$$4I_2 + 6I_2 + 10I_2 - 10I_1 + 10 = 0$$

$$20I_2 - 10I_1 + 10 = 0$$

$$20I_2 - 10I_1 = -10$$

$$10I_1 - 20I_2 = 10$$

$$15I_1 - 10I_2 = 5 \quad \times 2$$

$$30I_1 - 20I_2 = 10$$

$$20I_1 = 10$$

$$20I_1 = 10$$

$$15I_1 - 10I_2 = 5$$

$$10I_1 - 20I_2 = 10 \quad \times 1.5$$

$$15I_1 - 10I_2 = 5$$

$$- \quad 15I_1 - 30I_2 = 15$$

$$0 + 20I_2 = -10$$

$$I_2 = -0.5$$

$$= 0.5A$$

$$15I_1 - 10I_2 = 5$$

$$15I_1 - 10(-0.5) = 5$$

$$15I_1 + 5 = 5$$

$$15I_1 = 0$$

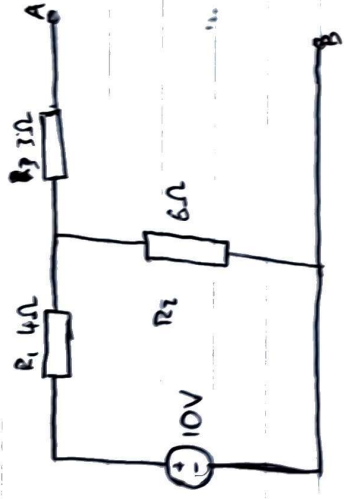
$$I_1 = 0$$

$$I_1 = \frac{10}{15}$$

$$I_2 = 0.67A - 0.5A$$

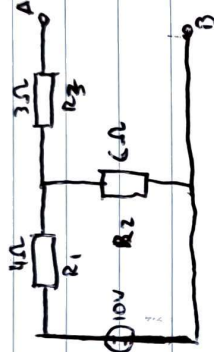
$$I_3 = 0.17A$$

$$I_1 = 0.67A$$

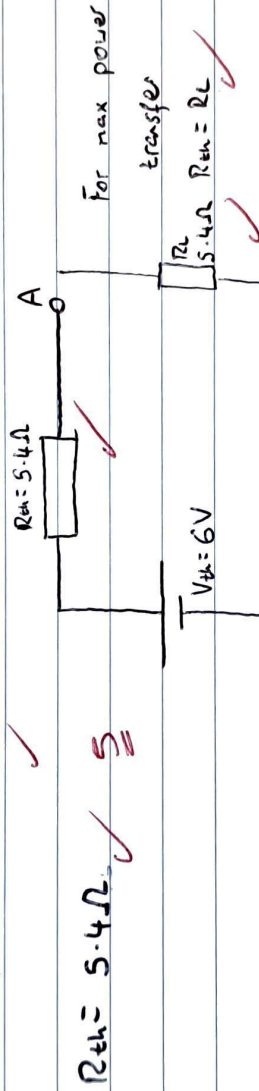
b)
i)

$$V_{th} = \frac{6}{6+4} \times 10V \quad V_{th} = V_{ab} = \frac{R_2}{R_1 + R_2} \times V_{CC} \quad \checkmark$$

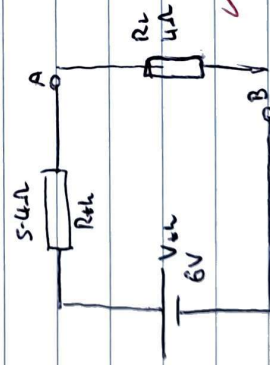
$$V_{th} = 6V \quad \checkmark \quad \underline{\underline{5}}$$



$$\begin{aligned} R_{th} &= R_{th} \\ &= \left(\frac{R_1 R_2}{R_1 + R_2} \right) + R_3 \quad \checkmark \\ &= \left(\frac{4 \times 6}{4 + 6} \right) + 3\Omega = \end{aligned}$$



$$R_{th} = 5.4\Omega \quad \checkmark \quad \underline{\underline{5}}$$



$$P = I^2 R_L \quad \checkmark \quad \underline{\underline{3}}$$

$$I = \frac{V}{R} \quad \checkmark$$

$$= \frac{6}{\frac{5.4}{4} + 4} = 1.1A$$

$$P = 1.1^2 \times 4 \quad \text{error carried forward} \quad \checkmark$$

$$P = 4.84W \quad \checkmark$$

Q3b

13/15

a)

$$i) V_{B0} = V_{B2} = \frac{V_{CC}}{R_1 + R_2} \times R_2 \quad \checkmark$$

$$= \frac{9}{100k + 10k} \times 10k \quad \checkmark$$

$$V_B = V_{B2} = 0.81V \quad \checkmark$$

$$V_{BE} = V_B - 0.7 \quad \checkmark$$

$$= 0.81 - 0.7 \quad \checkmark$$

$$= 0.12V \quad \checkmark$$

5

ii)

~~V_{CE} = 8.965V~~

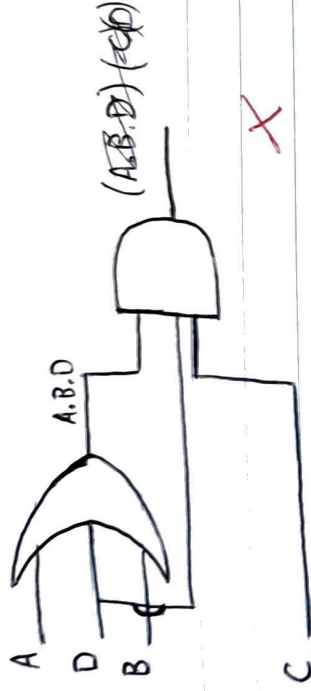
$$V_{CE} = \frac{V_{CC}}{R_C + R_E} \times R_E$$

$$= \frac{9}{3.9 + 1k} \times 1k \quad \times \quad \text{ON}$$

$$V_{CE} = 8.965V \quad \checkmark$$

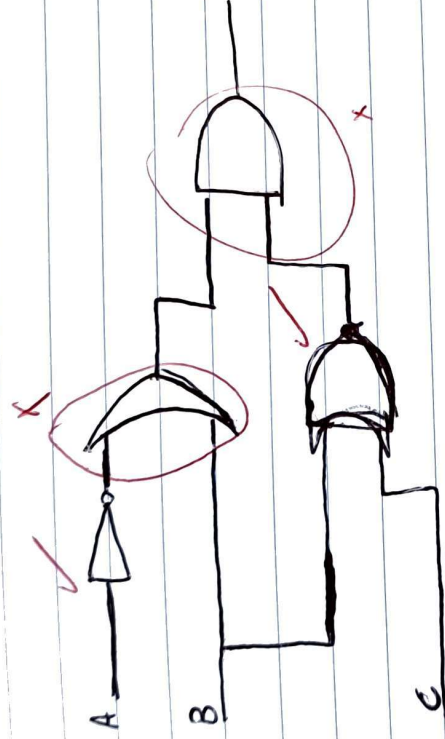
b) $DA \cdot DB + DC$
i)

Q4b
1/8



3//
X

ii)



1//

c)

i) $((A + B) + C)$ ✓

Q4c
6/6

ii) $A + (B \cdot C)B$ ✓

$$\begin{aligned} d) \quad Y &= \overline{(A \cdot B)} (\bar{A} + \bar{C}) \\ &= \overline{(A + B)} (\bar{A} + \bar{C}) \\ &= \overline{(A \cdot B)} (\bar{A} + \bar{C}) \\ &= (A + B) (\bar{A} + \bar{C}) \\ &= (A + B) (A + C) \end{aligned}$$

0//

Q4d
0/6

$$\begin{aligned} Y &= \overline{(A \cdot B)} (\bar{A} + \bar{C}) \\ &= \overline{(A + B)} (\bar{A} + \bar{C}) \\ &= (A + B) (\bar{A} + \bar{C}) \\ &= (A + B) (A + C) \end{aligned}$$

X