



Complete, fold and seal
(see note 2 below)

SURNAME: WINTER

FORENAME(S): ALED

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.

1	Student Number	Win21861113
2	Title of Examination Paper	Electrical and electronics principles
3	Module Code	GOEE4003
4	Date and Time of Examination	20.05.24 1:30pm
5	Examination Venue	Ward 2 68860
6	Seat Number	F4

7	Number of Answer Books handed in	
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List the numbers of the questions you have attempted	Office Use
Q ₁	15
Q ₂	17
Q ₃	19
Q ₄	13
Total ~	64 / 100

64%

1.
i) ~~Calculate~~

Q1
15/20

$$R_{43} = 7^{-1} + 13^{-1} = 4.55 \Omega \quad 2 //$$

$$R_{436} = 4.55 + 4.45 = 9 \Omega \quad 2 //$$

$$R_{4365} = 9^{-1} + 11^{-1} = 4.95 \Omega \quad 2 //$$

$$R_{78} = 3^{-1} + 7^{-1} = 2.1 \Omega \quad 2 //$$

$$R_{4365} + R_{78} = R_{\text{total}} \quad 1 //$$

$$R_6 = 4.95 + 2.1 = 7.05 \Omega \quad 2 //$$

ii) voltage point at A.

$$V = I \times R \quad R = 7.05 \quad I = ?$$

$$I = 10 - 2 = 8 \text{ A} \quad 3 //$$

$$V = 8 \times 7.05 = 56.4 \text{ V} \quad 3 //$$

iii) Total Power in the load.

$$P = I^2 \times R \quad 2 //$$

$$P = 8^2 \times 7.05 = 451.2 \text{ W} \quad 2 //$$

Q2
a)

$$-120 + 30I_1 + 10(I_1 - I_2) = 0$$

$$-120 + 30I_1 + 10I_1 - 10I_2 = 0$$

$$-120 + 40I_1 - 10I_2 = 0$$

$$40I_1 - 10I_2 - 120 = 0$$

$$40I_1 - 10I_2 = 120$$

$$-60 + 50I_2 + 10(I_1 - I_2) = 0$$

$$-60 + 50I_2 + 10I_1 - 10I_2 = 0$$

$$-60 + 40I_2 + 10I_1 = 0$$

$$40I_2 + 10I_1 - 60 = 0$$

$$10I_1 + 40I_2 = 60$$

$$40I_1 - 10I_2 = 120$$

$$10I_1 + 40I_2 = 60$$

$$50I_1 + 30I_2 = 180$$

$$I_3 = I_1 - I_2$$

$$I_3 = 50 - 30 = 20$$

$$I_3 = 20$$

Q2

17/30

Q2a

8/15

Question No.

2

6) Thevenin.

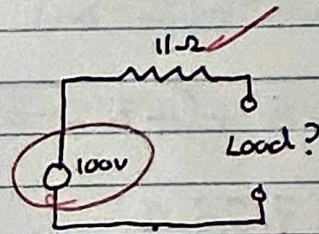
$$i) V_{th} = \left(\frac{R_2}{R_1 + R_2} \right) \times V_s \quad V_{th} = \left(\frac{15}{10 + 15} \right) \times 100$$

$$V_{th} = 60V$$

$$R_{th} = \left(\frac{R_1 \times R_2}{R_1 + R_2} \right) + R_3 \quad R_{th} = \left(\frac{10 \times 15}{10 + 15} \right) + 5$$

$$R_{th} = 11\Omega$$

$$ii) R_L \approx R_{th} \quad R_L = 11\Omega$$



$$iii) P = I^2 \times R \text{ or } V \times I \quad I = V \div R$$

$$I = 100 \div 11 = 9.09A \quad P = 9.09^2 \times 11 = 908.9W$$

iv

0

Q2b
9/15

Q3

$$i) \text{ impedance } (Z) = \sqrt{R^2 + (X_L - X_C)^2} \quad \sqrt{R^2 + (X_C)^2}$$

$$X_L = 2\pi FL \quad X_L = 2 \times \pi \times 50 \times 150 \times 10^{-3} = 47.12 \Omega$$

$$X_C = \frac{1}{2\pi FC}$$

$$X_C =$$

$$\frac{1}{2 \times \pi \times 50 \times 100 \times 10^{-6}} = 31.83 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z = \sqrt{8^2 + (47.12 - 31.83)^2}$$

$$Z = 17.26 \Omega$$

$$ii) I = V \div Z \text{ so } I = 240 \div 17.26 = 13.9 \text{ A}$$

$$iii) Z_{\text{coil}} = \sqrt{R^2 + (X_L)^2} = \sqrt{8^2 + (47.12)^2}$$

$$Z_{\text{coil}} = 376.96 \text{ V}$$

$$= 54.92 \text{ V}$$

Calculation errors

$$iv) X_C = 31.83 \Omega \quad 240 \div 31.83 = V = I \times R$$

$$V = \frac{240}{\cos^{-1}} \quad 31.83 \times 13.9 = 442.44 \text{ V}$$

$$v) \theta = \cos^{-1} \frac{R}{Z} \quad \theta = \cos^{-1} \frac{8}{17.26} = 24.88^\circ$$

$$v) \theta = \cos^{-1} \frac{R}{Z} \quad \theta = \cos^{-1} \frac{8}{17.26} = 62.4^\circ$$

$$vi) P = I^2 \times R \quad P = 13.9^2 \times 8 = 1545.68$$

$$= 1.5 \text{ kW.}$$

Q4

$\cdot$ $+$ $-$
 $\Rightarrow$ $\Rightarrow$ $\Rightarrow$

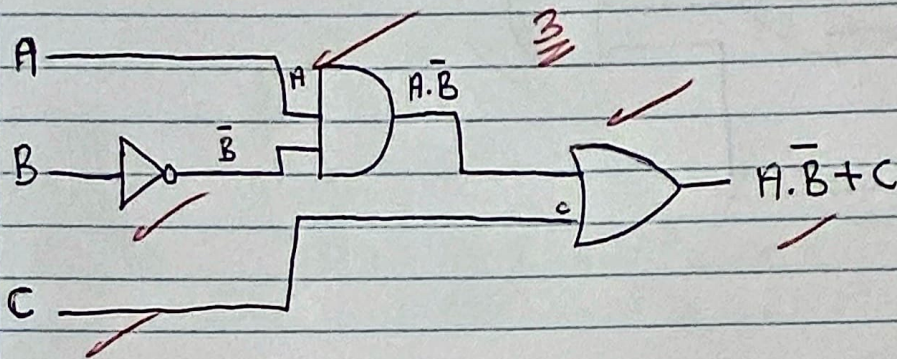
Q4

13/30

b

i

$$Z = A \cdot \bar{B} + C$$

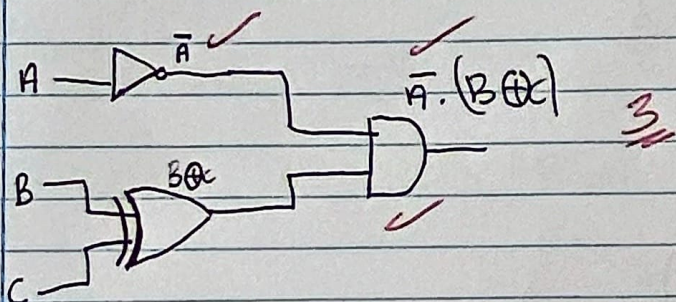


Q4b

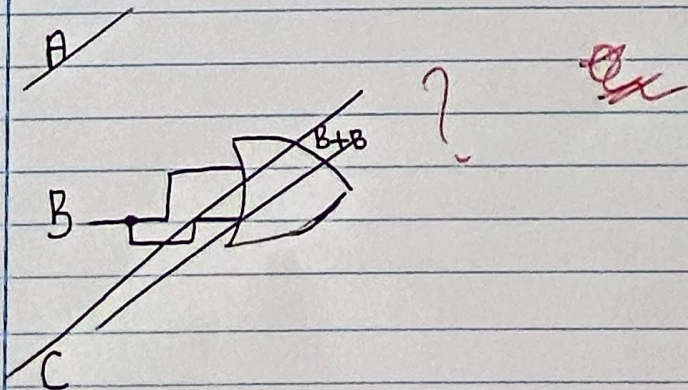
7/9

ii

$$Z = \bar{A} \cdot (B \oplus C)$$

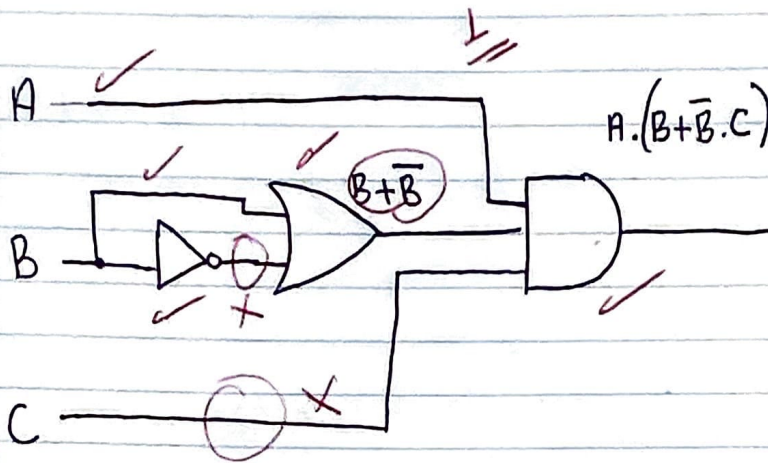


$$Z = A \cdot (B + \bar{B} \cdot C)$$



4
iii

$$z = A.(B + \bar{B}.C)$$



c

i. $A.(B + C.D)$ x 0

ii. $\bar{A}(B + B + \bar{C})$ x 0

iii. $\bar{A}.B + \bar{C} + \bar{B}.C$ x 0

d) $X = \overline{(A.B)(\bar{A} + C)}$

$$X = \overline{(A.B)} + \overline{(\bar{A} + C)}$$

$$X = (A.B) + (\bar{\bar{A}}.C)$$

$$X = (A.B) + (A + C)$$

Q4c

0

Q4d

2/5

Q4

a

i. Current through $R_1 + R_2$ $I = V \div R$ $V = 12$

$$R_1 = 12 \div 100 \times 10^3 = 120 \mu A$$

$$R_2 = 12 \div 22 \times 10^3 = 545.45 \mu A$$

$$R_1 + R_2 = 122 k\Omega \quad 12 \div 122 \times 10^3 = 98.36 \mu A \quad \underline{\underline{2}}$$

ii. Voltage across $R_1 + R_2$ $V = I \times R$

$$R_4 = 120 \times 10^6 \times$$

$$R_1 = 98.36 \times 10^{-6} \times \overset{100}{122 \times 10^3} = 11.9 V \quad \times$$

$$R_2 = 98.36 \times 10^{-6} \times 22 \times 10^3 = 2.16 V \quad \underline{\underline{1}}$$

iii. Voltage at emitter. $V = I \times R$

$$98.36 \times 10^{-6} \times 4.7 \times 10^3 = 0.46 V$$

$$2 - 0.7 = 11.3 V \quad \times$$

iv. $I_c \approx I_E = 2.1$

$$v. \quad 22 \times 10^3 \times 98.36 \times 10^{-6} = I \times R$$

$$= 2.16 V \quad \underline{\underline{0}}$$

$$vi. \quad 10 \times 10^3 \times 98.36 \times 10^{-6} = 0.98336 V \quad \times$$

vii. Emitter current $V = 0.98336 \div R$

$$0.98 \div 10 \times 10^3 = 98 \mu A \quad \underline{\underline{1}} \quad \text{error carried forward}$$

$$viii. \quad 10 \times 10^3 \times 98.36 \times 10^{-6} = 0.98336 V$$

$\times$ $\underline{\underline{0}}$

Q4a

4/10