



Complete, fold and seal
(see note 2 below)

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.

SURNAME: Ivey

FORENAME(S): James

1	Student Number	IVE 208 57781
2	Title of Examination Paper	Electrical and Electronic Principles
3	Module Code	G OEE 4003
4	Date and Time of Examination	20/05/24 Pm
5	Examination Venue	Ward 2 68860
6	Seat Number	03
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	20 ✓
Q2	23 ✓
Q3	13 ✓
Q4	11 ✓
Total	67/100 ✓

67

67%

1. i) R3 - R8

R3 and R4

$$\frac{1}{\frac{1}{7} + \frac{1}{13}} = 4.55 \Omega$$

R34 and R6

$$4.55 \Omega + 4.45 \Omega = 9 \Omega$$

R346 and R5

$$\frac{1}{\frac{1}{9} + \frac{1}{11}} = 4.95 \Omega$$

R7 and R8

$$\frac{1}{\frac{1}{3} + \frac{1}{7}} = 2.1 \Omega$$

R3456 and R78

$$4.95 \Omega + 2.1 \Omega = 7.05 \Omega$$

$$R_L = 7.05 \Omega$$

ii) A = $8A, 7.05 \Omega$ $\frac{V}{IR}$

$$8A \times 7.05 \Omega = 56.4 V$$

Q120/20

11.iii. Power dissipated

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

$$P = 8^2 \times 7.05 \Omega$$

$$P = 451.2 \text{ W}$$

iv) I_1 and I_2

$$\frac{V}{R}$$

$$I_1 = \left(\frac{R_{346}}{R_{346} + R_5} \right) \times 8$$

$$I_2 = \left(\frac{R_5}{R_5 + R_{346}} \right) \times 8$$

$$I_1 = \left(\frac{9}{9 + 11} \right) \times 8$$

$$I_2 = \left(\frac{11}{11 + 9} \right) \times 8$$

$$= 3.6 \text{ A}$$

$$= 6.4 \text{ A}$$

2.a) Find I_1 , I_2 and I_3

$$I_3 = \frac{V}{R}$$

I_1

$$-120 \text{ V} + 30 I_1 + 10 (I_1 + I_2)$$

$$-120 \text{ V} + 40 I_1 + 10 I_2$$

$$120 \text{ V} = 40 I_1 + 10 I_2$$

I_2

$$-60 \text{ V} + 50 I_2 + 10 (I_1 + I_2)$$

$$-60 \text{ V} + 60 I_2 + 10 I_1$$

$$60 \text{ V} = 60 I_2 + 10 I_1$$

I_3

$$120 \text{ V} = 40 I_1 + 10 I_2$$

$$60 \text{ V} = 10 I_1 + 60 I_2$$

$$\times 6 \Rightarrow 720 \text{ V} = 240 I_1 + 60 I_2$$

$$60 \text{ V} = 10 I_1 + 60 I_2$$

$$660 \text{ V} = 230 I_1$$

$$I_1 = \frac{660}{230} = 2.87 \text{ A}$$

Q2

23/30

Q2a

15/15

$$2a) \quad 120V = 40I_1 + 10I_2 \quad \checkmark \quad = 120V = 40I_1 + 10I_2 \quad \checkmark$$

$$60V = 10I_1 + 60I_2 \quad \times 4 \quad = 240V = 40I_1 + 240I_2 \quad \checkmark$$

$$-120V = -230I_2 \quad \checkmark$$

$$I_2 = 0.52A$$

I_3

~~Explain~~

~~Explain~~

$$I_2 + I_1$$

$$0.52A + 2.87A \quad \checkmark$$

$$= 3.39A \quad \checkmark$$

$$I_3 = 3.39A \quad \checkmark$$

b) i) V_{TH} and R_{TH}

$$V_{TH} = \left(\frac{R_2}{R_2 + R_1} \right) 100 \quad \checkmark$$

$$= \left(\frac{15}{15 + 10} \right) \times 100 \quad \checkmark$$

$$V_{TH} = 60V \quad \checkmark$$

R_{TH}

R_1 and R_2

$$\frac{1}{\frac{1}{10} + \frac{1}{15}} = 6\Omega \quad \checkmark$$

equivalent circuit ??

R_{12} and R_3

$$6\Omega + 5\Omega = 11\Omega \quad \checkmark$$

Q2b

8/15

2b. ii) $R_L = 11 \Omega$

iii) Maximum power transferred in the load

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

$$P = I \times V$$

$$\text{For } I = \frac{V}{R} = \frac{60}{11} = 5.45 \text{ A}$$

$$P = 5.45^2 \times 60 = 1782.15 \text{ W}$$

3. $100 \mu\text{F}$, 8Ω , 150 mH , 240 V , 50 Hz

i) $X_C = \frac{1}{2\pi f C}$

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

$$X_C = 31.83 \Omega$$

$$X_L = 2\pi f L$$

$$= 2 \times \pi \times 50 \times 150 \times 10^{-3}$$

$$X_L = 47.12 \Omega$$

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

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

$$Z = 17.17 \Omega$$

ii) Current flowing

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

$$\frac{240}{17.17} = 13.98 \text{ A}$$

Q3

13/20

3. iii) Voltage across the coil

$$V_L = 13.98 \text{ A} \times 150 \text{ mH}$$

$$= 2.09 \text{ V}$$

$$= 13.98 \times 47.12 \times 150 \times 10^{-3}$$

$$V = 98.81 \text{ V}$$

iv) Voltage across the capacitor

$$V_C = 13.98 \text{ A} \times 100 \text{ uF}$$

$$= 13.98 \text{ A} \times 31.83 \times 100 \times 10^{-6} = 0.044 \text{ V}$$

$$\cancel{13.98 \times 8.16 \times 10^{-6}}$$

$$\cancel{46.67 \text{ V}}$$

v) $\Phi = \cos^{-1}\left(\frac{R}{Z}\right)$

$$= \cos^{-1}\left(\frac{8}{17.17}\right)$$

$$\Phi = 62.23^\circ$$

vi) Real Power

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

$$P = 13.98^2 \times 17.17$$

$$P = 3355.71 \text{ W}$$

4a) i. DC current through R_1 and R_2

$$R_1 = \frac{12}{100k} \times \frac{V}{R}$$

$$A = 0.00012 \text{ across } R_1$$

$$mA = 0.12mA$$

$$R_2 = \frac{12}{22k} = \frac{V}{R}$$

$$A = 0.00054$$

$$= 0.54mA$$

ii) DC Voltage across R_1 and R_2

$$R_1 = V = I \times R$$

$$= 0.00012 \times 100k = 12$$

$$R_1 = 12V$$

$$R_2 = 6V$$

iii) DC Voltage = 6V

iv) DC emitter and collector currents

$$I = \frac{V}{R} = \frac{12}{100k} = 0.12mA$$

$$\text{Collector} = 0.12mA$$

$$\text{Emitter} = 0.0012A \text{ or } 1.2mA$$

$$V) \text{ Collector Voltage} = 6V$$

$$vi) \text{ Emitter voltage} = 6V$$

$$vii) \text{ Emitter current} = 0.0006A \text{ or } 0.6mA$$

$$viii) \text{ DC voltage} = 0.6mA$$

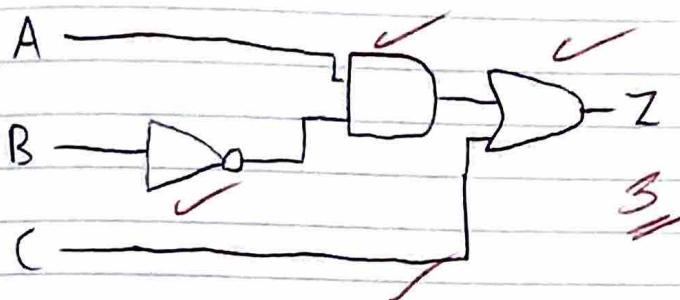
Q4

11/30

Q4a

0

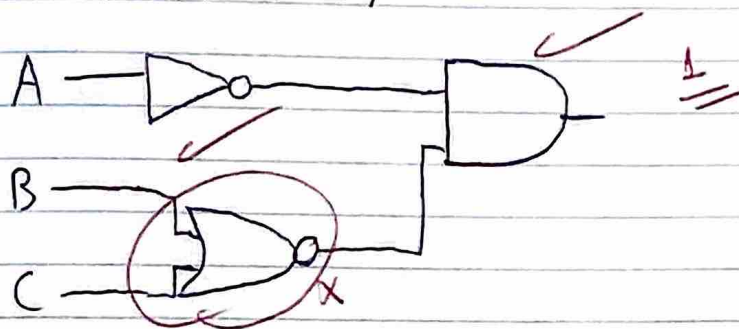
Q4b) i) $Z = A \cdot \bar{B} + C$



Q4b

6/9

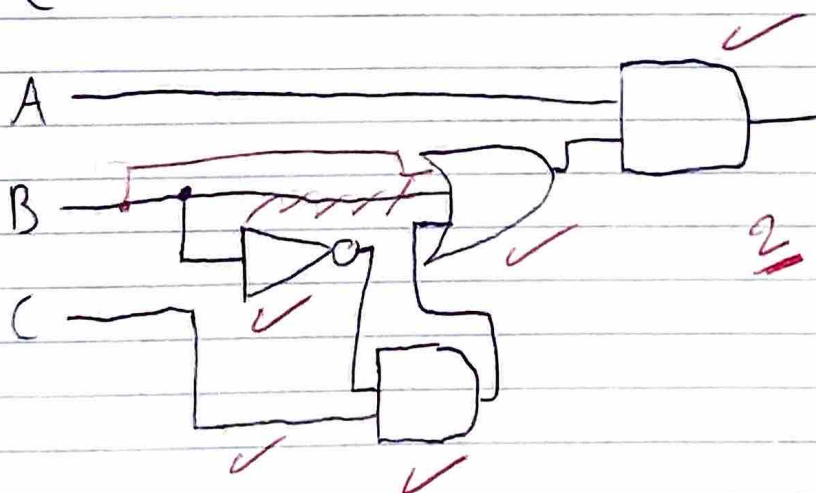
ii) $z = \bar{A} \cdot (B \oplus C)$



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

A —

~~B~~
~~C~~



$$4(i) \cdot (A \cdot B) + (C) \cdot D$$

$$ii) (\bar{A} \cdot B) + (B \oplus C)$$

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

$$(\overline{A \cdot B \oplus \bar{C}}) + (B \cdot C)$$

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

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

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

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

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

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

Q4C

4/6

Q4d

4/5