



Complete, fold and seal
(see note 2 below)

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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	NEA 20856038
2	Title of Examination Paper	Electrical and Electronic Principles
3	Module Code	GOCC 4003
4	Date and Time of Examination	20.05.24 PM
5	Examination Venue	68860 Ward 2
6	Seat Number	D5
7	Number of Answer Books handed in	1

[illegible]

L2

78%

1)
i)

Load Resistance

$$R_{34} = \frac{R_3 \times R_4}{R_3 + R_4} = \frac{13 \times 7}{13 + 7} = 4.55 \Omega$$

$$\begin{aligned} R_{346} &= R_{34} + R_6 \\ &= 4.55 \Omega + 4.45 \Omega \\ &= 9 \Omega \end{aligned}$$

$$R_{3456} = \frac{R_5 \times R_{346}}{R_5 + R_{346}} = \frac{11 \times 9}{11 + 9} = 4.95 \Omega$$

$$R_{78} = \frac{R_7 \times R_8}{R_7 + R_8} = \frac{3 \times 7}{3 + 7} = 2.1 \Omega$$

$$\begin{aligned} R_{345678} &= R_{3456} + R_{78} \\ &= 4.95 \Omega + 2.1 \Omega = 7.05 \Omega \end{aligned}$$

ii) Voltage at A

$$I = 10 \text{ A (in)} - 2 \text{ A (out)} = 8 \text{ A}$$

$$V = I \times R \quad \text{so } I = \frac{V}{R}$$

$$\begin{aligned} &= 8 \times R_1 \\ &= 8 \times 7.05 \\ &= 56.4 \text{ V} \end{aligned}$$

Q120/20

(2) 10
(1) 10

UN 1502 2011

Arbeitsvertrag

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2)

a) $\$$

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

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

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

$$40I_1 - 10I_2 = 120$$

$$I_1 = I_1 - I_2$$

Q226/30

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

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

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

$$10I_1 + 40I_2 = 60$$

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

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

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

$$10I_1 - 60I_2 = 60$$

$$50 \quad 40I_1 - 10I_2 = 120 \div 10$$

$$10I_1 - 60I_2 = 60 \div 10 \quad \text{Correct}$$

Method

$$4I_1 - 1I_2 = 120 \quad \times 1$$

$$1I_1 - 6I_2 = 6 \quad \times 4$$

error carried

Forward

$$4I_1 - 1I_2 = 120$$

$$4I_1 - 24I_2 = 24$$

$$23I_2 = 96$$

$$I_2 = \frac{96}{23} = 4.17A$$

Correct method

error carried

Forward

$$I_1 = 4I_1 - 1(4.17) = 120$$

$$4I_1 - 4.17 = 120$$

$$4I_1 = 124.17$$

$$I_1 = \frac{124.17}{4}$$

$$I_1 = 31.04A$$

$$I_3 = I_1 - I_2 = 31.04 - 4.17 = 26.87 \text{ A}$$

$$\text{So } I_1 = 31.04 \text{ A}$$

$$I_2 = 4.17 \text{ A}$$

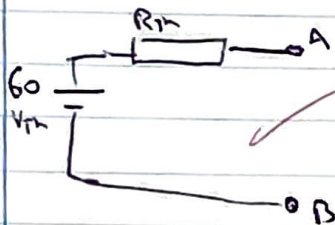
$$I_3 = 26.87 \text{ A}$$

error carried
forward.

b)
i)

Thermin circuit

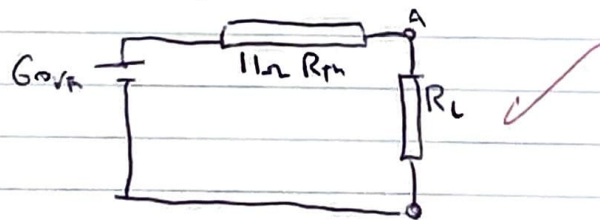
$$V_{Th} = \frac{R_2}{R_1 + R_2} \times V_r = \frac{15}{10 + 15} \times 100 = 60 \text{ V}_{Th}$$



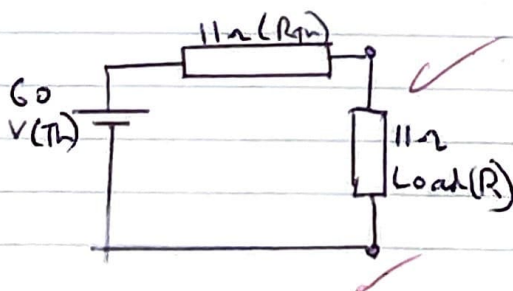
$$R_{Th} = \frac{R_1 \times R_2}{R_1 + R_2} + R_3$$

$$R_{Th} = \frac{10 \times 15}{10 + 15} + 5 = 11 \Omega_{Th}$$

So Thermin equivalent circuit



- ii) To achieve maximum power transfer across A.B
The Load resistance = $R_{Th} = 11 \Omega$



iii) Maximum power transfered to load

$$P = I^2 R$$

$$I = \frac{V}{R} = \frac{60}{R_{th} + R_L} = \frac{60}{22}$$

$$I = 2.72A$$

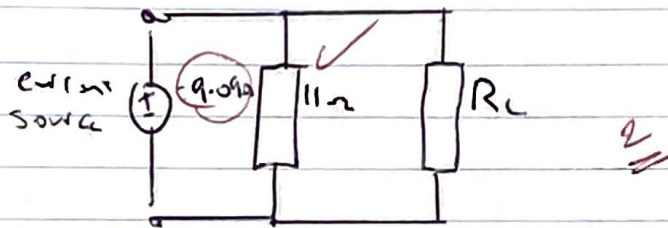
$$P = 2.72^2 \times 11\Omega$$

$$= 81.38W$$

iv) Norton equivalent circuit

$$R_{123} = \frac{R_1 \times R_2}{R_1 + R_2} + R_3 = \frac{10 \times 15}{10 + 15} + 5$$

$$= 11\Omega$$



$$V = IR \quad \text{So } I = \frac{V}{R}$$

$$I = \frac{100V}{11\Omega} = 9.09A$$

3)

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

$$R = 8 \Omega$$

$$X_L = 2\pi fL$$

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

$$X_L = 2\pi(50)(50 \times 10^{-3})$$

$$= 47.12 \Omega$$

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

$$= 31.83 \Omega$$

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

$$= 17.77 \Omega$$

ii) Current flowing

$$I = \frac{V}{Z} \text{ or } \frac{V}{Z} = \frac{240V}{17.77 \Omega} = 13.5A$$

$$iii) V = I \times R = 13.5 \times \sqrt{8^2 + 47.12^2}$$

$$= 645.22V$$

iv) Voltage across capacitor

$$V = I \times X_C = 13.5 \times 31.83$$

$$= 429.7V$$

Q3

17/20

v) Phase angle = $\cos^{-1}\left(\frac{R}{Z}\right)$ ✓
 $= \cos^{-1}\left(\frac{8}{17.7}\right) = 63.24^\circ$ ✓ 0

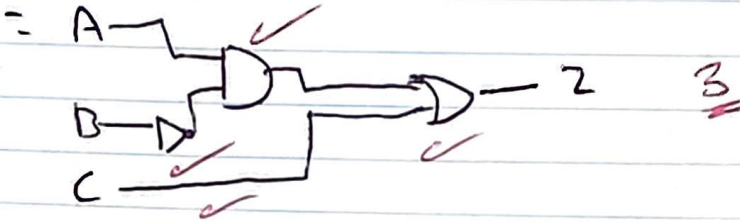
v) Power dissipated

$$P = I^2 \times R = 17.7^2 \times 8 = 2526.18 \text{ W}$$
 0

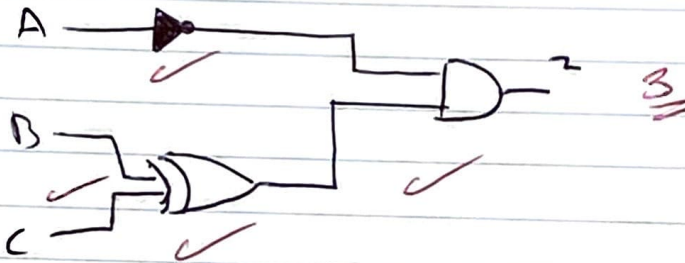
4)

b)

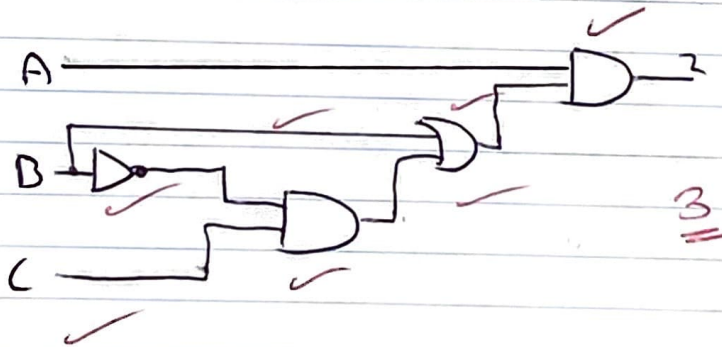
$$i) Z = A \cdot \bar{B} + C$$



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



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



Q24

Q4

15/30

Q4a

0

Q4b

9/9

i) $(A \cdot B + C)(D) = Z$ 2

Q4c

ii) ~~$\bar{A} \cdot B + (\bar{B} + \bar{C}) = Z$~~ $\bar{A} \cdot B + (\bar{B} + \bar{C}) = Z$ 2

5/6

iii) $A \cdot B + \bar{C} + (\bar{B} \cdot \bar{C}) = Z$ 1

d) D.M of gas

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

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

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

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

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

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

Q4d

1/5