



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:

Webb

FORENAME(S):

Thomas

1	Student Number	WEB25887285
2	Title of Examination Paper	Electrical and Electronic Principles
3	Module Code	GOEE4003
4	Date and Time of Examination	22 MAY 2026 10:00
5	Examination Venue	Main Hall
6	Seat Number	E4
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	
Q2	
Q3	
Q4	
Q1	20 ✓
Q2	28 ✓
Q3	19 ✓
Q4	8 ✓
Total	75/100

72

75%



$$Q1a)i) R_{12} = \frac{24 \times 12}{24 + 12} = 8 \Omega$$

$$R_{123} = 8 + 8 = 16 \Omega$$

$$R_{45} = 2 + 6 = 8 \Omega$$

$$R_{12345} = \frac{16 \times 8}{16 + 8} = 5.33 \Omega$$

$$R_{123456} = 5.33 + 10 = 15.33 \Omega$$

$$2) V = IR \rightarrow I = \frac{V}{R} = \frac{20}{15.33} = 1.3 A$$

$$3) P = IV = 1.3 \times 20 = 26 W$$

$$4) R_{12345} = 5.33 \Omega \quad R_6 = 10 \Omega$$

$$V = \frac{R_6}{R_{12345} + R_6} \times 20 V = \frac{10}{15.33} \times 20 = 13.05 V$$

$$5) V = \frac{R_{12345}}{R_{12345} + R_6} \times 20 = \frac{5.33}{15.33} \times 20 = 6.95 V$$

$$6) I_2 = \frac{R_{123}}{R_{123} + R_{45}} \times I = \frac{16}{16 + 8} \times 1.3 = 0.87 A$$

$$7) I_{R_4} = I_{R_5} = 0.87 A$$

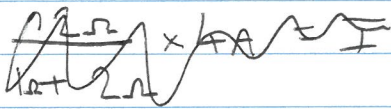
$$V = IR = 6 \times 0.87 = 5.22 V$$

$$8) V = \frac{R_3}{R_{12} + R_3} \times 6.95 = \frac{8}{8 + 8} \times 6.95 = 3.475 V$$

$$9) 1.3 A - 0.87 A = 0.43 A$$

$$\frac{12 \Omega}{24 \Omega + 12 \Omega} \times 0.43 A = 0.143 A$$

Q120/20Q1a16/16

b) 

$$\frac{2\Omega}{1\Omega + 2\Omega} \times I = 4A$$

$$I = \frac{4(1+2)}{2} = 6A$$

$$R = 2 + 0.5 + \left(\frac{2 \times 1}{2+1}\right) = 3.17\Omega$$

$$V = IR = 6 \times 3.17 = 19V$$

Q1b

4/4

Q2)a) $-96 + 4I_1 + 4I_1 + 12(I_1 + I_2) = 0$
 $-96 + 8I_1 + 12I_1 + 12I_2 = 0$
 $20I_1 + 12I_2 = 96$
 $5I_1 + 3I_2 = 24$

$$-32 + 8I_2 + 8I_2 + 12(I_2 + I_1) = 0$$

$$16I_2 + 12I_2 + 12I_1 = 32$$

$$28I_2 + 12I_1 = 32$$

$$7I_2 + 3I_1 = 8$$

$$I_2 = \frac{(8 - 3I_1)}{7} \rightarrow 5I_1 + \frac{3(8 - 3I_1)}{7} = 24$$

$$5I_1 + \frac{24 - 9I_1}{7} = 24$$

$$35I_1 + 24 - 9I_1 = 168$$

$$26I_1 = 144$$

$$I_1 = 5.54A$$

$$I_2 = \frac{24 - 5I_1}{3} = \frac{(24 - 5 \times 5.54)}{3} = -1.23A$$

Current through $R_2 = I_1 - I_2 = 5.54 - (-1.23) = 6.77A$

$$P = I^2 R = 6.77^2 \times 12 = 550W$$

Q2

28/30

Q2a

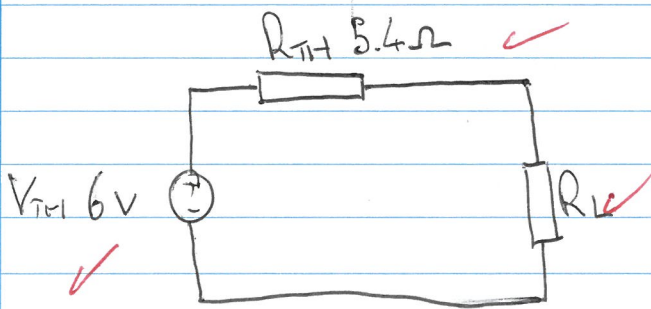
13/15

b) 1) Voltage between A and B:

$$R_{12} = \frac{8 \times 8}{8 + 8} = 4 \Omega$$

$$V = \frac{6}{6 + 4} \times 10 = 6V = V_{TH}$$

$$R_{TH} = R_{12} \parallel R_3 + R_4 = \frac{4 \times 6}{4 + 6} + 3 = 5.4 \Omega$$



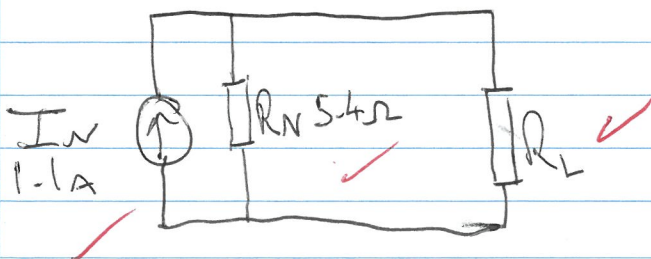
2) $R_L = R_{TH}$ at maximum power transfer

$$R_L = 5.4 \Omega$$

$$3) P = I^2 R = 0.56^2 \times 5.4 = 1.67W$$

$$I = \frac{V}{R} = \frac{6}{10.8} = 0.56A$$

$$4) I_N = \frac{V_{TH}}{R_{TH}} = \frac{6}{5.4} = 1.1A \quad R_N = R_{TH} = 5.4 \Omega$$



Q2b

15/15

$$Q3) 1) X_C = \frac{1}{2\pi f C} = \frac{1}{2\pi \times 50 \times 800 \times 10^{-6}} = 3.98 \Omega$$

$$X_L = 2\pi f L = 2\pi \times 50 \times 32 \times 10^{-3} = 10.05 \Omega$$

$$R = 8 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{8^2 + (3.98 - 10.05)^2}$$

$$= 10.04 \Omega$$

$$2) I = \frac{V}{Z} = \frac{200}{10.04} = 19.92 A$$

$$3) V = IZ$$

$$\text{for resistor } R: V = 19.92 \times 8 = 159.36 V$$

$$\text{for inductor: } V = 19.92 \times 10.05 = 200.2 V$$

$$\text{for capacitor: } V = 19.92 \times 3.98 = 79.28 V$$

$$4) \text{ phase angle} = \tan^{-1} \left(\frac{X_L - X_C}{R} \right)$$

$$= \tan^{-1} \left(\frac{10.05 - 3.98}{8} \right) = 37.2^\circ$$

Next Page

Q3

19/20

5) Let $X_L - X_C = X_n$ ✓

$$Z = \sqrt{R^2 + X_n^2}$$
 ✓

$$Z^2 = R^2 + X_n^2 \rightarrow X_n = \sqrt{Z^2 - R^2}$$
 ✓

Let $Z = 100$ and $R = 8$ ✓

$$\Rightarrow X_n = \sqrt{100^2 - 8^2} = 99.68 \Omega$$
 ✓

6) The circuit would be inductive ✓ why? $\frac{L}{C}$

24)a) 1) $V_E = I_E \times R_E$ ✓

Since $I_E = I_C = 0.002A$ ✓

$$V_E = 0.002 \times 1500 = 3V$$
 ✓

2) $V_E + 0.7 = V_B = 3 + 0.7 = 2.3V$ ✓

3) $\frac{R_2}{R_1 + R_2} \times V_{CC} = 2.3V$ ✓ E.C.F. $\frac{R_1}{R_1 + R_2} \times V_{CC} = 17.7V$ ✓ E.C.F.

$$2.3 \times (R_1 + R_2) = V_{CC} \times R_2$$
 ✓

$$R_1 = \frac{V_{CC} \times R_2}{2.3} - R_2 = 115k\Omega$$
 ✓ E.C.F. $V_{R1} = ?$

4) $I = \frac{V}{R} = \frac{20}{130000} = 1.54 \times 10^{-4} A$ ✓

$0.000154A$
 $0.154mA$ ✓

5) $115k\Omega$ ✓

6) $V_C = V_{CC} - I_C R_C = 20 - (0.002 \times 3000) = 14V$ ✓

7) $R_C = 3k\Omega$ ✓

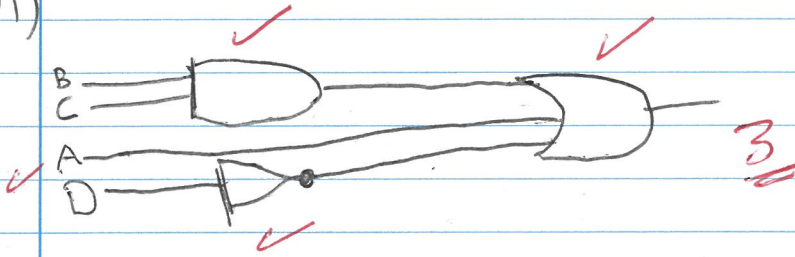
Q4

8/30

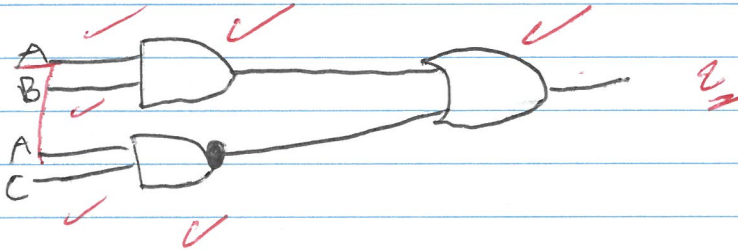
Q4a

3/12

b) 1)

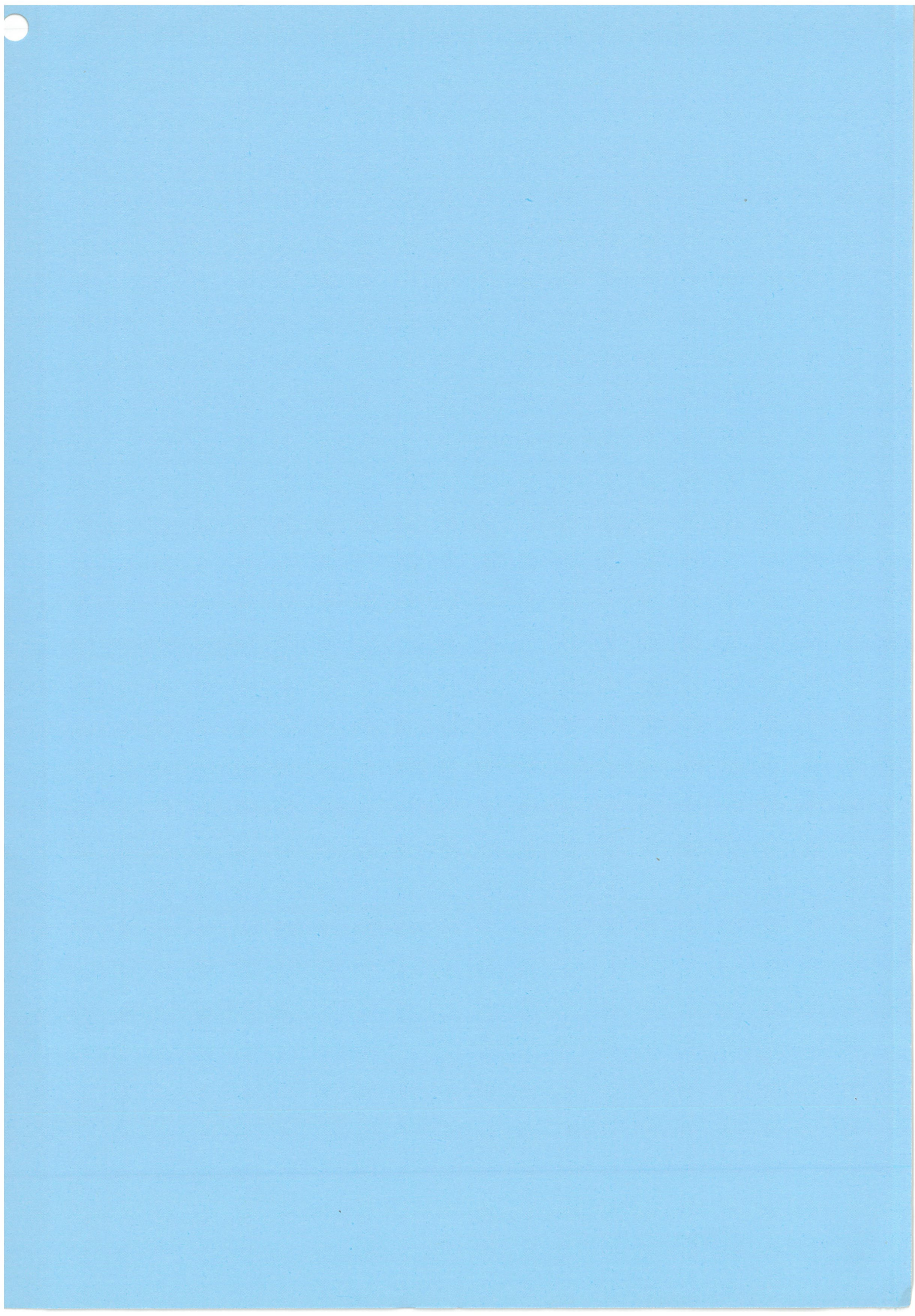
Q4b5/6

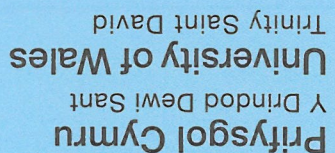
2)



$$d) Y = \overline{(A+B)} \overline{(B+C)} = (A+B)(B+\bar{C}) \quad \times$$

Q4d0/6Q4c0/6





12 Tüdalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrifft annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgirfennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw ffras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

1	Rhif Myfyriwr	
2	Teitl y Papur	Arholiad
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

(See the other side for English version)

[illegible]

Llenwch, plygch a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: