

12 Pages

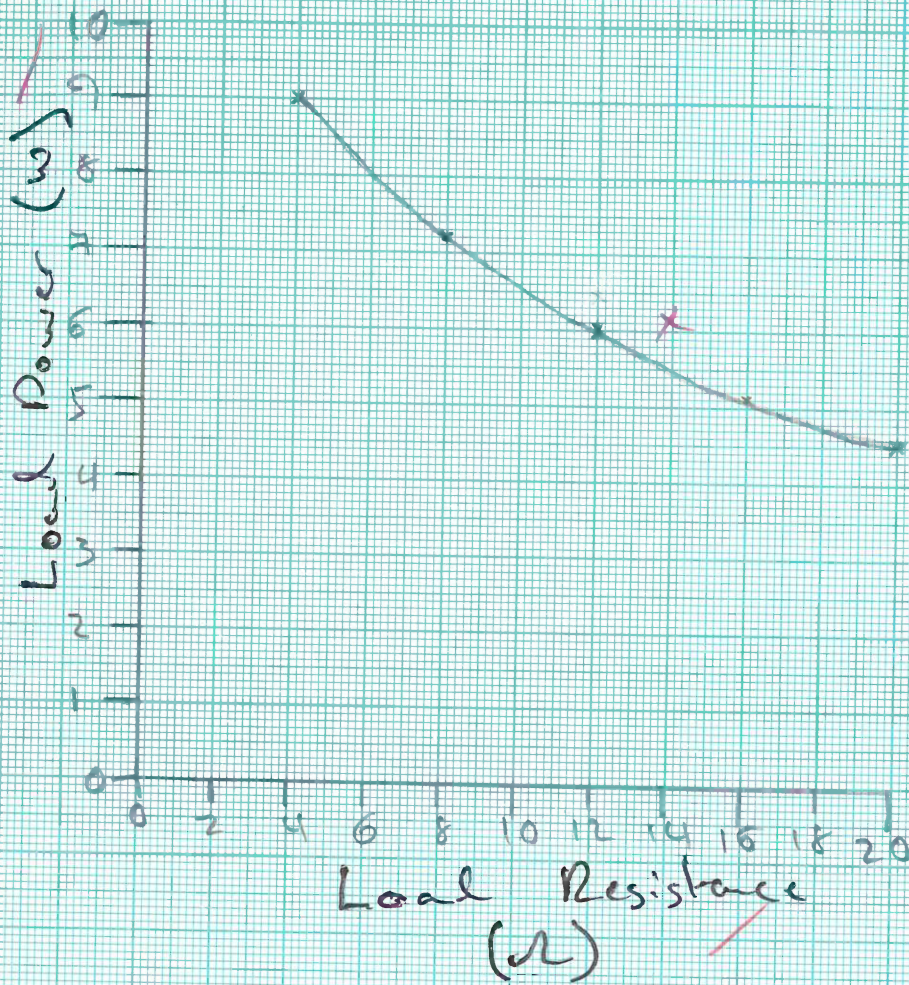
1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or mark it as typed and the 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	2420839
2	Title of Examination Paper	ELECTRICAL AND ELECTRONIC PRINCIPLES
3	Module Code	ACDA4006
4	Date and Time of Examination	9:00 13/4/25
5	Examination Venue	310 1Q
6	Seat Number	6
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	25 ✓
2	24 ✓
3	25 ✓
4	2 ✓
Total	76 %

4b)

Load Resistance
vs Load Power



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ACDA4006

$$V = 1V \quad P = 1W$$

1) a)

$$\frac{20}{25} = 0.8$$

$$0.8 \times 100 = 80\%$$

$$25 - 20 = 5$$

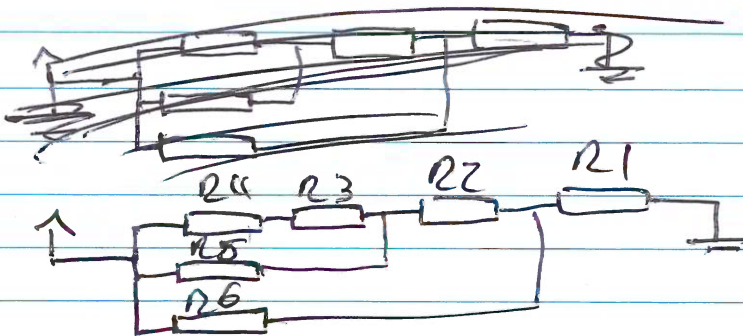
80% efficiency 5W loss

b)

$$P = 1W = 1 = \frac{P}{V}$$

$$\frac{1}{3} = 0.333$$

$$\bullet \frac{1}{3} A \text{ or } \underline{\underline{333.33 \text{ mA}}}$$

c)
i)

$$R_4, R_3 = 50 + 30 = 80 \Omega$$

$$R_4, R_3, R_5 = \frac{1}{80} + \frac{1}{50} = \frac{1}{x} \Rightarrow x = 30.769$$

$$R_4, R_3, R_5, R_2 = 30.769 + 25 = 55.769$$

$$R_4, R_3, R_5, R_2, R_6 = \frac{1}{55.769} + \frac{1}{50} = \frac{1}{x}$$

$$\frac{1}{x} = 26.364$$

$$\cancel{R_4} R_T = 26.364 + 20 = \underline{\underline{46.364}}$$

ii)

$$\frac{15}{46.364} = 0.32352$$

$$I @ R_1 = 0.32352 A$$

$$\text{or } \underline{\underline{323.52 \text{ mA}}}$$

1) ~~A~~

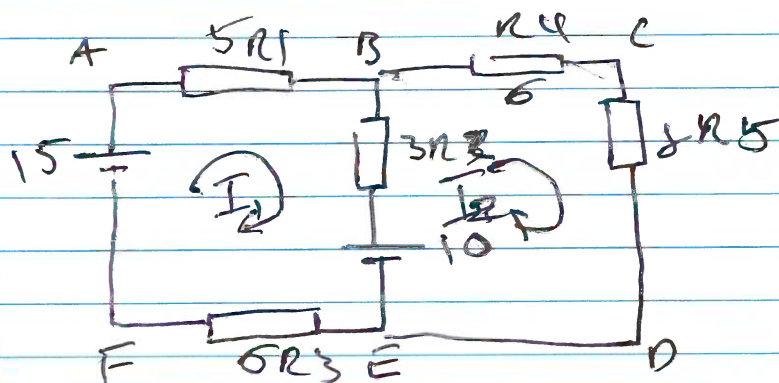
a) Kirchhoff's Current Law states that current entering a node must equal current leaving a node.

Q1 d) later

Q1 total

$$\frac{25}{25}$$

2a)



$$ADE F = 15 - 5I_1 - 3I_1 + 3I_2 - 10 - 6I_1 \quad (1)$$

$$BCDE = 10 - 3I_2 + 3I_1 - 6I_2 - 8I_2 \quad (2)$$

$$(1) = 15 - 14I_1 + 3I_2 = 0 \quad \times 3$$

$$(2) = 10 + 3I_1 - 17I_2 = 0 \quad \times 14$$

⊕

$$(1) = 15 - 42I_1 + 9I_2 = 0$$

$$(2) = 140 + 42I_1 - 238I_2 = 0$$

$$155 + 0 - 229 = 0$$

$$155 = 229I_2$$

$$I_2 = \frac{155}{229} = 0.6769$$

$$(1) \quad 5 - 14I_1 + 3(0.6769) = 0$$

$$7.0305 - 14I_1 = 0$$

$$7.0305 = 14I_1$$

$$\frac{7.0305}{14} = I_1 = 0.5022$$

$$2a) I_{QR1} = 0.5022 \text{ A or } 502.2 \text{ mA}$$

$$I_{QR2} = 0.5022 - 0.6769 = -0.1747$$

$$\text{or}$$

$$0.6769 - 0.5022 = +0.1747$$

- 0.1747 with respect to 15V
- + 0.1747 with respect to 10V

$$I_{QR3} = 0.5022$$

$$I_{QR4} = \cancel{0.6769} - 0.1747$$

$$I_{QR5} = \cancel{0.6769} - 0.1747$$

$$5) i) Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$X_L = 2\pi fL = 2\pi \times 50 \times 0.001$$

$$= 0.314159$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 0.00047}$$

$$= 6.7725$$

$$X_T = X_L - X_C = 0.314159 - 6.7725$$

$$= -6.4584$$

$$Z = \sqrt{100^2 + (-6.4584)^2} = \underline{\underline{100.208}}$$

$$ii) \frac{120}{100.208} = 1.1978$$

$$iii) \tan^{-1} \left(\frac{6.4584}{100} \right) = 3.6953$$

Q2 total

24
25

3a)) ~~Resistance is a ~~the~~ circuit is~~
~~to opposition to cur~~

Resistance is a property of a component to oppose the flow of current within a circuit

2

ii) Impedance is the combination of both resistance and reactance and describes the opposition to the flow of current within an AC circuit

2

iii) Reactance is the opposition to the change of ~~current~~ direction of current within an AC circuit

2

iv) Voltage Rating is a value given to a component to inform a user of the maximum voltage a component can be used at before expecting catastrophic failure

2

b) i) ~~40 A~~ ~~40 A~~ ~~40 A~~ 40 A

1

ii) $\frac{40}{\sqrt{2}} = \underline{\underline{28.2842 A}}$

2

iii) $\frac{314}{2\pi} = \underline{\underline{49.974 Hz}}$

2

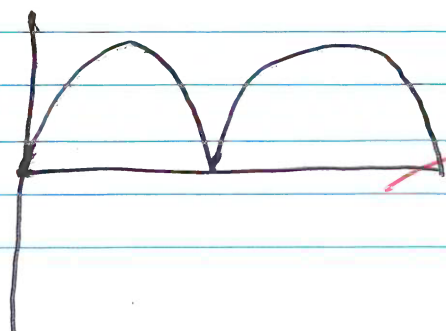
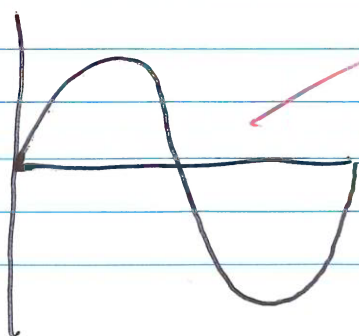
3)c) The circuit shown in Figure 5 is a full wave bridge rectifier. The function of this circuit is to take an AC waveform and ~~change~~ turn that waveform to one polarity, generally positive.

VI provides our waveform which ~~is stepped down~~ steps down our voltage. During the positive half of the AC waveform D2 and D4 are brought into conduction allowing current to flow through the top of R1. During this positive half D3 and D1 are reverse biased and ~~at~~ ~~do~~ do not allow current to flow, besides leakage.

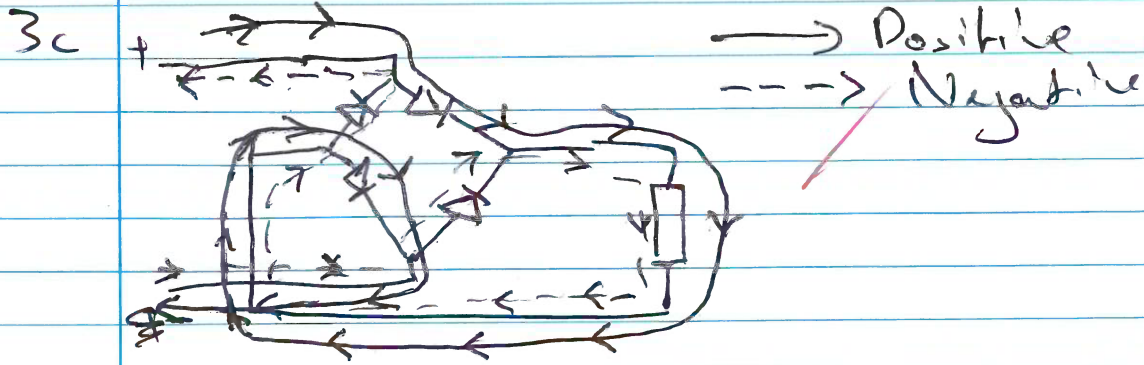
During the negative half of the waveform the opposite happens. D2 and D4 fall out of conduction as they are reverse biased and D1 and D3 are brought into conduction. Due to the way the bridge is constructed current flows the same way as before through the top of R1.

Input

Output (Across R1)



12



Q3 total

25
25

4a)

$R_L (\Omega)$	Load $p (W)$
4	9
8	7.2
12	6.0
16	5.14
20	4.5

$$\frac{V^2}{R} = P \quad \frac{12^2}{12+4} = 9$$

$$\frac{12^2}{12+8} = 7.2$$

∴

Q4 total

2
25

1d)

They are all in parallel so V across all resistors is 10V

4.

4b) Inside