



12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners will not accept a script or have it typed and the expense of typing is 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).
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1	Student Number	2316329
2	Title of Examination Paper	Electrical and Electronic Principles
3	Module Code	ACDA4006
4	Date and Time of Examination	9/1/24 12:00 pm
5	Examination Venue	310
6	Seat Number	36
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

68/100

1.

a)



330Ω resistor
 3 V

$$I = V/R \quad I = 3/330 = 9.1\text{mA}$$

If 270Ω resistor used

$$I = V/R \quad I = 3/270 = 11.1\text{mA}$$

$$e) \text{ Efficiency} = \frac{20}{25} \times 100 = 80\% \text{ efficiency}$$

$$\begin{aligned} \text{Total power loss} &= \text{Input power} - \text{output power} \\ &= 25\text{W} - 20\text{W} \\ &= 5\text{W} \end{aligned}$$

$$b) I = P/V$$

$$I = 1/3 = 0.33\text{A}$$

Maximum charging current = 0.33A

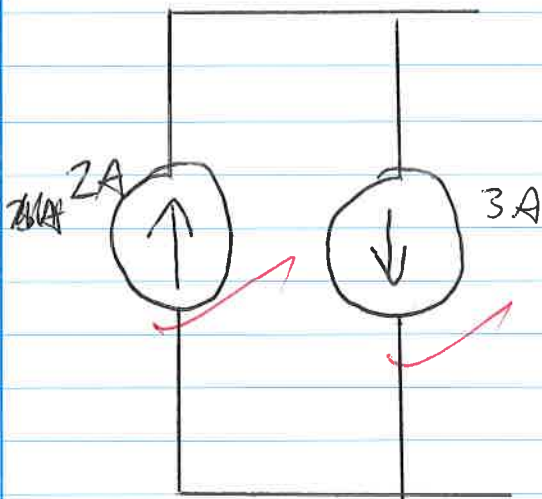
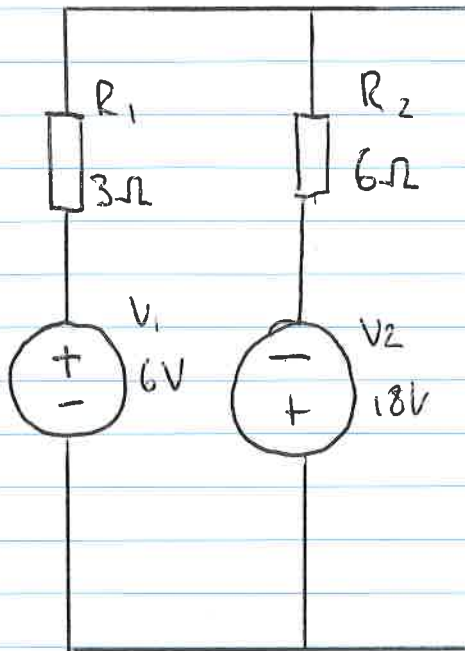
d)

i)

$$\frac{1}{\left(\frac{1}{50} + \frac{1}{20}\right) + \left(\frac{1}{25} + \frac{1}{50}\right) + \left(\frac{1}{50} + \frac{1}{30}\right)} = 5.45\Omega$$

$$ii) I = V/R \quad I = 15/20 = 0.75\text{A}$$

c)



$$6/2 = 3A \quad \checkmark$$

$$18/6 = 3A \quad \checkmark$$

2
✓

?

Q1 = 13

13

2. Part a not attempted

b) $V_B = 80$ Total current = 2A

$R_B = 80/2$
 $R_B = 40\Omega$

$R_C = 50$ $V_C = 50 \times 2$
 $I = 2A$ $= 100V$

i) $V_C = 100V$, $V_B = 80V$ $250 - (V_C + V_B) = 70$
 $V_A = 70V$

ii) $R = 50$ $V = IR$
 $I = 2A$ $V = 50 \times 2 = 100V$

iii) $V_A = 80V$ $R = V/I$
 $I = 2$

For R_B , $80/2 = 40\Omega$

For R_A , $70/2 = 35\Omega$

d) Step up transformer's secondary winding will have more coils ✓
 Step-up transformers will take voltage from low to high ✓

Step down transformers take voltage from a high voltage source & turn it into a lower value for use in homes etc ✓

Step down transformers secondary winding will have less coils ✓

P.T.O for part c

c)

- i) resistance to the flow of electrical current ✓
- ii) combination of reactance and resistance ✓
- iii) Opposition of resistance to the flow of electrical current ✓
- iv) Adding of impurities to create intrinsic and extrinsic semiconductors ✓

v) The amount of voltage a product can withstand before ~~blow~~
It is given on a label on the product and is the voltage the
product can safely operate at ✓

1+1

1+1

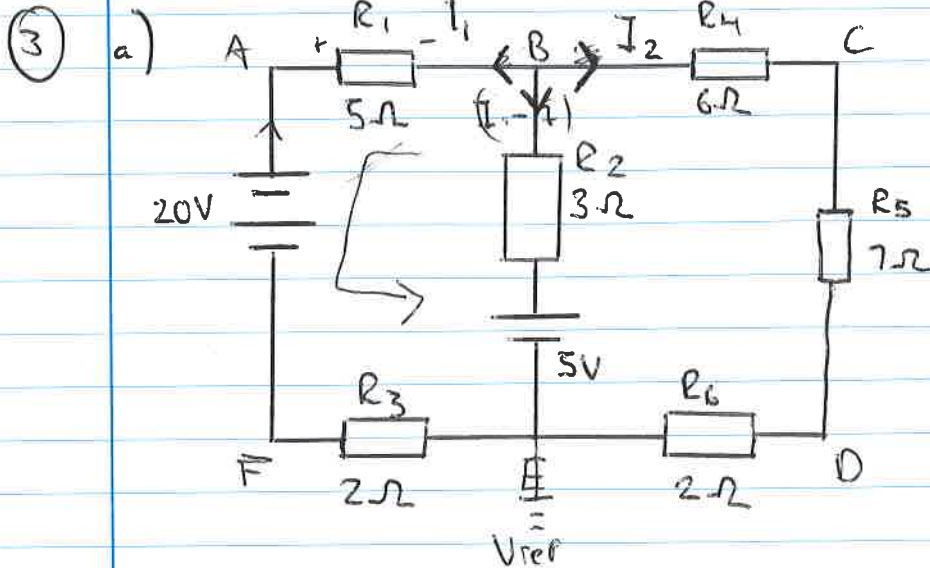
0+1

2

1+1

Q2 = 21

(21)



KVL in ABEFA

~~$-5I_1 - 3(I_1 - I_2) - 5 - 2I_1 - 20 = 0$~~

$$-5I_1 - 3(I_1 - I_2) - 5 - 2I_1 - 20 = 0$$

$$-5I_1 - 3I_1 + 3I_2 + 2I_1 = 25$$

$$-10I_1 + 3I_2 = 25 \quad \text{--- (1)}$$

KVL in CDEBC

$$-7I_2 - 2I_2 - 5 - 3(I_1 - I_2) - 6I_2 = 0$$

$$-7I_2 - 2I_2 - 3I_1 + 3I_2 - 6I_2 = 5$$

$$-12I_2 + 3I_1 = 5 \quad \text{--- (2)}$$

$$\textcircled{1} \quad -10I_1 + 3I_2 = 25 \quad \text{--- (1)} \quad \times 4$$

$$\textcircled{2} \quad 3I_1 + 12I_2 = -5 \quad \text{--- (2)}$$

$$\begin{aligned} & \text{--- (1)} \\ & -40I_1 + 12I_2 = 100 \end{aligned}$$

$$3I_1 + 12I_2 = -5$$

$$-43I_1 = -105$$

$$I_1 = 2.44A$$

Sub into ①

$$I_1 = 2.44A$$

$$244 + 3I_2 = 25$$

$$3I_2 = 49.4$$

$$I_2 = 16.467A$$

$$b) i) X_c = 1/2\pi fc$$

$$1/2\pi \times 1.5 \times 10^3 \times 0.022 \times 10^{-6} = 4822.88 \Omega \approx 4.8k\Omega$$

$$ii) Z = \sqrt{R^2 + X_c^2}$$

$$Z = \sqrt{(2.2 \times 10^3)^2 + (4822.88)^2}$$

$$= 5300.96 \Omega \approx 5.3k\Omega$$

$$iii) V = I/R$$

$$I = V/R$$

$$I = 10 / 2.2 \times 10^3 = 4.5mA$$

$$Q_3 = 12$$

12

4.

~~b) PNP
NPN
MOSFET
P type
N type~~

~~a) This is a full wave rectifier circuit
Transformer is a step down transformer
Diodes used as voltage regulators~~

5.

a) 12 V battery with 12Ω internal resistance

$$P = I^2 R$$

$$I = V/R$$

For load resistance of 4Ω

$$I = 12 / (12 + 4) = 0.75$$

$$P = I^2 R \quad 0.75^2 \times 4 = 2.25 \text{ W}$$

For load resistance of 8Ω

$$I = 12 / (12 + 8) = 0.6$$

$$P = I^2 R \quad P = 0.6^2 \times 8 = 2.88 \text{ W}$$

For load resistance of 12Ω

$$I = 12 / (12 + 12) = 0.5$$

$$P = I^2 R \quad P = 0.5^2 \times 12 = 3.00 \text{ W}$$

For load resistance of 16Ω

$$I = 12 / (12 + 16) = 0.4285714286$$

$$P = I^2 R \quad P = 0.4285714286^2 \times 16 = 2.939 \text{ W}$$

For load resistance of 20Ω

$$I = 12 / (12 + 20) = 0.375$$

$$P = I^2 R \quad P = 0.375^2 \times 20 = 2.8125 \text{ W}$$

Load Resistance (Ω)	Load Power (W)
4	2.25
8	2.88
12	3.00
16	2.94
20	2.81

Graph = 7 marks

22

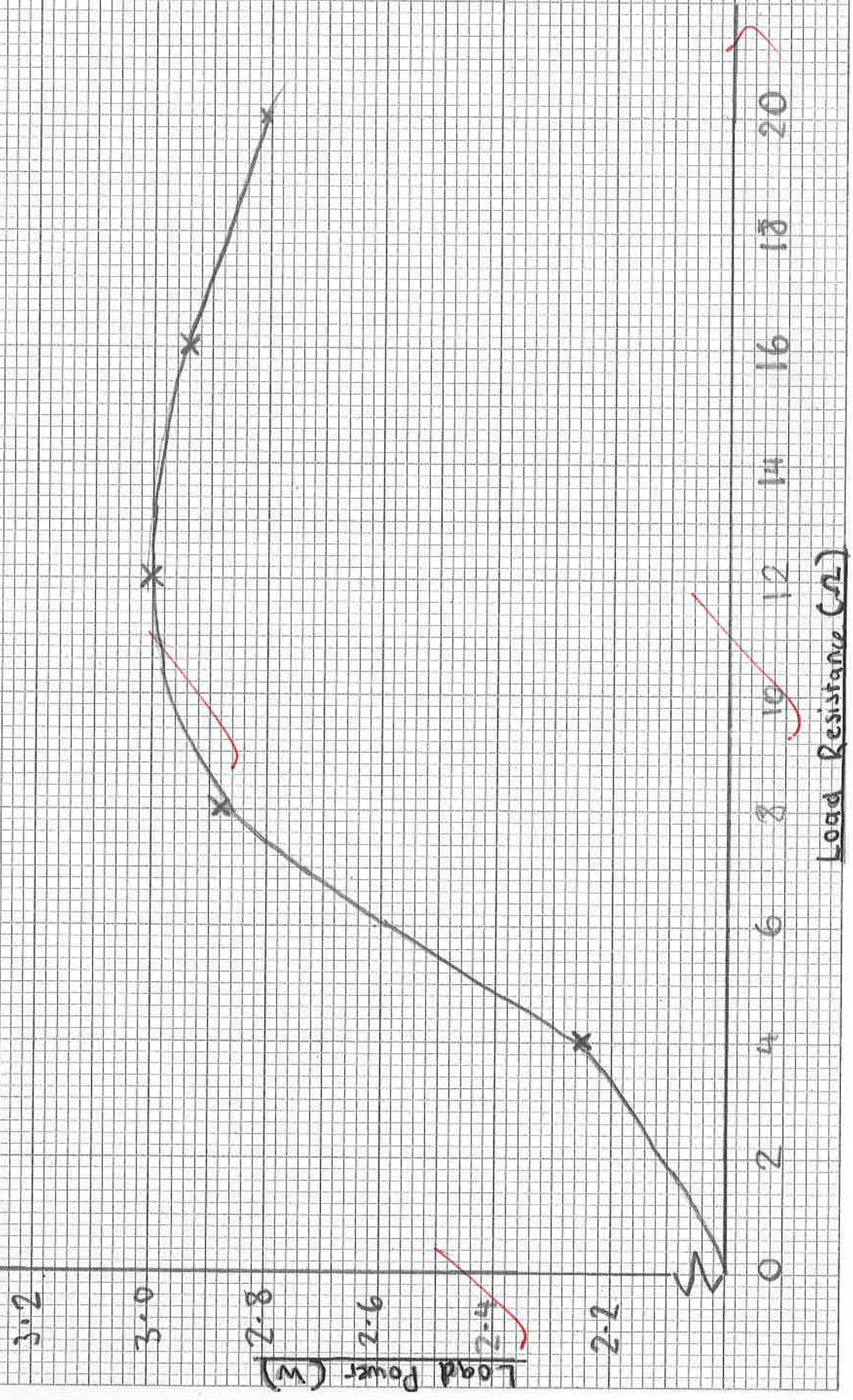
5

b Plotted on graph paper

Q5 = 22

c) Semiconductors
MOSFETs

A graph to show the load power against load resistance
 at different values when using a 12V battery with an internal resistance
 of 12Ω



Question No.

Examiner Only