

SURNAME: LEES

FORENAME(S): OWEN

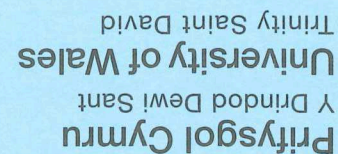
12 Pages

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 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	222 1115
2	Title of Examination Paper	ELECTRONICS 1
3	Module Code	SGEE 4003
4	Date and Time of Examination	15.05.23 09.30
5	Examination Venue	GRAMG
6	Seat Number	35
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
A1	19
~~B2~~ A2	
A3	9
AS	3
A6.	
A7	
A8	
A9	
B1	
B3	
Total	31

31 - mark confirmed



Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

CYFENW:

ENW(AU) CYNTAF:

Llenwch, plygwh a seliwh
(gweler nodyn 2 isod)

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

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholwyr nail ai anwybyddu sgript annarllennadwy, neu drefnu iddi! gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgriennwch eich atebion mewn linc.

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.

7. Os ddefnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyblywr/gwyblywr.

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.

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

(See the other side for English version)

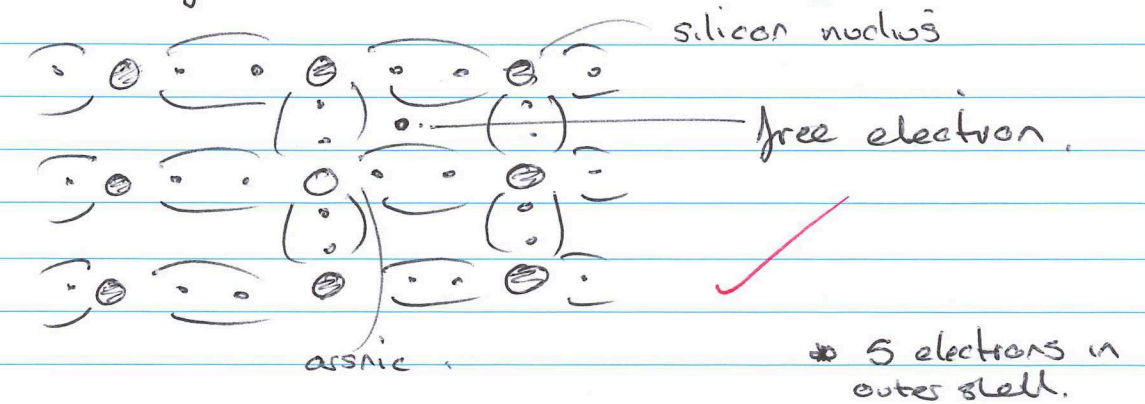
[illegible]

Part A

A1

An intrinsic semiconductor material such as silicon is made up of 14 electrons and 14 protons. There are 2 electrons orbiting the first 'shell', 8 in the second and 4 in the outer.

Silicon can be 'doped' to produce an extrinsic semiconductor with the insertion of a material such as arsenic*. This will give the new 'doped' material free electrons in order to be extrinsic.



A2

$$R_s = \frac{V_s - V_D}{I_F}$$

$$R_s = \frac{6 - 2.2}{8 \times 10^{-3}}$$

$$= 475 \Omega. \checkmark$$

A3

$$\beta = \frac{I_c}{I_b} \quad \therefore I_c = \beta I_b$$

$$= 90 \times (30 \times 10^{-6})$$

$$= 2.7 \text{ mA} \checkmark = 2.7 \text{ mA}$$

$$I_E = I_c + I_b \quad I_E = 30 \times 10^{-6} + 2.7 \times 10^{-3} = 57 \mu\text{A}$$

$$= 2.7 \text{ mA} \quad = 2.73 \text{ mA}$$

A4.

$$A_v = \frac{R_F + R_S}{R_S}$$

$$= \frac{30 \times 10^3 + 1.5 \times 10^3}{1.5 \times 10^3} \quad \times$$

$$= 21$$

A5

$$A_v = \frac{R_F + R_S}{R_S} - \frac{R_F}{R_S}$$

$$= \frac{30 \times 10^3 + 1.5 \times 10^3}{1.5 \times 10^3} \quad \checkmark \text{CE.}$$

$$= 30 \text{ K} \times \text{V} \quad \times$$

A6

$$\frac{V_{out}}{V_{in}} = - \frac{R_F}{R_S}$$

$$\frac{V_{out}}{200 \mu V} = - \frac{330 \text{ K}\Omega}{(4.7 \text{ K}\Omega + 56 + 12) \text{ K}\Omega} \quad \times$$

$$\frac{V_{out}}{200 \mu V} = - 4.54 (200 \times 10^{-6}) \quad \times$$

$$V_{out} = 907.8 \mu V$$

①

①

①

①

1

A7

$$f_c = \frac{1}{2\pi R_F C}$$

$$= \frac{1}{(2\pi)(100 \times 10^3)(0.033 \times 10^{-6})}$$

$$= 48.229 \text{ Hz} \quad \checkmark$$

③

A8

Binary	Dec	Hex
1000 1101	813 $\times$	8D $\checkmark$
1100 0911	123	C3 $\times$
1011 0111	117 $\times$	B7

Bin	Dec	Hex
0000	0	
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

②

15

A9

$$F = \bar{A}\bar{B} + ABC + \bar{A}BD + \bar{A}BCD$$

AB \ CD	00	01	11	10
00	1 ✓	1 ✓	1 ✓	1 ✓
01	0	1 ✗	1 ✗	0
11	0	0	1 ✓	1 ✓
10	0	0 ✗	1 ✓	0

Part B

B1

a)

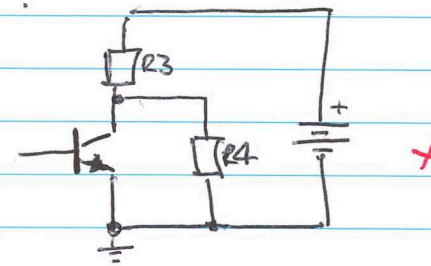
Fig B1.1 is a rectifying circuit. On the positive pulses D1, D2 and ~~D3~~ will charge the capacitor. On the negative pulses D4, ~~D3~~ will charge the capacitor.

(2)

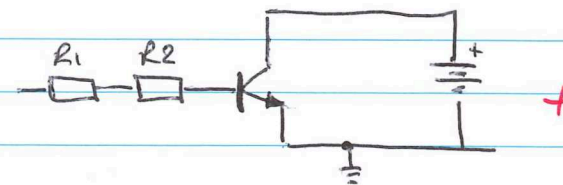
(3)

b)

DC.



AC



(0)

(2)

(3)

c) There are 5 stages by which to measure the bandwidth of an amplifier using standard equipment

1. Set the frequency of the oscilloscope to 1 kHz to find V_{pp} .

2. Find the -3db level by adjusting voltage to 0.7 V.

3. Find the low frequency bandwidth by measuring the -3db level below the V_{pp} .

4. Find the high frequency bandwidth by measuring the -3db level above the V_{pp} .

5. Subtract the low frequency bandwidth from the high frequency bandwidth to find the bandwidth of the amplifier.

d)

$$V_{cc} = 14V$$

$$I_Q = 2mA$$

$$h_{FE} = 120$$

$$\text{Input } V = 5mV \text{ } 25kHz.$$

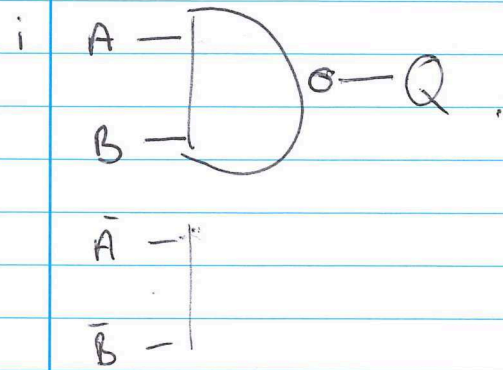
$$R_1 = \frac{V}{I} = \frac{14}{2 \times 10^{-3}} = 7000 \Omega.$$

$$R_2 = \frac{V_{pk}}{I} = \frac{5 \times 10^{-3}}{2 \times 10^{-3}} = 2.5 \Omega. \quad \times$$

$$h_{FE} = 1$$

B3

a)

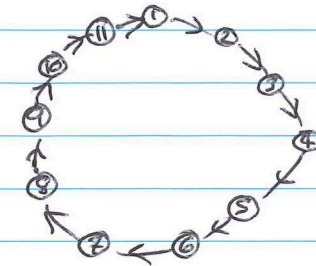
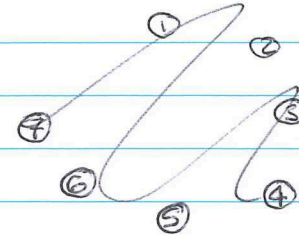


x

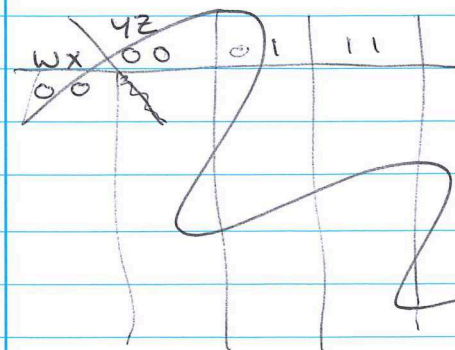
- b)
- No change
 - change
 - solid state
 - No change

↓

c)



Current state	next state	w	x	y	z
1	2	0	0	0	1
2	3	0	0	1	0
3	4	0	0	1	1
4	5	0	0	0	0
5	6	0	1	0	1
6	7	0	1	1	0
7	8	0	0	0	0
8	9	1	0	0	0
9	10	1	0	0	1
10	11	1	0	0	0
11	1	1	0	0	1
1		1	1	0	0



x

Current State	Next State	w	x	y	z
1	2	0	0	0	0
2	3	0	0	0	1
3	4	0	0	1	0
4	5	0	0	1	1
5	6	0	1	0	0
6	7	0	1	0	1
7	8	0	1	1	0
8	9	0	1	1	1
9	10	1	0	0	0
10	11	1	0	0	1
11	1	1	0	1	0
		1	0	1	1
		1	1	0	0
		1	1	0	1
		1	1	1	1

wx \ yz	00	01	11	10
00				
01				
11				
10				

Current State	Next State	w	x	y	z	w'	x'	y'	z'
0	1	0	0	0	0	0	0	0	1
1	2	0	0	0	1	0	0	1	0
2	3	0	0	1	0	0	0	1	1
3	4	0	0	1	1	0	1	0	0
4	5	0	1	0	0	0	1	0	1
5	6	0	1	0	1	0	1	1	0
6	7	0	1	1	0	0	1	1	1
7	8	0	0	0	1	1	0	0	0
8	9	1	0	0	0	1	0	0	1
9	10	1	0	0	1	1	0	1	0
10	11	1	0	1	0	0	0	0	0
11	1	1	0	1	1	0	0	0	1
12	x	1	1	1	1	x	x	x	x

wx \ yz	00	01	11	10
00				
01				
11				
10				

3