

SURNAME: Wood

Oliver

Examination Answer Books

12 Pages

1. Please give the information requested in the boxes below.

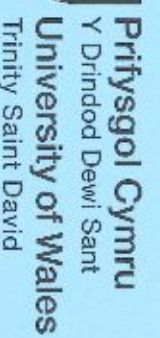
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.

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	1708179/1
2	Title of Examination Paper	Electronics 1
3	Module Code	PSDE4004
4	Date and Time of Examination	9:30 21/5/18
5	Examination Venue	69250
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

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

3. Rhaid i'r atebion fod newn llawysgrifen ddarlennadwy. Gall yr Arholwyr mall ai arwybyddu sgrifft amarlennadwy, neu drefnu iddi gael ei threipio a chael yr ymgaisydd i dalu.

4. Ysgriennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

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

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 Mociwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

[illegible]

**Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)**

CYFENNY:

ENW(AU) CYNTAF:

(See the other side for English version)

B1.

a) $V_{CC} = 9V$, $I_Q = 1.1mA$, $h_{FE} = 75$

R_C, R_E, R_1 and R_2

$$R_C = \frac{\frac{1}{2} \times V_{CC}}{I_Q} = \frac{\frac{1}{2} \times 9}{1.1 \times 10^{-3}} = 4090.9 \Omega \quad (4.09k\Omega)$$

$V_{E_{max}} \approx 10\% \text{ of } V_{CC}$

$$\therefore V_E = 9 \times 0.1 = 0.9V$$

$$I_E = I_Q = I_C = 1.1mA$$

$$R_E = \frac{V_E}{I_E} = \frac{0.9}{1.1 \times 10^{-3}} = 818.18 \Omega$$

$$I_B = \frac{I_C}{h_{FE}} = \frac{1.1 \times 10^{-3}}{75} = 14.66 \mu A \quad \left(\frac{73}{5000000} \right)$$

$$V_B = V_E + 0.7 = 0.9 + 0.7 = 1.6V$$

$$I_{E_{max}} = I_B \times 10 = 14.66 \mu A \times 10 = 146.6 \mu A \quad (146.6 \times 10^{-6})$$

$$R_1 = \frac{V_{CC} - V_B}{I_{B_{max}}} = \frac{9 - 1.6}{146.6 \times 10^{-6}} = 50685.2 \Omega \quad (51k\Omega)$$

$$R_2 = \frac{V_B}{I_{B_{max}}} = \frac{1.6}{146.6 \times 10^{-6}} = 10959.2 \Omega \quad (11k\Omega)$$

b) $\beta = 80$ $I_B = 15 \mu A$

$$\beta = \frac{I_C}{I_B} \therefore I_C = \beta \times I_B = 80 \times 15 \times 10^{-6}$$

$$\therefore I_C = 1.2mA$$

$$I_E = I_C + I_B = (1.2 \times 10^{-3}) + (15 \times 10^{-6})$$

$$I_E = 1.22 \times 10^{-3} \quad (1.22mA)$$

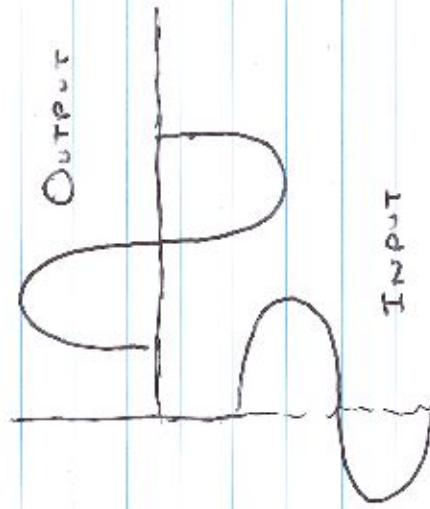
B1.

B1

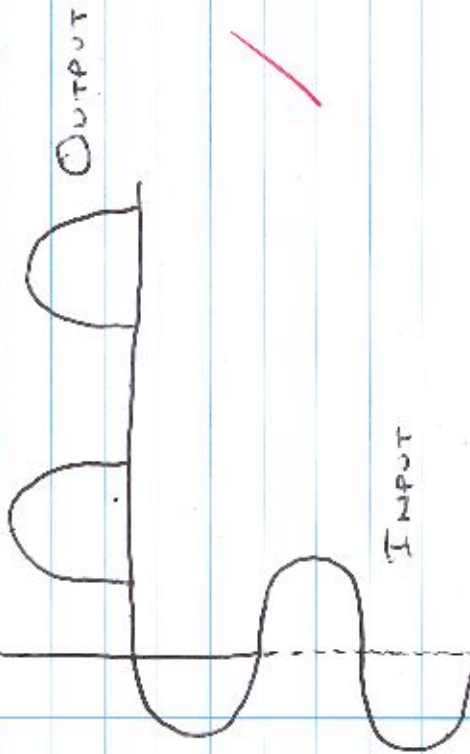
c)

Class A

Class A amplifiers provide a replica of the input waveform (as seen in the diagram below). By doing this no distortion is found however the efficiency is around 20% which means a lot of energy is lost due to heat.

Class B

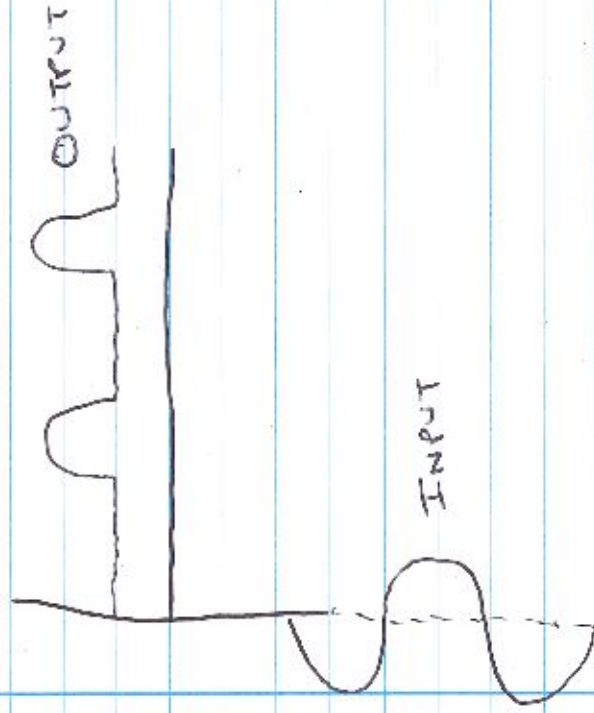
Class B amplifiers only produce 50% of the original waveform. This therefore makes this amplifier more efficient at about 50%, however 50% distortion is also introduced.



c)

Class C

Class C amplifiers produce less than 50% of the original waveform. This therefore provides a very high efficiency of around 80%, however, the distortion is extremely high.



D)

The impedance of an amplifier can be found by using a generator (Function), a variable resistor and an oscilloscope. The variable resistor is connected between the function generator and the amplifier. The Vpp of the amplifier should be calculated, then the Resistor should be set to 0 and the function generator will be programmed to give a high distorted signal. The value of the variable resistor is then changed until the oscilloscope shows 50% of the original Vpp. The value of the variable resistor at this point is equal to the impedance.

4 1/2

6

6

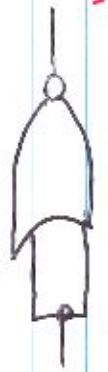
61 e)



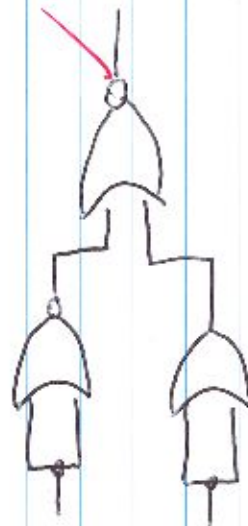
The 4 Impedances seen are Z_{supply} , Z_{input} , Z_{output} and Z_{load} . Ideally All Impedances should be as low as possible.

63 a)

i) NOT



ii) AND



iii) OR



iv) NAND



5

7

3

63 b)

i) $F = \overline{A+B} + \overline{BC} + \overline{A(B+C)}$
 $F = \overline{AB} + \overline{BC} + \overline{AB} + \overline{AC} + \overline{ABC}$

ABC	00	01	11	10
F	1	1	0	0

ABC	01	10	00	01
F	1	1	1	1

$F = \overline{A} + \overline{BC}$

ii) $G = \overline{A+B} + \overline{ABC} + \overline{A+BC}$
 $G = \overline{AB} + \overline{ABC} + \overline{AB} + \overline{AC}$

ABC	01	11	01	01
G	1	1	1	1

ABC	00	01	11	10
G	1	1	0	0

$G = \overline{AC} + \overline{AB}$

4

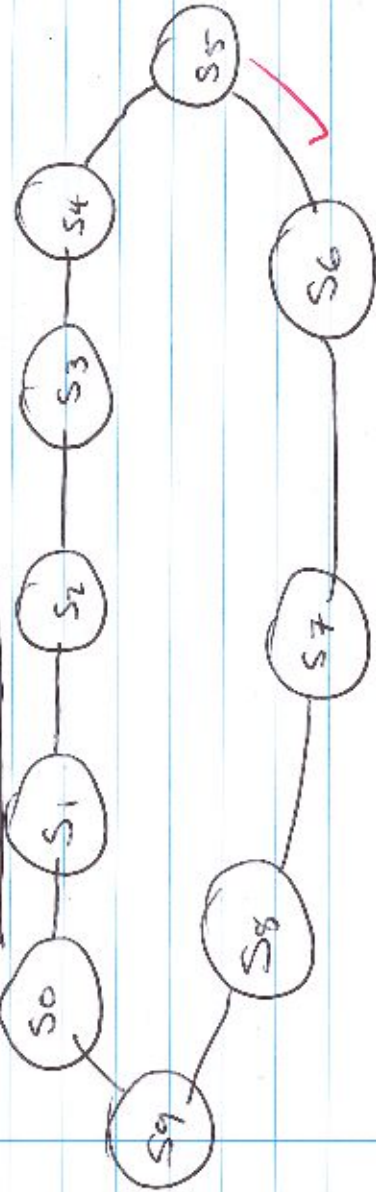
2

State Allocation

83) c)

$S_0 = 2$	$S_4 = 6$	$S_8 = 10$
$S_1 = 3$	$S_5 = 7$	$S_9 = 11$
$S_2 = 4$	$S_6 = 8$	
$S_3 = 5$	$S_7 = 9$	

State Diagram



State	QA
S0	0000
S1	0001
S2	0010
S3	0011
S4	0100
S5	0101
S6	0110
S7	0111
S8	1000
S9	1001

QA Table

State	QA
S0	0000
S1	0001
S2	0010
S3	0011
S4	0100
S5	0101
S6	0110
S7	0111
S8	1000
S9	1001

QA and Output Binary table

State	Next state	QA	QA+	Output
S0	S1	0000	0001	0
S1	S2	0001	0010	0
S2	S3	0010	0011	0
S3	S4	0011	0100	0
S4	S5	0100	0101	0
S5	S6	0101	0110	0
S6	S7	0110	0111	0
S7	S8	0111	1000	0
S8	S9	1000	1001	0
S9	S0	1001	0000	0

Binary:

2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011

KARNAUGH MAPS

QA+	00	01	11	10
00	0	0	0	0
01	0	0	1	1
11	1	1	1	1
10	1	1	1	1

$$QA^+ = A + BC$$

$$QB^+ = B\bar{C} + \bar{A}BC$$

QB+	00	01	11	10
00	0	0	0	0
01	0	1	0	0
11	1	1	1	1
10	1	1	1	1

B3)

C) Q_C^+

	00	01	11	10
00	1	1	0	0
01	1	1	0	0
11	x	x	x	x
10	1	1	x	x

$$Q_C^+ = \overline{C}$$

Therefore Boolean expressions are:-

$$Q_A^+ = A + BC$$

$$Q_B^+ = B\overline{C} + \overline{A}BC$$

$$Q_C^+ = \overline{C}$$

A1)



A PN junction is the joint between P-type material and N-type material. Due to the majority carrier of electrons in the N-type material and the holes available in the P-type material the electrons diffuse from the N-type material to the P-type material. As on the holes begin to become full, a wall of electrons is formed between the materials. This is called the depletion layer. In order for this depletion layer to be overcome around 0.7V is needed (silicon).

A2)

A Zener diode is utilized to control breakdown voltage. At first the Zener diode provides a good barrier to backwards voltage however when the breakdown voltage is reached the backwards current increases rapidly.

A3)

$$R_S = \frac{V_S - V_D}{I_F} \quad R_S = 2 \times \Omega$$

$$V_D = 2.2 \text{ V}$$

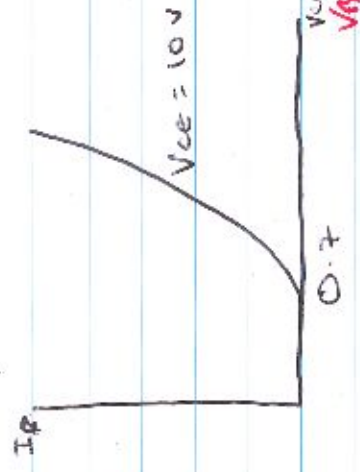
$$V_S = 9 \text{ V}$$

$$\therefore I_F = \frac{V_S - V_D}{R_S}$$

$$I_F = \frac{9 - 2.2}{2000}$$

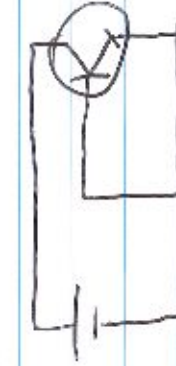
$$I_F = 3.4 \text{ mA}$$

A4)



The common emitter input can be found by keeping the value of V_{CE} at 10V and then changing the value of I_B and then plotting a graph (shown above). It can be seen that the graph acts in the same way as a diode. This is because a transistor is also a forward biased PN junction.

A6)



2



3



x

A8)

Hex to Octal

$117 \div 8 = 14 \text{ r } 6$
 $14 \div 8 = 1 \text{ r } 7$
 Octal = 176

Hex to decimal

$117 \times 8^2 = 64$
 $1 \times 8^1 = 8$
 $7 \times 8^0 = 7$
 79

Hex to Octal

$1213 \div 8 = 151 \text{ r } 6$
 $151 \div 8 = 18 \text{ r } 8$
 $18 \div 8 = 2 \text{ r } 2$
 $2 \div 8 = 0 \text{ r } 2$
 = 6322

Binary to Hex

$1110 \quad 1110$
 $14 \quad 14$
 $E \quad E = EE$

Hex to Octal

$114 \div 8 = 17 \text{ r } 6$
 $17 \div 8 = 2 \text{ r } 3$
 $2 \div 8 = 0 \text{ r } 2$
 236

Truth Table

A	B	C	D
0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

A9) A Decoder is type of converter, A Decoder can be utilised to convert from Binary to Octal. This would be achieved by having a decoder with 10 inputs and 8 outputs. A decoder can only have one input and 1 output working at a time.

A10) A JK Flip flop can toggle, switch, set and reset.

0001	set
0010	
0100	toggle
0000	

A11) Binary to Hex
Hex Binary to Hex

$1100 \quad 1101$
 $8+4 = 12 \quad 8+4+1 = 13$
 $10 = A$
 $11 = B$
 $12 = C$

In Hex = CDH

Binary to decimal

11001101
 $128+64+8+4+1 = 205_{10} \text{ (Decimal)}$

Octal to binary

$25_8 \quad 2 \quad 5$
 $010 \quad 101$

Therefore in binary = 010101

A8) Octal to Decimal

$$2 \times 8^1 = 16$$

$$5 \times 8^0 = 5$$

$$\underline{21}$$

Octal to Hex

$$25 \div 16 = 1 \text{ R } 9 \quad 16 = 1 \times 16$$

$$3 \div 16 = 0 \text{ R } 3 \quad 16 = 0 \times 16$$

$$13_{10} = 13_H$$

Binary	Octal	Decimal	Hex
11001101	6322	205	CD
010101	25	21	15
1101110	7072	238	EE
1001111	126	79	4F

Decimal to Binary

$$238 \div 2 = 119 \text{ R } 0$$

$$119 \div 2 = 59 \text{ R } 1$$

$$59 \div 2 = 29 \text{ R } 1$$

$$29 \div 2 = 14 \text{ R } 1$$

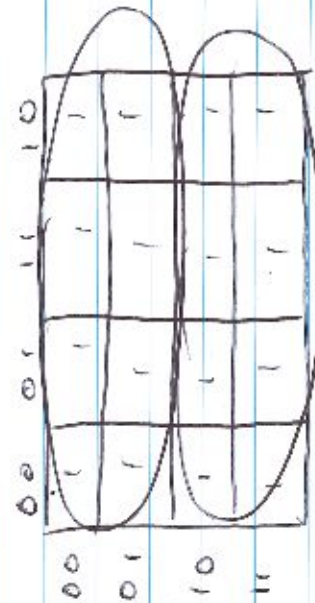
$$14 \div 2 = 7 \text{ R } 0$$

$$7 \div 2 = 3 \text{ R } 1$$

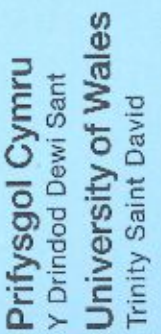
$$3 \div 2 = 1 \text{ R } 1$$

$$1 \div 2 = 0 \text{ R } 1$$

A7)



$$F = \overline{A} + A$$



SURNAME: Davies

FORENAME(S): Jed Lloyd.

Examination Answer Books

12 Pages

1. Please give the information requested in the boxes below.

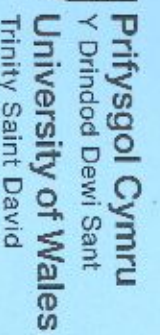
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.

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	1708151/1
2	Title of Examination Paper	Electronics 1
3	Module Code	PSDE 4004
4	Date and Time of Examination	21 st May 2018 9.30 - 11.30
5	Examination Venue	Coleg Sir Gâr 68250
6	Seat Number	
7	Number of Answer Books handed in	

(Llawer yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

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

3. Rhaid i'r atebion fod mewn llawysgriflen ddarlennadwy. Gall yr Arholwyr naili ai arwyblyddu sgrïot annarlennadwy, neu drefnu iddi gael ei throipio a chael yr ymgaisydd i dalu.

4. Ysgirfennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwyo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

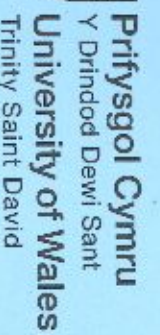
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylwr/gwylwyr.

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 Myfyrwr	
2	Teitl y Papur Arholiad	
3	Cod y Mudiad	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

[illegible]

(See the other side for English version)



**Llenwch, plygwch a seliwch
(aweler nodyn 2 isod)**

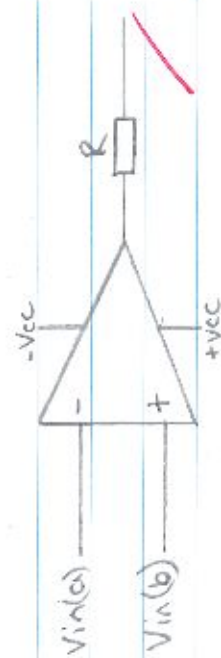
CYFENWY:

ENW(AU) CYNTAF:

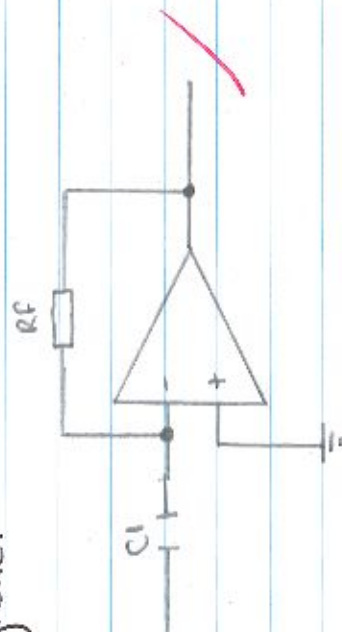
ENW(AU) CYNTAF:

AS.

Comparator



Integrator



A7. $F = \overline{A}\overline{B}D + \overline{A}C + A\overline{B}\overline{C}\overline{D} + \overline{B}C\overline{D} + A\overline{B}\overline{C} + B\overline{C}\overline{D}$ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

	CD			
AB	00	01	11	10
00			1	1
01			1	1
11	1		1	
10	1	1		

$$F = \overline{A}CD + A\overline{B}C + \overline{A}C\overline{D} + \overline{A}C + \overline{A}C$$

Binary	Octal	Decimal	Hex
11001101	315	205	CD
10101	25	21	15
11101110	356	238	EE
10110111	267	183	B7

A8.

A8. Workings.

	Decimal
128 64 32 16 8 4 2 1	
11001101	$128 + 64 + 8 + 4 + 1 = 205$

Octal

1100101

315

Hex

11001101

13421

C D

A = 10

B = 11

Octal	Binary	Hex
25	$\begin{array}{r} 21421 \\ 10 \overline{) 10101} \end{array}$	10101

256 128 64 32 16 8 4 2 1
0 1 1 1 0 1 1 1 0.

Decimal = 238.

Binary Octal

1110110 21421421

 1110110

 356

Hex $\begin{array}{r} 14 \\ 14 \\ \hline 34215421 \\ 11101110 \end{array}$ E E

Binary $\begin{array}{r} 7 \\ 8215421 \\ \hline 0110111 \end{array}$

Decimal $\begin{array}{r} 7 \\ 2142 \\ \hline 10110111 \\ 267 \end{array}$

$28 \ 64 \ 32 \ 16 \ 8 \ 4 \ 2 \ 1$
 $10 \ 11 \ 0 \ 1 \ 1 \quad 128 + 32 + 16 + 4 + 2 + 1 = 183.$

A9. An ~~8~~ encoder is a converter. Converting Octal, Decimal or Hexadecimal to Binary. Only one input is active at a given time and writes a word to the output. The number of inputs is equivalent to the base number of the input.

3

A10. JK Flip-Flop.

Inputs		Outputs	
J	K	Q	$\bar{Q}$
0	0	0	1
0	0	1	0
1	0	0	1
1	0	1	0
0	1	0	1
0	1	1	0
1	1	0	1
1	1	1	0

NO CHANGE

B32.

a) High Input impedance
Low Output impedance.

1/2

1/2

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

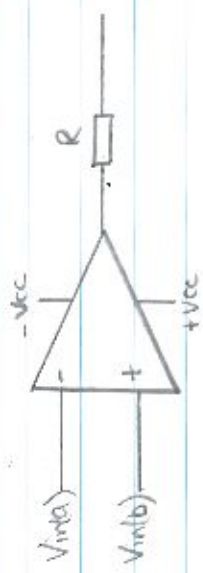
$$R_F = 200K$$

$$R_S = 18K$$

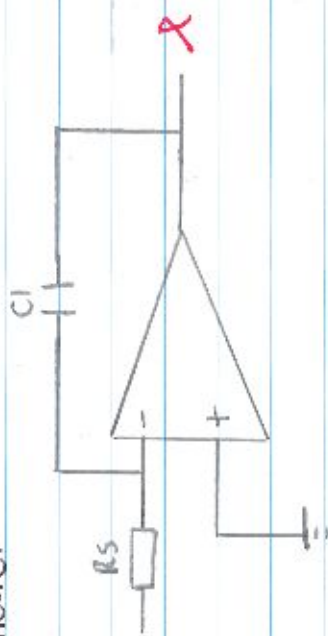
$$= \frac{(200 \times 10^3) + (18 \times 10^3)}{18 \times 10^3}$$

$$= 12.11$$

c) Comparator



Differentiator



$$f_2 = \frac{f_{unity}}{A_{CL}}$$

$$f_{unity} = 30 \times 10^6$$

$$A_{CL} = 800$$

$$f_2 = \frac{30 \times 10^6}{800}$$

$$\text{Bandwidth} = 37.5 \text{ KHz}$$

$$f_{max} = \frac{\text{Slew Rate}}{2\pi \times V_{pk}}$$

$$\text{Slew Rate} = 1.2$$

$$= 1.2M \times 10^6$$

$$= 1200000$$

$$V_{pk} = V_{cc} - 2$$

$$= 9 - 2 = 7$$

$$f_{max} = \frac{1200000}{2 \times \pi \times 7}$$

$$f_{max} = 27.3 \text{ KHz}$$

e) cont.

$$f_{\max} = \frac{1200000}{2 \times \pi \times 200 \times 10^3}$$

$$= 955 \text{ KHz.}$$

f)

$$A_{CL} = -\frac{R_F}{R_i}$$

$$1 + \frac{R_F}{R_i}$$

$$= -\frac{180 \times 10^3}{2.4 \times 10^3}$$

$$= -75.$$

$$V_{out} = V_{in} \times A_{CL}$$

$$= (150 \times 10^{-6}) \times 75.$$

$$= -11.25 \text{ mV}$$

g)

$$A_{CL} = -\frac{R_F}{R_i + R_{source}}$$

$$i) R_{source} = 1 \Omega$$

$$A_{CL} = \frac{-100 \times 10^3}{(1000 + 1)}$$

$$= -99.9$$

ii)

$$R_{source} = 8 \text{ k}\Omega$$

$$A_{CL} = \frac{-100 \times 10^3}{(1000 + 8000)}$$

$$= -11.11.$$

h)

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

Where,

$$R_F = 100 \times 10^3$$

$$C = 33 \times 10^{-9}$$

$$= \frac{1}{2 \times \pi \times (100 \times 10^3) \times (33 \times 10^{-9})}$$

$$= 48.23.$$

$$= 48 \text{ Hz.}$$

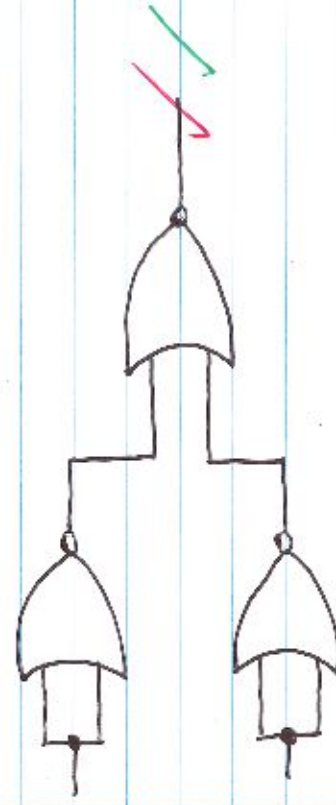
B3

a)

i) NOT



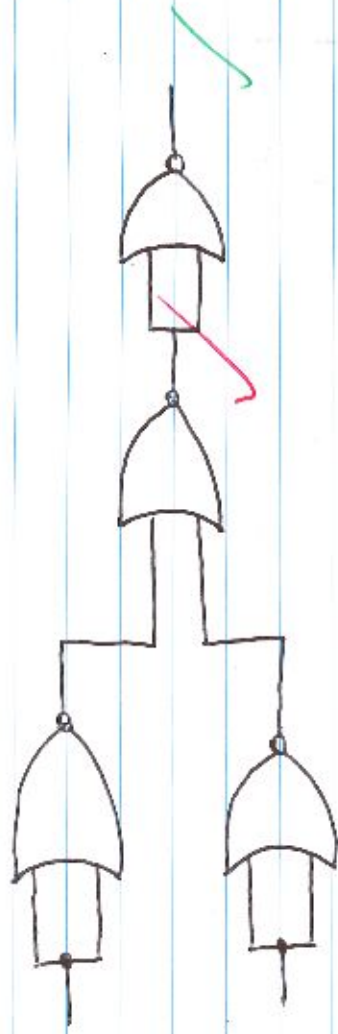
ii) AND



iii) OR



iv) NAND



(4)

c) Firstly each output must be allocated a state number.

$S_0 = 2$
 $S_1 = 3$
 $S_2 = 4$
 $S_3 = 5$
 $S_4 = 6$
 $S_5 = 7$
 $S_6 = 8$
 $S_7 = 9$
 $S_8 = 10$
 $S_9 = 11$

$$F = \overline{A + \overline{B}} + \overline{BC} + \overline{A(B+C)}$$

$$F = \overline{A}B + \overline{BC} + \overline{A}BC$$

AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	0	0
10	1	1	0	0

$$F = \overline{A} + \overline{C}$$

$$G = \overline{A + \overline{B}} + \overline{ABC} + \overline{A + (BC)}$$

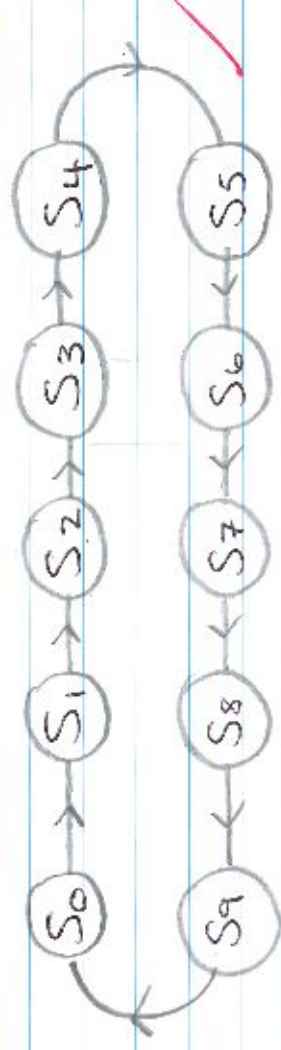
$$G = \overline{A}B + \overline{ABC} + \overline{AB} + \overline{AC}$$

AB	00	01	11	10
00	0	0	1	1
01	1	1	1	1
11	0	0	0	0
10	0	0	0	0

$$G = \overline{A}B + \overline{AC}$$

(3)

From this a state diagram can be produced.



(3)

A state table can be produced. Output W, X, Y and Z correspond to the binary outputs from 2 to 11.

c) cont.

Current	Next	Current				Next				Outputs			
		QA	QB	QC	QD	QA ⁺	QB ⁺	QC ⁺	QD ⁺	W	X	Y	Z
S ₀	S ₁	0	0	0	0	0	0	0	1	0	0	1	0
S ₁	S ₂	0	0	0	1	0	0	1	0	0	0	1	1
S ₂	S ₃	0	0	1	0	0	0	1	1	0	1	0	0
S ₃	S ₄	0	0	1	1	0	1	0	0	0	1	0	1
S ₄	S ₅	0	1	0	0	0	1	0	1	0	1	1	0
S ₅	S ₆	0	1	0	1	0	1	1	0	0	1	1	1
S ₆	S ₇	0	1	1	0	0	1	1	1	1	0	0	0
S ₇	S ₈	0	1	1	1	0	1	0	0	1	0	0	1
S ₈	S ₉	1	0	0	0	1	0	0	1	1	0	1	0
S ₉	S ₀	1	0	0	1	0	0	0	0	1	0	1	1

From the state table above the Karnaugh Maps can be created.

QA⁺

AB ^{CD}	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	x	x	x	x
10	1	0	x	x

QB⁺

AB ^{CD}	00	01	11	10
00	0	0	1	0
01	1	1	0	1
11	x	x	x	x
10	0	0	x	x

QC⁺

AB ^{CD}	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	x	x	x	x
10	0	0	x	x

QD⁺

AB ^{CD}	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	x	x	x	x
10	1	0	x	x

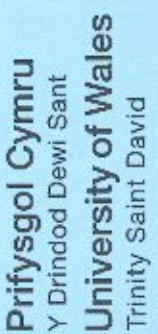
Using the Karnaugh Maps the boolean expressions can then be derived.

$$QA^+ = A\bar{C}\bar{D} + BCD$$

$$QB^+ = \bar{A}\bar{B}C\bar{D} + B\bar{D} + B\bar{C}$$

$$QC^+ = \bar{A}\bar{C}\bar{D} + \bar{A}C\bar{D}$$

$$QD^+ = \bar{C}\bar{D} + \bar{A}\bar{D}$$



**Complete, fold and seal
(see note 2 below)**

SURNAME: ~~Donkwa~~ ~~Donkwa~~ EVANS

FORENAME(S): DANIEL ROSS

Examination Answer Books

12 Pages

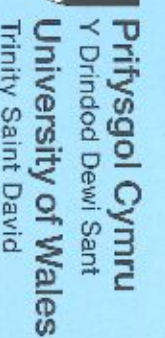
Instructions to Candidates

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.

Office Use	List the numbers of the questions you have attempted
	A3
	A7
	A8
	B2
	B3
	A
	B2
	B3
	Total

1	Student Number	DEU23200 170813411
2	Title of Examination Paper	Electronics 1
3	Module Code	PDSE 4004
4	Date and Time of Examination	09.30-11.30
5	Examination Venue	68250
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

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 at iello i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Atholwyr naill ai anwybyddu sgrifi annallennadwy, neu drefnu iddi gael ei thielpo a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras 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 defnyddir mwy nag un llyfr, rhwngwch hwy gyda i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyflwr/gwyflwyr.
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.

Llenwch, plygwch a seliwch
(aweler nodyn 2 isod)

CYFENW:

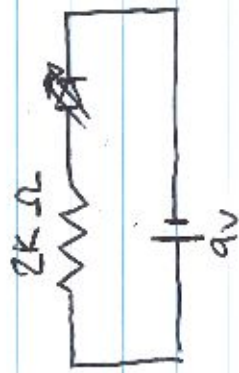
ENW(AU) CYNTAF:

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

[illegible]

(See the other side for English version)

A3.



Current through resistor and LED (Circuit diagram)

$$V = I \times R$$

$$I = \frac{V}{R}$$

$$I = \frac{9V}{2k\Omega}$$

$$I = 4.5mA$$

✓

0

$$A7. F = A \cdot \bar{B} \cdot D + \bar{A}C + A\bar{B}C + \bar{B} \cdot C \cdot D + A \cdot \bar{B} \cdot \bar{C} + BCD$$

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

$$F = A + \bar{B} + D + \bar{A}C + AD + BD + \bar{C}D + B + C + D + A + \bar{B}C + B + C + D$$

AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

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

✓

0 2

A8. Binary

Octal

Decimal

Hex

11001101₂315₈205₁₀~~55~~ CD00010101₂

258

21₁₀

55

11101110₂356₈238₁₀

EE

10110111₂267₈183₁₀

B7

$$21 \div 16 = 1r5$$

$$5$$

$$238 \div 16 = 14r14$$

$$14$$

5 2

128 64 32 16 8 4 2 1

$$205 \div 8 = 25r5$$

$$28 \times 8 = 16$$

$$1213$$

$$25 \div 8 = 3r1$$

$$5 \times 8 = 5$$

$$1213$$

$$1 + 4 + 8 + 128 + 64 =$$

$$= 21$$

$$1213$$

$$000110101$$

$$183 \div 8 = 22r7$$

$$205 \div 16 = 12r13$$

$$1213$$

$$111011110$$

$$22 \div 8 = 2r6$$

$$298 \div 8 = 3r5$$

$$1213$$

$$10110111$$

$$2$$

$$3$$

$$1213$$

B2.

- A. * High input impedance ✓
 * low output impedance ($< 200\Omega$) ✓
 * High open loop voltage gain ✓
 * Voltage gain constant of a range of frequencies ✓
 * Very high CMRR ($< 90dB$) ✓

⑤
③

B.

$$R_F = 200K \quad R_i = 18K$$

$$A_{CL} = 1 + \frac{R_F}{R_i}$$

$$A_{CL} = 1 + \frac{200K}{18K}$$

$$A_{CL} = 12.01 \quad \checkmark$$

③ ✓

C.

$$d. f_z = \frac{f_{unity}}{A_{CL}}$$

$$f_z = \frac{30MHz}{800}$$

$$f_z = 37.5KHz \quad \checkmark$$

③ ✓

e.

$$f_{max} = \frac{\text{Slew rate}}{2\pi \times V_{PK}} \quad \checkmark$$

$$f_{max} = \frac{1,200,000}{2\pi \times 100mV}$$

$$f_{max} = 1.19KHz \quad \times$$

① ✓

$$f. A_{CL} = \frac{-R_F}{R_i}$$

$$A_{CL} = \frac{-180K}{2.7K}$$

$$A_{CL} = -75 \quad \times$$

$$V_{out} = A_{CL} \times V_{in}$$

$$V_{out} = -75 \times 150 \times 10^{-6}$$

$$V_{out} = -11.25mV \quad \checkmark$$

②
① 1/2

$$g. A_{CL} = \frac{-R_F}{R_i}$$

$$i. A_{CL} = \frac{-100K}{1K + 1K.1}$$

$$A_{CL} = -50 \quad \times$$

$$ii. A_{CL} = \frac{-R_F}{R_i}$$

$$A_{CL} = \frac{-100K}{1K + 8K}$$

$$A_{CL} = -11.1 \quad \checkmark$$

① ✓

$$h_0 \quad f_c = \frac{1}{2\pi RC}$$

$$f_c = \frac{1}{2\pi \times 100K \times 33 \times 10^{-9}}$$

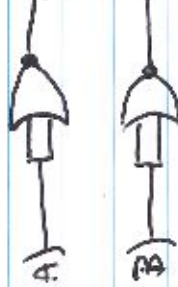
$$f_c = 48.2 \text{ Hz}$$

B3.

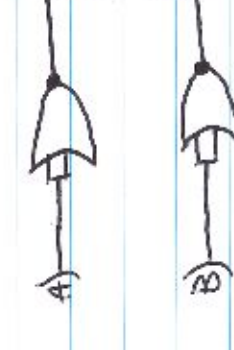
a.

IG
(2) IG, 2 IG
2 IG, 1 IG
(2) IG, 2 IG, 1 IG

i) NOT :- A)  (A) ✓

ii) AND :- A)  (F = AB) ✓

iii) OR :- A)  (F = A + B) ✓

iv) NAND :- A)  (F = A-bar B-bar) ✓

3 ✓

4 ✓

- b) i. $F = \overline{A+B} + \overline{B+C} + \overline{A(B+C)}$
 $F = A \cdot \overline{B} + B + \overline{C} + \overline{A} + \overline{(B \cdot C)}$
 $F = A \cdot \overline{B} + B + C + \overline{A \cdot B} + \overline{A \cdot C}$

AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

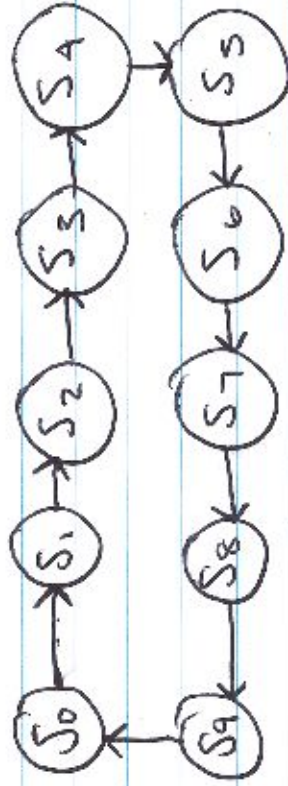
$$F = \overline{A} + \overline{B} + \overline{C}$$

- ii. $G = A + \overline{B} + \overline{A} \cdot \overline{B} + A + \overline{B} + C$
 $G = A \cdot \overline{B} + \overline{A} \cdot \overline{B} + \overline{A} \cdot B + C$
 $G = A \cdot \overline{B} + \overline{A} \cdot \overline{B} + \overline{A} \cdot B + C$

AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

$$G = A + \overline{B} + C$$

- Step 0 = 2 Count
 Step 1 = 3 Count
 Step 2 = 4 Count
 Step 3 = 5 Count
 Step 4 = 6 Count
 Step 5 = 7 Count
 Step 6 = 8 Count
 Step 7 = 9 Count
 Step 8 = 10 Count
 Step 9 = 11 Count



Step Number	Current	Next	QA	QB	QC	QD	QA ⁺	QB ⁺	QC ⁺	QD ⁺	Outputs
S0	0000	0001	0	0	0	0	0	0	0	0	W X Y Z
S1	0001	0010	0	0	0	1	0	0	0	1	0 1 0 1
S2	0010	0011	0	0	1	0	0	0	1	0	0 1 0 0
S3	0011	0100	0	1	0	0	0	1	0	0	0 1 1 0
S4	0100	0101	0	1	0	1	0	1	0	0	0 1 1 1
S5	0101	0110	0	1	1	0	0	1	1	0	1 1 0 0
S6	0110	0111	0	1	1	1	0	1	1	1	1 1 0 1
S7	0111	1000	1	0	0	0	1	0	0	0	1 0 0 0
S8	1000	1001	1	0	0	1	1	0	0	0	1 0 0 1
S9	1001	1010	1	0	1	0	1	0	1	0	1 0 1 0
S10	1010	1011	1	0	1	1	1	0	1	1	1 0 1 1
S11	1011	1100	1	1	0	0	1	1	0	0	1 1 0 0
S12	1100	1101	1	1	0	1	1	1	0	0	1 1 0 1

$$QA^+ = BCD + A + AD + AC$$

$$QB^+ = CD + B + BD + BC$$

$$QC^+ = BD + BC + AD + AC + ACD$$

$$QD^+ = B + BC + A + AC + C$$

$$QA^+ = BCD + A + AD + AC$$

AB \ CD	00	01	11	10
00				
01				
11	x	x	x	x
10	1	1	1	1

$$QB^+ = CD + B + BD + BC$$

AB \ CD	00	01	11	10
00				
01	1	1	1	1
11	x	x	x	x
10				

$$QC^+ = BD + BC + AD + AC + ACD + C$$

AB \ CD	00	01	11	10
00				
01	1	1	1	1
11	x	x	x	x
10				

$$QD^+ = B + BC + A + AC + C$$

AB \ CD	00	01	11	10
00				
01	1	1	1	1
11	x	x	x	x
10				

$$QA^+ = A + BCD$$

$$QB^+ = \bar{A}B + CD$$

$$QC^+ = C + \bar{A}BD + A\bar{B}D$$

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



**Complete, fold and seal
(see note 2 below)**

SURNAME: Gough

FORENAME(S): JORDAN MARC

Examination Answer Books

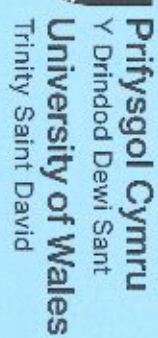
12 Pages

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.

1	Student Number	1708174/1
2	Title of Examination Paper	Electronics 1
3	Module Code	PSDE4004
4	Date and Time of Examination	21 st May 2018 9:30 - 11:30
5	Examination Venue	68250 Coleg Sir Gar
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwngch yr holl wybodaeth y gofynnir andani yn y blychau isod.
2. Rhwngch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef ai selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr naill ai arwybyddu sgrifft annarlennadwy, neu drefnu iddi gael ei theipio a chael yr ymgaisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw ffas nodiadau yn y llyfr atebion a thynnu llinell drywyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwyr/gwylywyr.
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 Myfyrwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

[illegible]

(See the other side for English version)

**Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)**

CYFENWY:

ENW(AU) CYNTAF-

A1.



A depletion layer is formed from a P-N junction. When the free electrons at the N-junction combine with the holes in the P-junction, a current will flow. However, this will only happen once a required voltage, 0.7V, has been met.

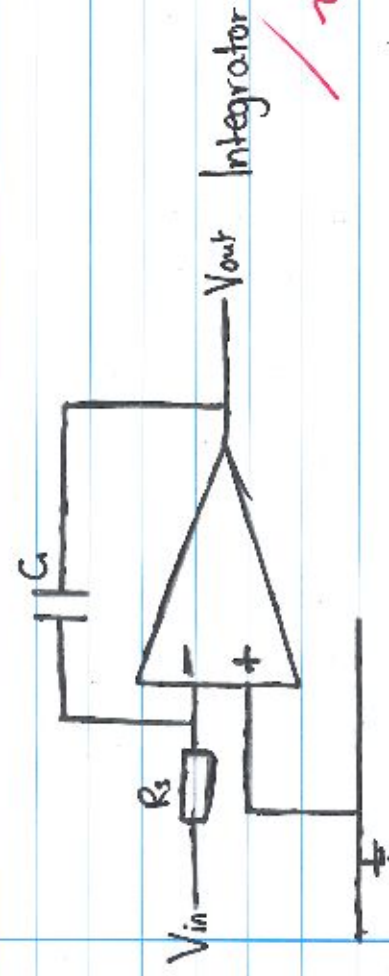
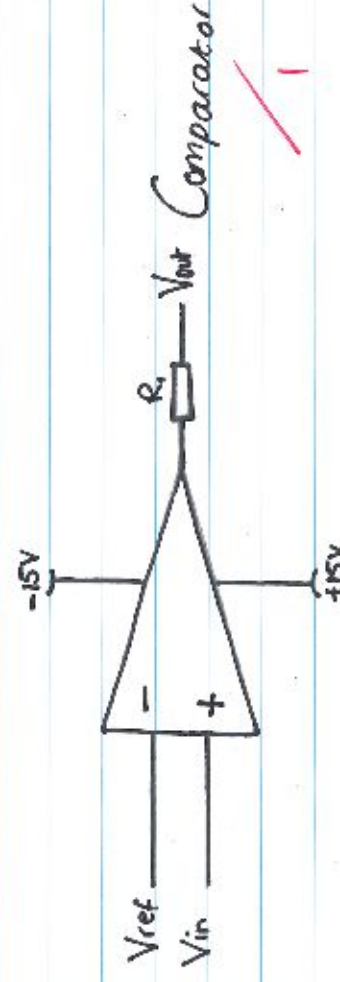
A2. A zener diode operates in the reverse-breakdown region. When the voltage across the diode reaches the breakdown voltage, the current through the diode increases rapidly.

$$A3. I = \frac{V_s - V_D}{R} = \frac{9 - 2.2}{2000}$$

$$I = 3.4 \times 10^{-3} \text{ mA or } 3.4 \text{ mA}$$

A4.

A5.



A6.

A7.

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

$$F = A \cdot \bar{C} \cdot \bar{D} + A \cdot \bar{B} \cdot \bar{C} + CD + AC$$

A8.

Binary	Octal	Decimal	Hex
11001101 ₂	315	205	CD
10101	25	21	15
10011011 ₂	235	238	EE
10110111	267	183	B7H

$011 \ 001 \ 101$
 $3 \ 1 \ 5$
 $2 \ 5$
 $010 \ 101$
 $(8 \times 16) + (7 \times 1)$
 $= 183$
 $235 \ 267$
 16
 $283 \ 205$
 $21 \ 256$
 $238 \ 256$
 $14 \ 16$
 $238 - 256 = 2746 = 1$
 2746
 $238 = 14$
 16
 $238 - (16 \times 14) = 14$
 14
 $110 = 6$
 $101 = 5$
 $011 = 3$
 $B = 1011$
 $7 = 0111$
 $B = 1011$
 $11B = 10011011$
 $1 = 001$
 $110 = 6$
 $101 = 5$
 $011 = 3$

An 8-to-3 line encoder is used to convert from Octal, ~~hexadecimal or decimal~~ into binary. The encoder has one input, but must have a number of select inputs equal to the base of the number.

J	K	Q	$\bar{Q}$	Comment
0	0	0	0	No CHANGE
0	0	1	1	
0	1	0	1	SET
0	1	1	1	
1	0	0	0	RESET
1	0	1	0	
1	1	0	1	TOGGLE
1	1	1	0	

B2.

a. Infinite voltage gain - The voltage gain will be infinite.
 Infinite input impedance - The input resistance of integrated circuits is infinite.

Infinite bandwidth - The signal from DC to infinity will amplify at any frequency, typically in the MHz range.

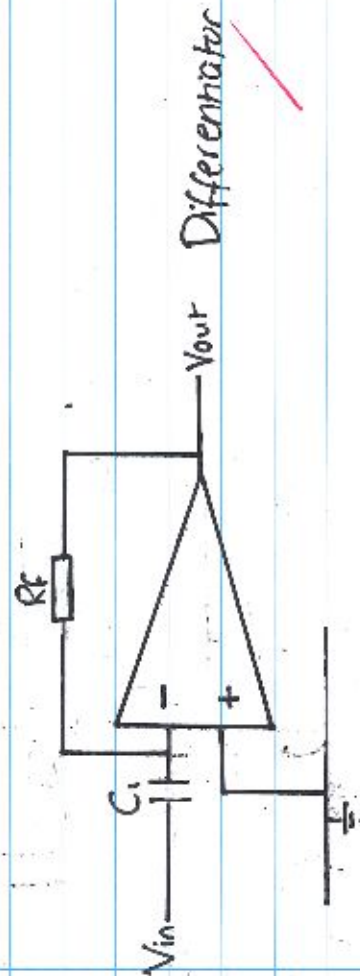
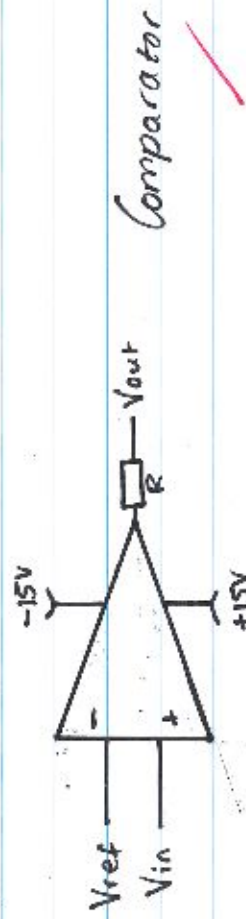
Zero output impedance - The output impedance will be zero

Zero offset - The output will be zero volts when there is no input. This can be achieved by applying a small compensating voltage.

$$b. A_f = \frac{R_f + R_s}{R_s} = \frac{200 + 18}{18} = \frac{218}{18}$$

$$A_f = 12.1$$

C.

d. $f_2 = f_{unity}$

$$f_2 = \frac{A_{OL} A_{CL}}{800} = \frac{30 \times 10^6}{800} = 37.5 \text{ kHz}$$

$$e. f_{max} = \frac{\text{Slew rate}}{2\pi \times V_{pk}}$$

$$\text{Slew rate} = 1.2 \text{ V}/\mu\text{s} \times 10^6 = 1.2 \times 10^6$$

$$V_{pk} = 9 - 2 = 7$$

$$f_{max} = \frac{1.2 \times 10^6}{(2 \times \pi \times 7)} = 27.3 \text{ kHz}$$

$$f. \text{ Average Gain} = 1 + \left(\frac{R_f}{R_s} \right)$$

$$= 1 + \frac{180}{2.4} = 76$$

$$\text{Output voltage} = 76 \times 150 \times 10^{-6} = 0.0114 \text{ V} = 11.4 \text{ mV}$$

$$g. \text{ Gain} = -\frac{R_f}{(R_i + R_s)}$$

$$= -\frac{100 \times 10^3}{(1 \times 10^3 + 1)} = -100$$

$$ii. \text{ Gain} = \frac{-100 \times 10^3}{(1 \times 10^3 + 8 \times 10^3)} = -11$$

$$h. f_c = \frac{1}{2\pi R_f C}$$

$$= \frac{1}{2 \times \pi \times 100 \times 10^3 \times 33 \times 10^{-9}} = 48.2 \text{ Hz}$$

63.

a.

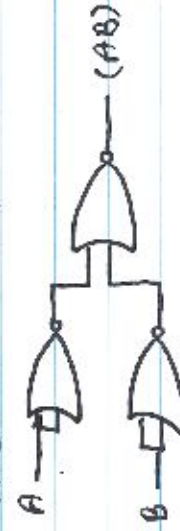
i.

NOT



ii.

AND



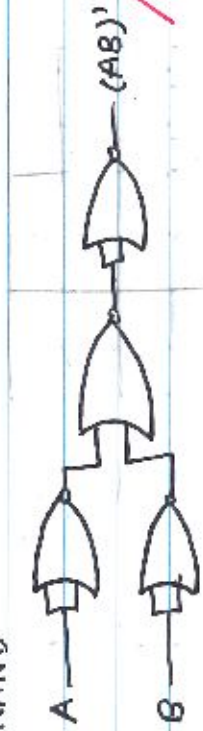
iii.

OR



iv.

NAND



b.

i.

$$F = \overline{A+B} + \overline{BC} + \overline{A(B+C)}$$

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

$$= \overline{A+B} + \overline{BC} + \overline{A}\overline{B}\overline{C}$$

AB	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

BC	00	01	11	10
0	1	1	1	1
1	1	1	1	1

$$F = BC + \overline{AC}$$

X

ii.

$$G = \overline{A+B} + \overline{ABC} + \overline{A+B}\overline{C}$$

$$= \overline{A+B} + \overline{ABC} + \overline{A+B}\overline{C}$$

$$= \overline{A+B} + \overline{ABC} + \overline{A+B}\overline{C}$$

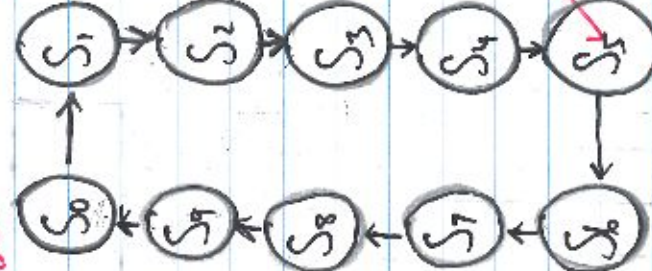
BC	00	01	11	10
0	1	1	1	1
1	1	1	1	1

$$G = \overline{A+B}$$

C.

$S_0 = \text{Count } 2, S_1 = \text{Count } 3, S_2 = \text{Count } 4, S_3 = \text{Count } 5,$
 $S_4 = \text{Count } 6, S_5 = \text{Count } 7, S_6 = \text{Count } 8, S_7 = \text{Count } 9, S_8 = \text{Count } 10,$
 $S_9 = \text{Count } 11$

State	Inputs				Next	Outputs					
	Current										
	Q_3	Q_2	Q_1	Q_0	Q_3^+	Q_2^+	Q_1^+	Q_0^+	X	Y	Z
S_0	0	0	0	0	0	0	1	0	0	1	0
S_1	0	0	0	1	0	0	1	0	0	1	1
S_2	0	0	1	0	0	1	0	0	1	0	0
S_3	0	0	1	1	0	1	0	0	1	0	1
S_4	0	1	0	0	0	1	0	1	0	1	0
S_5	0	1	0	1	0	1	0	1	1	1	1
S_6	0	1	1	0	1	1	1	0	0	0	0
S_7	0	1	1	1	1	1	0	0	1	0	1
S_8	1	0	0	0	1	0	1	1	0	1	0
S_9	1	0	0	1	1	0	0	0	0	1	1



The first step of designing a counter is to determine the number that will be counted on each step. This can be done using a state table. The state table can also be used to develop Karnaugh maps, which are used to find the required boolean expressions.

Q_A^+	AB	00	01	11	10
00	00				
01	01			1	
11	11	1	1	1	1
10	10	1	1		

$$Q_A^+ = A\bar{C}\bar{D} + BCD$$

Q_B^+	AB	00	01	11	10
00	00				
01	01	1	1		
11	11	1	1	1	1
10	10	1	1		

$$Q_B^+ = \bar{B}\bar{C} + BCD + B\bar{C}\bar{D}$$

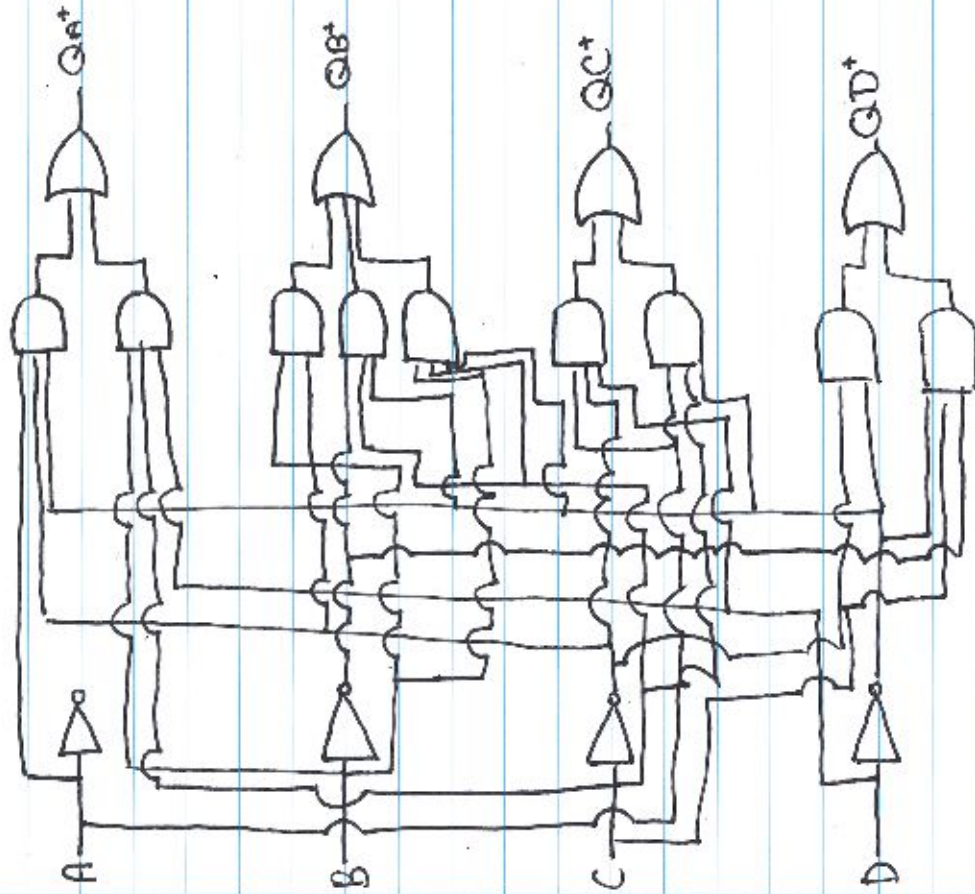
Q_C^+	AB	00	01	11	10
00	00				
01	01		1	1	
11	11	1	1	1	1
10	10	1	1		

$$Q_C^+ = \bar{A}\bar{C}\bar{D} + \bar{A}C\bar{D}$$

Q_D^+	AB	00	01	11	10
00	00				
01	01		1	1	
11	11	1	1	1	1
10	10	1	1		

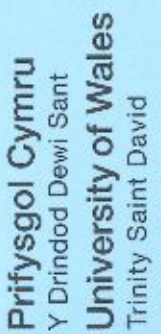
$$Q_D^+ = \bar{C}\bar{D} + \bar{B}\bar{C}\bar{D}$$

Shown above are the Karnaugh maps and the boolean expressions required to develop a counter that counts repeatedly from 2 to 11.



Shown above is the logic circuit derived from the State table and Karnaugh maps.

42



SURNAME:

FORENAME(S):

Examination Answer Books

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.

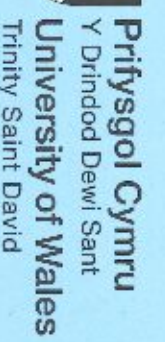
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).

8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

List the numbers of the questions you have attempted	Office Use
A 7	
A 8	
B 1. a	
B 1. C	
B 3. a	
B 3. b	
B 3. C	
A	9
B 1	9½
B 3	20
Total	39½

1	Student Number	1503510/2
2	Title of Examination Paper	Electronics 2
3	Module Code	PSDE: 4004
4	Date and Time of Examination	Mon 21 st May 2018 9:30 - 11:30
5	Examination Venue	68250
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler y'r ochr arall am y fersiwn Cymraeg)



12 Tüdalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwngch yr holl wybodaeth y gofynnir amdan i yn y blychau isod.
2. Rhwngch eich enw yn y lle a ddarparwyd ar y dde, plygwch et a'i sellio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrifft annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgaisydd i dalu.

4. Ysgrifennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

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

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

[illegible]

(See the other side for English version)

Llenwch, plygwch a seliwch
(aweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

A7 $F = A\bar{B}\bar{D} + \bar{A}C + A\bar{B}\bar{C}D + \bar{B}CD + A\bar{B}\bar{C} + \bar{B}CD$

A	B	C	D	Output
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

AB	CD	$\bar{C}\bar{D}$	$\bar{C}D$	$C\bar{D}$	CD	$\bar{A}C$
00	00	1	1	1	1	1
00	01	1	1	1	1	1
00	10	1	1	1	1	1
00	11	1	1	1	1	1
01	00	1	1	1	1	1
01	01	1	1	1	1	1
01	10	1	1	1	1	1
01	11	1	1	1	1	1
10	00	1	1	1	1	1
10	01	1	1	1	1	1
10	10	1	1	1	1	1
10	11	1	1	1	1	1
11	00	1	1	1	1	1
11	01	1	1	1	1	1
11	10	1	1	1	1	1
11	11	1	1	1	1	1

$F = A\bar{C}\bar{D} + \bar{C}D + \bar{A}C$

A.8/

Binary	Octal	Decimal	Hex
11001101	315	1205	C D
010101	25	21	15
11101110	356	238	EE
10110111	267	183	B7

Conversions.

~~Octal to Binary~~ Binary to octal

$$\begin{array}{r} 421421 \\ |011|001|101 \\ 315 \end{array}$$

Octal - Binary

$$\begin{array}{r} 421421 \\ 010|101 \\ 25 \end{array}$$

Decimal - Binary

$$\begin{array}{r} 238 \\ 256 \quad 128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ \underline{010110110} \\ 11101110 \end{array}$$

Hex - Binary

$$\begin{array}{r} 84218421 \\ 10111011 \\ 117 \end{array}$$

Binary - octal

$$\begin{array}{r} 421421421 \\ |011|101|110 \\ 356 \end{array}$$

Binary - Decimal

$$\begin{array}{r} 128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ 11001101 \\ 128+64+8+4+1=205 \end{array}$$

$$128+64+8+4+1=205$$

$$\begin{array}{r} 256 \quad 128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ 10110111 \\ 128+32+16+4+2+1=183 \end{array}$$

Binary - Hex

$$\begin{array}{r} 421421421 \\ 11001101 \\ 12C \end{array}$$

$$\begin{array}{r} 128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ 1101110 \\ 128+32+16+4+2+1=183 \end{array}$$

PART B

B1.a

$$V_{CC} = 9V \quad I_Q = 1.1mA \quad h_{FE} = 75$$

$$R_L = \frac{1/2 V_{CC}}{I_Q}$$

$$= \frac{4.5}{1.1mA}$$

$$R_L = 4.09 k\Omega$$

$$R_E = \frac{10\% V_{CC}}{I_Q}$$

$$= \frac{0.9}{1.1mA}$$

$$R_E = 818.2 \Omega$$

$$I_B = \frac{I_Q}{h_{FE}}$$

$$= \frac{1.1mA}{75}$$

$$I_B = 14.67 \mu A$$

$$V_B = V_E + 0.7$$

$$= 0.9 + 0.7$$

$$V_B = 1.6V$$

Continue on next page.

~~Resonance~~

$$I_{R1} = I_B \times 10$$

$$= 14.67 \times 10$$

$$I_{R1} = 146.7 \mu A$$

$$R1 = \frac{V_{CC} - V_B}{I_{R1}}$$

$$= \frac{9 - 1.6}{146.7}$$

$$R1 = 50.44 \text{ k}\Omega$$

$$R2 = \frac{V_B}{I_B}$$

$$= \frac{1.6}{14.67}$$

$$R2 = 109.1 \text{ }\Omega$$

B1.C

Class A transistor Amplifier has 20% efficiency with a high resonance.

Class B transistor Amplifier has 50% efficiency and 50% resonance.

Class C transistor Amplifier has a high efficiency and a low resonance.

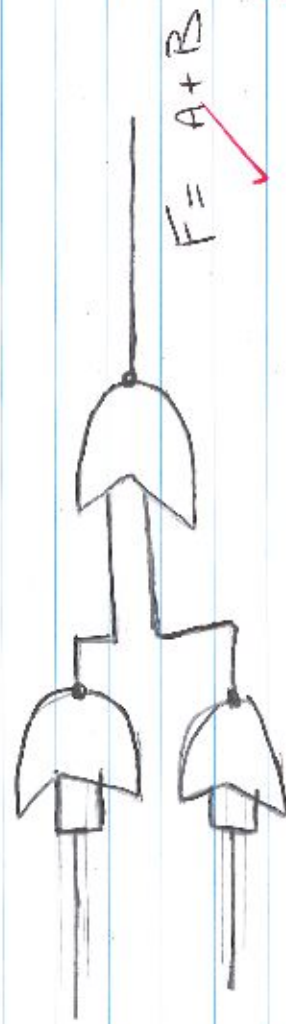
B3

a)

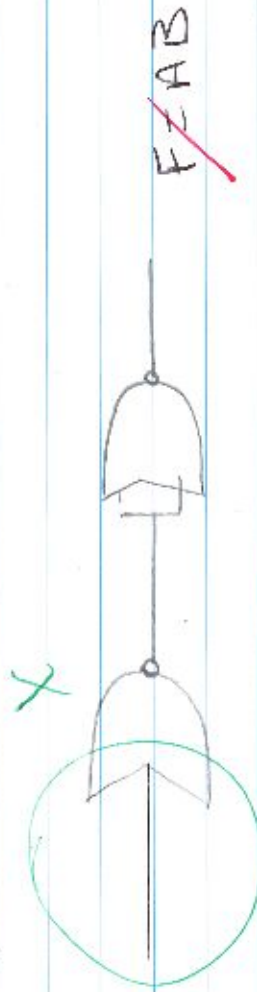
NOT



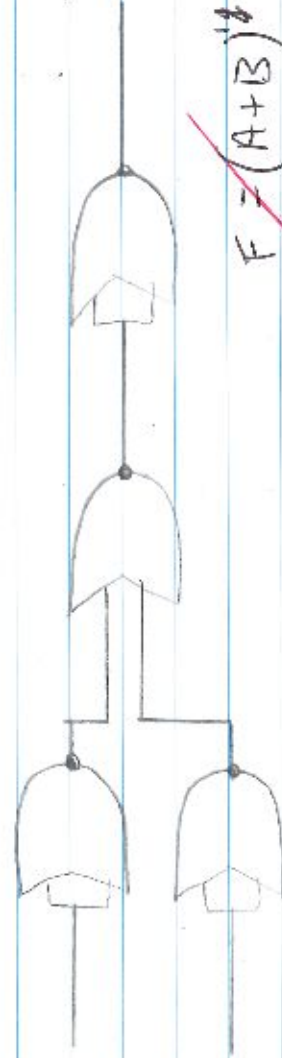
AND



OR



NAND



$$F = (A + B)'$$

2

4
3 1/2

B3 bii)

$$F = \overline{A+B} + BC + \overline{A(B+C)}$$

$$\downarrow \quad \downarrow$$

$$\overline{A+B} \quad \overline{A(B+C)}$$

$$\downarrow \quad \downarrow$$

$$\overline{A} \cdot \overline{B} \quad \overline{A} \cdot \overline{B} \cdot \overline{C}$$

$$\overline{A} \cdot \overline{B} + \overline{B} \cdot \overline{C} + \overline{A} \cdot \overline{B} \cdot \overline{C}$$

	A	B	C	D	Output
0	0	0	0	0	1
1	0	0	1	0	1
2	0	1	0	0	0
3	0	1	1	0	0
4	1	0	0	0	1
5	1	0	1	0	1
6	1	1	0	0	0
7	1	1	1	0	0
8	1	1	1	1	0
9	1	1	1	1	1

CD	00	01	11	10
AB	00	1	0	0
AB	01	1	1	1
AB	11	0	1	1
AB	10	0	0	0

$$F = \overline{A} \cdot \overline{B} + \overline{B} \cdot \overline{C} + \overline{A} \cdot \overline{B} \cdot \overline{C}$$

$$G = \overline{A+B} + \overline{A} \cdot \overline{B} + \overline{A+B}$$

$$\downarrow \quad \downarrow$$

$$\overline{A+B} \quad \overline{A(B+C)}$$

$$\downarrow \quad \downarrow$$

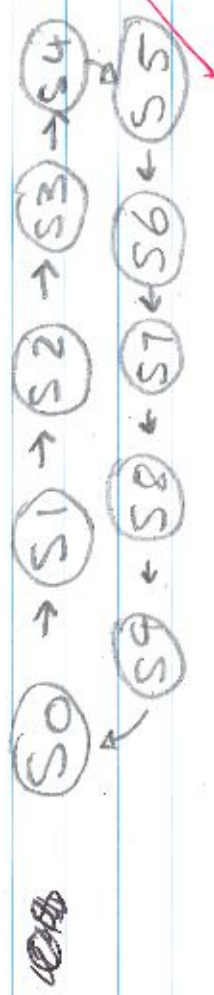
$$\overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{B} \cdot \overline{C} + \overline{A} \cdot \overline{B} \cdot \overline{C}$$

	A	B	C	D	Output
0	0	0	0	0	1
1	0	0	1	0	1
2	0	1	0	0	1
3	0	1	1	0	1
4	1	0	0	0	0
5	1	0	1	0	0
6	1	1	0	0	0
7	1	1	1	0	0
8	1	1	1	1	0
9	1	1	1	1	0

CD	00	01	11	10
AB	00	1	1	1
AB	01	1	1	1
AB	11	0	0	0
AB	10	0	0	0

$$G = \overline{A} \cdot \overline{B}$$

3c) Steps = 0-9



Truth table.

Current	Next	Current				Next				Output			
		QA	QB	QC	QD	QA	QB	QC	QD	W	X	Y	Z
S0	S1	0	0	0	0	0	0	0	1	0	0	1	0
S1	S2	0	0	0	1	0	0	1	0	0	0	1	1
S2	S3	0	0	1	0	0	0	1	0	0	1	0	0
S3	S4	0	0	1	1	0	1	0	0	0	1	0	1
S4	S5	0	1	0	0	0	1	0	1	0	1	1	0
S5	S6	0	1	0	1	0	1	1	0	0	1	1	1
S6	S7	0	1	1	0	0	1	1	1	1	0	0	0
S7	S8	0	1	1	1	1	0	0	0	1	0	0	1
S8	S9	1	0	0	0	1	0	0	1	0	0	0	0
S9	S0	1	0	0	1	0	0	0	0	0	0	1	0

Q_A	Q_B	Q_C	Q_D	Q_D	Q_C	Q_B	Q_A
$\bar{A}\bar{B}$	00	01	11	10			
$\bar{A}B$	00	0	0	0			
$A\bar{B}$	01	0	0	1	0		
AB	11	1	1	1	1	1	1
$A\bar{B}$	10	1	1	0	1	1	0

$$A\bar{C}\bar{D} + BCD$$

$$Q_A = A\bar{C}\bar{D} + BCD$$

Next Page.

Q_B	Q_C	Q_D	Q_D	Q_C	Q_B
$\bar{A}\bar{B}$	00	01	11	10	
$\bar{A}B$	00	0	0	1	0
AB	01	1	1	0	1
$A\bar{B}$	11	1	1	1	1
AB	10	0	0	1	1

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

Q_C	Q_D	Q_D	Q_C	Q_D	Q_C
$\bar{A}\bar{B}$	00	01	11	10	
$\bar{A}B$	00	0	0	1	1
AB	01	0	0	1	1
$A\bar{B}$	11	1	1	1	1
AB	10	0	0	1	1

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

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

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

Q_D	Q_C	Q_D	Q_C	Q_D	Q_C
$\bar{A}\bar{B}$	00	01	11	10	
$\bar{A}B$	00	0	0	1	1
AB	01	0	0	1	1
$A\bar{B}$	11	1	1	1	1
AB	10	0	0	1	1

$$Q_D = 1A$$

4



Complete, fold and seal
(see note 2 below)

SURNAME: Phillips

FORENAME(S): Jonathan David

Examination Answer Books

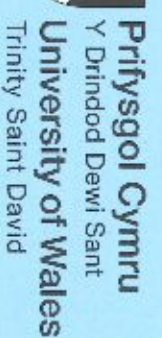
12 Pages

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.

(Gweler yr ochr arall am y fersiwn Cymraeg)

1	Student Number	17081601
2	Title of Examination Paper	Electronics 1
3	Module Code	PSE4004
4	Date and Time of Examination	21/05/2018 9:30 - 11:30
5	Examination Venue	Centre NO. 6850
6	Seat Number	
7	Number of Answer Books handed in	



Llyfr Atebion Arholiadau

12 Tudalen

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 at i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgriflen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgript annarllenadwy, neu drefnu iddi gael ei thelpio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras 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 defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwyr/gwyllwyr.
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.

**Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)**

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF:

1	Rhif Myfyriwr	
2	Teti 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	

[illegible]

(See the other side for English version)

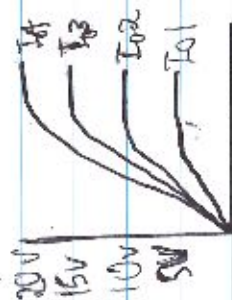
[illegible]

A2. A Zener diode is a type of diode that can be made to go against the current from any direction. x

$$+3.5k - 2k, \quad \frac{1}{2}V_{\text{div}} = 2.2V_{\text{div}} = 9$$

$$V_2 - V_{\text{load}} = 9 - 2 = 6.8 \text{ V} = V_{\text{LED}}$$

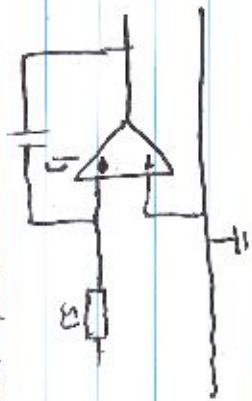
$$\text{Current} = V_{LED} / \Omega = 6.8V / 2k = 3.4mA$$



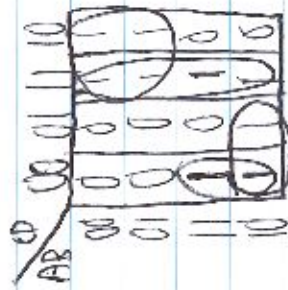
Q5.	comparator
-----	------------



Integrator



A7. $f = ABD + AC + ABCD + B.C.D + A.B.C + BCD$

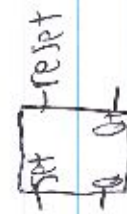


$f = \bar{A}.C + CD + AC\bar{D} + ABC$

Binary	Octal	Decimal	Hex
11001101	315	205	CD5
10101101	257	21	15
11110101	356	237	F9
11001101	22	18	12

A9. An 8 to 3 line encoder can convert a decimal, hexadecimal, or octal value into binary.

A10. A JK flip flop is a component with logic gates inside.



Reset

B2

a. Infinite gain - An Ideal op-amp can have any amount of voltage gain

Infinite Bandwidth - can keep an equal frequency across all emitters

Infinite input resistance - can take in a signal with less power

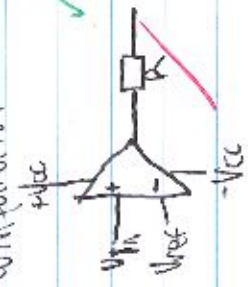
Small output impedance - can create a high power signal

Zero offset - There would be absolutely no output without there being any input.

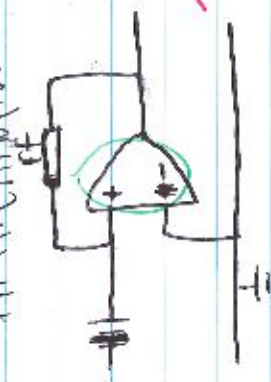
b. $(A \times R) = \text{gain}$

$200K + 10K = 403.7$

c. Comparator



Differentiator



d. $f_{unity} = 30 \text{ MHz}$, $ACL = 800$

$f_a = \frac{f_{unity}}{ACL} = \frac{30 \times 10^6}{800} = 37.5 \text{ kHz}$

$$e. f_{\max} = \frac{\text{Slew rate}}{2\pi \times V_{pk}}$$

$$\text{Slew rate} = 1.2 \text{ V}/\mu\text{s} \text{ or } 1.2 \times 10^6$$

$$V_{pk} = 200 \times 10^{-3} \text{ V}_{pk}$$

$$\frac{1.2 \times 10^6}{2\pi \times 200 \times 10^{-3}} = 954.9 \text{ kHz}$$

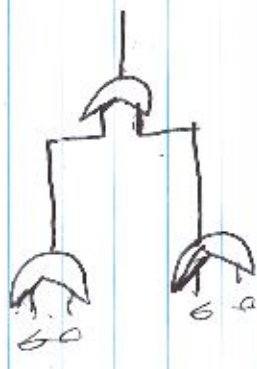
B3

3

2



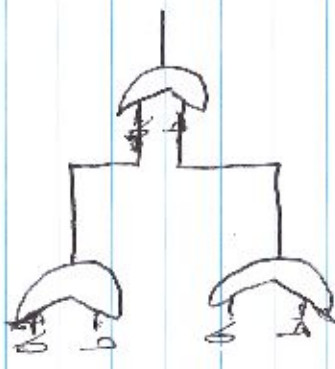
x



x



x



1

b.

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

AB	00	01	11	10
00	0	0	0	0
01	0	1	0	0
11	0	1	1	0
10	0	1	0	1

$$F = \bar{C} + AB$$

x

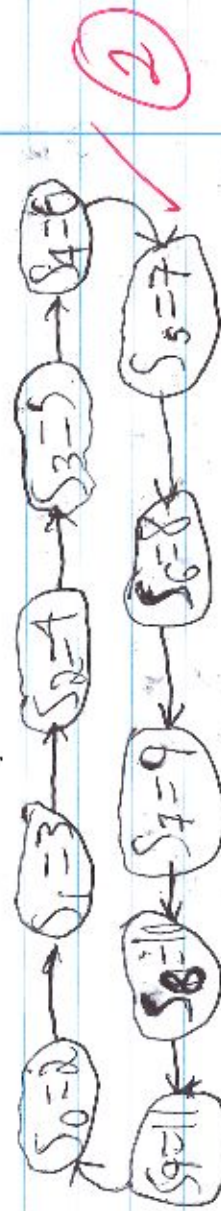
$$ii. G = A + B + \bar{A}B\bar{C} + \bar{A} + \bar{B}C$$

AB	00	01	11	10
00	0	0	0	0
01	0	1	1	0
11	0	0	0	0
10	0	0	0	0

$$G = AB$$

✓

C. The first stage to building a finite state machine that can count is to first build a state diagram to show the stages.



The next stage is to build a truth table. Then the Karnaugh maps to get the Boolean equations.

Stage	Starting Number				Next Number				Result			
	A	B	C	D	A	B	C	D	A	B	C	D
S0	0	0	0	0	0	0	0	0	0	0	0	0
S1	0	0	0	1	0	0	0	1	0	0	0	1
S2	0	0	1	0	0	0	1	0	0	0	1	0
S3	0	0	1	1	0	0	1	1	0	0	1	1
S4	0	1	0	0	0	1	0	0	0	1	0	0
S5	0	1	0	1	0	1	0	1	0	1	0	1
S6	0	1	1	0	0	1	1	0	0	1	1	0
S7	0	1	1	1	0	1	1	1	0	1	1	1
S8	1	0	0	0	1	0	0	0	1	0	0	0
S9	1	0	0	1	1	0	0	1	1	0	0	1