Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint 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.**

Complete, fold and seal
(see note 2 below)

SURNAME: Utting

FORENAME(S): William Connor

1	Student Number	~~Z111222~~ 2221112
2	Title of Examination Paper	Electronics
3	Module Code	SGEE 4003
4	Date and Time of Examination	15/5/23
5	Examination Venue	Coleg Sir Gâr
6	Seat Number	13
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
~~A1~~ A	35
~~A2~~	
~~A3~~ B2	27½
~~A4~~	
~~A5~~ B3	28
Total	90½

91 - mark confirmed

(Gweler yr ochr arall am y fersiwn Cymraeg)

(See the other side for English version)

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Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch 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 llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgript annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar ddalen 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 gwylwyr/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 Myfyriwr	
2	Teitl y Papur Arholiad	
3	God y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

Rhestrwch rifau'r cwestiynau a ymgeisiwyd gennych	At Ddibenion y Swyddfa
	Cyfanswm

Llenwch, plygwch a selio
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

Question No. | Examiner Only

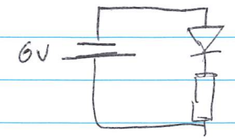
A1



Can't fully remember. Some other element can be added to the silicon to either have an extra electron(s) that isn't bonded into the structure or have 3 electrons in the outer shell so there is a "hole". Something like that

3

A2



3.8V 8mA 475Ω

$\frac{3.8}{8\times10^{-3}} = 475\Omega$ ✓

3

A3 $\beta = \frac{I_C}{I_B}$ $\quad 90 = \frac{I_C}{30\mu}$ $\quad 90 \times 30\mu = I_C = 2.7mA$

$I_E = I_C + I_B = 2.7m + 30\mu = 2.73mA$ ✓

4

A4 ~~$(75 \times 150) \times 50$~~

$((75 \times 0.5) \times 150) \times 50 = 281250$ gain 1/1

1

A5

$V_{out} = -V_{in}\left(\frac{R_2}{R_1}\right)$

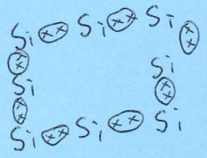
$V_{out} = -V_{in}\left(\frac{30,000}{1500}\right)$ gain of -20 ✓

$\frac{30\,000}{1500} = 20$

3

Arholwr yn unig | Rhif y Cwestiwn

14



Question No.

Examiner Only

A6 ~~Stage 1~~ inverting op amps

Stage 1

$$V_{out} = -V_{in}\left(\frac{R_6}{R_5}\right) = -200\mu\left(\frac{330{,}000}{4700}\right) = -0.01404V$$

Stage 2

$$V_{out} = 0.01404\left(\frac{330\,000}{56\,000}\right) = 0.08274V$$

Stage 3

$$V_{out} = -0.08274\left(\frac{330\,000}{12000}\right) = -2.2754V$$

6

A7

$$f_c = \frac{1}{2\pi R_6 C} = \frac{1}{2\pi\, 100{,}000\,(0.033\mu)} = 48.23\,Hz$$

3

A8

	Binary (128 64 32 16 8 4 2 1)	decimal	Hex
Binary	1000 1101	141	8D
Decimal	0111 1011	123	7B
Hex	1011 0111	183	B7

6

A9 $F = \bar{A}\bar{B} + ABC + A\bar{B}D + \bar{A}\bar{B}CD$

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

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

6

Athoiwr yn unig

Rhif y Cwestiwn

21

Question No.

Q B2

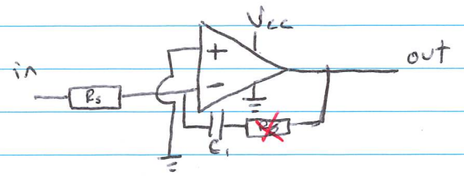
a) An ideal op amp has the following characteristics. Infinite bandwidth. This allows all frequencies to be equally amplified. Infinite gain in an open loop. ~~Infinite gain allows the op amp to be~~. Infinite input impedance, this reduces the loading effect on the source signal. zero output impedance ~~allows~~ ~~also~~ keeps the output voltage constant by varying the output current. This negates the effect of the load on the output. Zero offset keeps the output 0 when the input is 0, this can be changed by adding resistance to the pins.

^ Zero/null offset

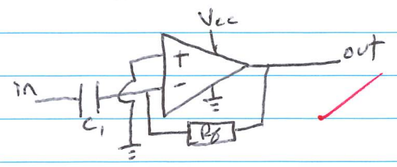
1/5

9

b) integrator

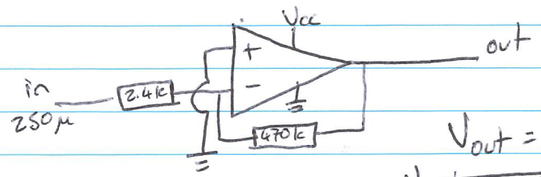


differentiator



5

c)



$$V_{out} = -V_{in}\left(\frac{R_2}{R_1}\right)$$

~~$V_{out} = -20$~~

$$V_{out} = -250_{\mu}\left(\frac{470k}{2.4k}\right)$$

$V_{out} = -48.96mV$

5

Athoiwr yn unig

Rhif y Cwestiwn

19

Question No.

d) $V_{out} = \frac{-R_f}{R}(V_1 + V_2 \ldots)$

$V_{out} = \frac{-1000}{30}(5+9+11) = -33.33(5+25)$

$= -833.33\,V$

2½

e) $f_{max} = \frac{\text{Slew rate}}{2\pi V_{PK}}$ $\quad 1V/1\times10^{-6}s$ $\quad 1000\,000 V/s$

$= \frac{1\times10^6}{2\pi(8)} = 19894.37\,Hz$

$f_{max} = \frac{\text{Slew rate}}{2\pi \quad 200\times10^{-3}V}$

$= \frac{1\times10^6}{2\pi \times 200\times10^{-3}} = 795776.72\,Hz$

6

Rhif y Cwestiwn

8½

Examiner Only

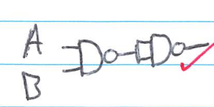
Question No.

Q B3

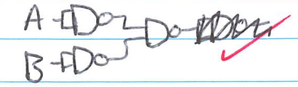
a) Not



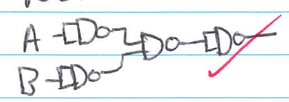
And



OR



Nor



A	B	$\bar{A}$	$\bar{B}$	$\overline{\bar{A}.\bar{B}}$
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	1

4

b)

J	K	Q	Q_+	
0	0	0	0	~~set~~ no change
0	0	1	1	
1	0	0	1	~~reset~~ set
1	0	1	1	
0	1	0	0	reset
0	1	1	0	
1	1	0	1	toggle
1	1	1	0	

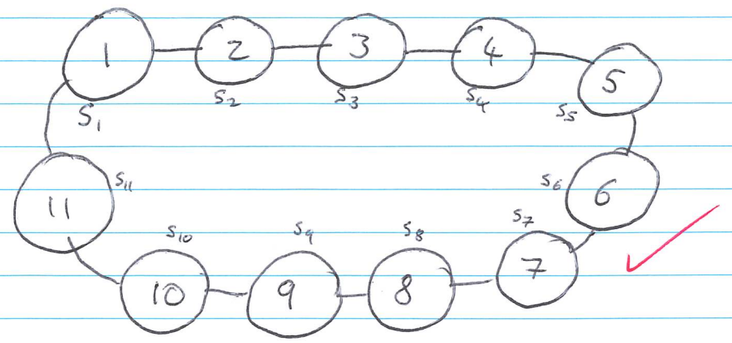
4

Rhif y Cwestiwn

8

Examiner Only

c)



current step	next step	current Q_1	Q_2	Q_3	Q_4	next Q_1^+	Q_2^+	Q_3^+	Q_4^+	W	X	Y	Z
S_1	S_2	0	0	0	0	0	0	0	1	0	0	0	1
S_2	S_3	0	0	0	1	0	0	1	0	0	0	1	0
S_3	S_4	0	0	1	0	0	0	1	1	0	0	1	1
S_4	S_5	0	0	1	1	0	1	0	0	0	1	0	0
S_5	S_6	0	1	0	0	0	1	0	1	0	1	0	1
S_6	S_7	0	1	0	1	0	1	1	0	0	1	1	0
S_7	S_8	0	1	1	0	0	1	1	1	0	1	1	1
S_8	S_9	0	ϕ	ϕ	ϕ	1	0	0	0	ϕ	0	0	0
S_9	S_{10}	1	0	0	0	1	0	0	1	1	0	0	1
S_{10}	S_{11}	1	0	0	ϕ	1	0	ϕ	0	1	0	1	0
S_{11}	S_1	1	0	1	0	0	0	0	0	1	0	1	1

Q_1^+

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

$Q_1^+ = A.\bar{C} + B.C.D$

Q_2^+

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

$Q_2^+ = A.\bar{C} + B.\bar{C} + B.\bar{D} + \bar{B}.C.D$

Q_3^+

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

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

$Q_3^+ = \bar{C}.D + A.D + \bar{A}.C.\bar{D}$

Q_4^+

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	0

$Q_4^+ = \bar{A}.\bar{D} + \bar{C}.\bar{D}$

W

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

$W = A + B.C.D$

X

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

$X = \bar{B}.C.D + B.\bar{C} + A\bar{C} + B.\bar{D} + A.\bar{B}$

Y

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

$Y = \bar{C}.D + C.\bar{D}$

Z

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	1

$Z = \bar{D}$