



SURNAME: HARRIES

FORENAME(S): DAVID SAMUEL

Examination Answer Books

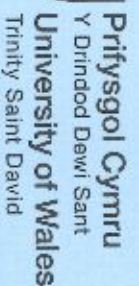
12 Pages

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	1502997-1
2	Title of Examination Paper	DIGITAL SIGNALS AND COMMS
3	Module Code	PSDE5015
4	Date and Time of Examination	3 MAY 9:30 AM
5	Examination Venue	COLEG SER GAR 623
6	Seat Number	
7	Number of Answer Books handed in	1

(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 ei a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai arwybwyddu sgrïpt annallennadwy, neu drefnu iddi gael ei threpio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn linc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnwch llinell drwyddynt.
6. Ni ddylid rhwngo 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 gwyllwr/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.

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

(gweler 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	

(See the other side for English version)

B3) a) BYTES: 7

4

1	6	6	2	46-1500	4
PREAMBLE	SFD	DESTINATION ADDRESS	SOURCE ADDRESS	LENGTH	DATA AND PAD
					FCS

PREAMBLE: STARTS THE FRAME AND ESTABLISHES SYNCHRONISATION CONDITIONS BETWEEN DEVICES.

SFD: START FRAME DELIMITER (SFD) CONTAINS THE

SEQUENCE: 10101011

DESTINATION: ADDRESSES CAN BE IN EITHER 2 BYTE OR 6 BYTE AND SOURCE FORMAT. ALL ADDRESSES ON THE NETWORK MUST BE IN THE SAME FORMAT. ANY DATA TRANSMISSION 10mb/s OR HIGHER MUST USE 6 BYTE FORMAT ACCORDING TO THE IEEE PROTOCOL. 2 BYTE FORMAT IS THEREFORE BECOMING OBSOLETE.

LENGTH: INDICATES THE LENGTH OF DATA IN THE DATA

FIELD. IF THE LENGTH OF DATA DOES NOT MEET THE 46 BYTE REQUIREMENT, A PAD FIELD IS

ADDED TO THE DATA FRAME WHICH MOSTLY CONSISTS OF ZEROS.

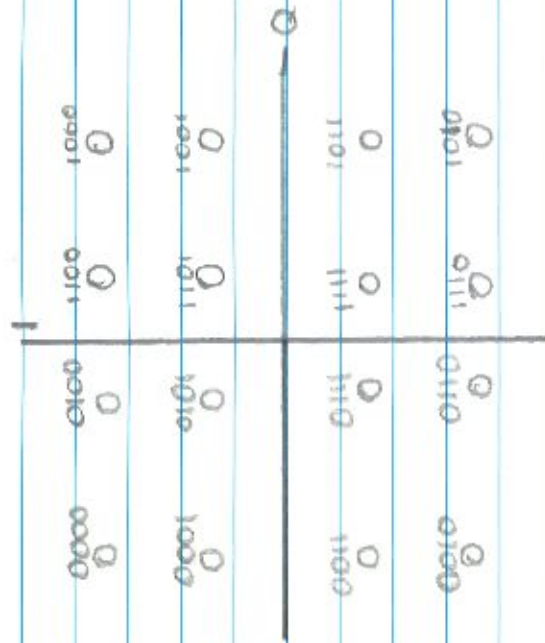
DATA: THE DATA FIELD SIMPLY CONTAINS THE DATA BEING TRANSMITTED BETWEEN DEVICES.

FCS: FRAME CHECK SEQUENCE (FCS) IS AN ERROR DETECTION FUNCTION. CALCULATIONS ARE DONE AT BOTH THE SOURCE AND THE DESTINATION. THEY ARE COMPARED AND IF THEY DO NOT MATCH, AN ERROR IS GENERATED.

10

Question No.	Examiner Only	Question No.	Examiner Only
b)	PHYSICAL LAYER: CONTAINS CONNECTOR AND INTERFACING SPECIFICATIONS ALONG WITH CABLE REQUIREMENTS AND ELECTRICAL, MECHANICAL, FUNCTIONAL AND PROCEDURAL SPECIFICATIONS	c)	COLLISION DETECTION IN ETHERNET NETWORKS IS DONE WHEN TWO OR MORE DEVICES TRY TO TRANSMIT DATA AT THE SAME TIME IN THE SAME COLLISION DOMAIN.
	DATA LINK LAYER: ALLOWS ACCESS TO THE NETWORK AND PROVIDES A PHYSICAL ADDRESS WHICH ALLOWS THE DEVICE TO SEND AND RECEIVE DATA. IT ALSO HAS ERROR DETECTION CAPABILITIES. IT ALSO WORKS WITH THE DEVICES NETWORKING SOFTWARE.		WHEN A COLLISION OCCURS THE TRANSMITTING DEVICES SEND OUT A CARRIER SIGNAL WHICH TELLS THE OTHER DEVICES A COLLISION HAS OCCURRED. THIS CAUSES THE DEVICES TO ENTER A 'BACK OFF' MODE. WHILE IN THIS MODE THEY DO NOT TRANSMIT ANY DATA. THEY REMAIN IN THIS MODE FOR A RANDOM AMOUNT OF TIME. THIS RANDOM TIMING PREVENTS FURTHER COLLISIONS.
	NETWORKING LAYER: HAS AN END-TO-END LOGICAL ADDRESSING SYSTEM THAT GRANTS THE ABILITY FOR PACKETS OF DATA TO BE ABLE TO BE SENT ACROSS SEVERAL LAYERS NETWORKS SUCH AS ETHERNET, TOKEN RING AND FRAME RELAYS.		THESE COLLISION DETECTION PROCESSES AND 'BACK OFF' MODES ARE CONTAINED WITHIN THE COLLISION DOMAIN THAT THE DATA COLLISION OCCURED IN. THIS MEANS OTHER COLLISION DOMAINS ARE UNAFFECTED.
	TRANSPORT LAYER: PROVIDES END-TO-END COMMUNICATION BETWEEN DEVICES. THE TYPE OF COMMUNICATION IS APPLICATION DEPENDENT: RELIABLE AND CONNECTION ORIENTED, OR CONNECTIONLESS AND BEST EFFORT.		IN ORDER FOR DATA TO BE TRANSMITTED FROM A DEVICE IN ONE COLLISION DOMAIN TO A DEVICE IN A DIFFERENT COLLISION DOMAIN, IT MUST FIRST RECEIVE PERMISSION FROM A BRIDGE. THIS PREVENTS DATA FROM ONE DOMAIN COLLIDING WITH DATA FROM ANOTHER.
	SESSION LAYER: HAS MANY SERVICES, INCLUDING THE TRACKING OF BYTES AT BOTH ENDS OF THE SESSION. THIS ALLOWS APPLICATIONS TO BE ABLE TO TAKE CONTROL, MANAGE AND TERMINATE DIALOGUES BETWEEN DEVICES.	d)	UNICAST: A FRAME GETS SENT TO A SINGLE DEVICE ON A NETWORK. IT USES THE DEVICES MAC ADDRESS OR HARDWARE ADDRESS. ALL OTHER DEVICES RECEIVE THE FRAME BUT DISCARD IT DUE TO IT HAVING A SPECIFIC DEVICES ADDRESS.
	PRESENTATION LAYER: THIS LAYER CONVERTS THE TRANSMITTED DATA INTO A READABLE FORMAT FOR THE DEVICE TO UNDERSTAND.		MULTICAST: A FRAME GETS SENT TO A FEW, BUT NOT ALL, DEVICES ON A NETWORK. IT USES A VARIATION OF THE DEVICES HARDWARE ADDRESSES, OR A SERVER TO ENSURE IT ARRIVES AT THE CORRECT ONES.
	APPLICATION LAYER: MAKES THE DATA AVAILABLE AND VIEWABLE TO THE USER THROUGH THE USE OF A WEB BROWSER		BROADCAST: A FRAME IS SENT TO ALL DEVICES ON A NETWORK. IT DOES NOT USE HARDWARE ADDRESSES AND INSTEAD USES FRAME RELAYS AND SWITCHES.

e)



16-QAM USES AMPLITUDE MODULATION AND PHASE MODULATION TO TRANSMIT 4 BITS OF DATA. IT USES 3 AMPLITUDE LEVELS AND 3 PHASE SHIFTS. THIS INCREASES SPECTRAL EFFICIENCY.

1101	PHASE ANGLE OF 45°	AMPLITUDE OF 25%
1000	" " 45°	" " 75%
1001	" " 135°	" " 50%
1100	" " 135°	" " 50%

F) RESOLUTION IS THE NUMBER OF DIVISIONS AN ADC CAN MAKE TO HAVE AS MANY QUANTISATION LEVELS AS POSSIBLE. A HIGHER BIT ADC WILL HAVE A HIGHER RESOLUTION. MEANING MORE QUANTISATION LEVELS, LESS QUANTISATION ERROR, AND A HIGHER QUALITY OUTPUT. RESOLUTION IS MEASURED IN VOLTS OR mV or μV . A RESOLUTION OF 1mV WOULD REPRESENT 1mV PER QUANTISATION LEVEL.

A1 a) $\mu = \frac{V_{max} - V_{min}}{V_{max} + V_{min}} = 0.63$ $\frac{18-4}{18+4} = 0.63$

b) $E_c = \frac{V_{max} + V_{min}}{2} = \frac{18+4}{2} = 11V$

$E_s = \frac{V_{max} - V_{min}}{2} = \frac{18-4}{2} = 7$

c)

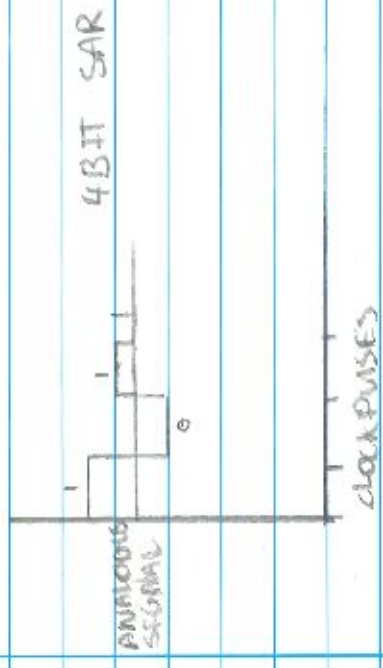
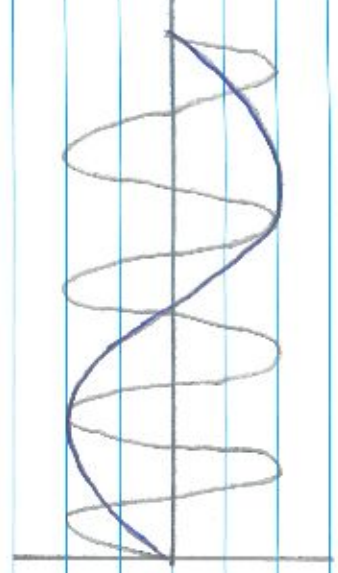
A3) $Z_0 = \frac{138 \log D}{\sqrt{k} d}$ $50 = \frac{138 \log D}{\sqrt{2.5} d}$ 0.4

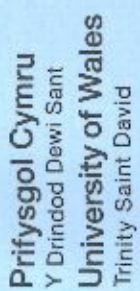
$50 = 87.17 \log D$ 0.4

ANTILOG $50 = \frac{D}{87.17}$ 0.4

$3.741 = \frac{D}{0.4}$ $D = 1.49622mm$

A4) SUCCESSIVE APPROXIMATION WORKS ON THE PRINCIPLE THAT ON EACH CLOCK PULSE, THE OUTPUT OF A DAC IS COMPARED TO AN INPUT ANALOGUE VOLTAGE, BY A COMPARATOR. THE FIRST OUTPUT TO BE COMPARED IS THE MOST SIGNIFICANT BIT, THIS IS 50% OF THE TOTAL OUTPUT. IT IS COMPARED TO THE INPUT ANALOGUE SIGNAL AND IF THE SIGNAL IS GREATER THAN THE

Question No.	Examiner Only	Question No.	Examiner Only
	DIGITAL MSB, THE MSB IS LATCHED AND STORED AS 1. IF IT IS LESS THAN THE MSB, IT IS SET BACK TO 0. ON THE NEXT CLOCK PULSE, THE SECOND MSB IS SET TO 1 AND COMPARED IF GREATER THAN THE ANALOGUE SIGNAL IT GETS LATCHED, AND IF NOT IT GETS SET BACK TO 0. THIS CONTINUES FOR EACH BIT. A CONVERSION TAKES N CLOCK PULSES WHERE N IS THE NUMBER OF BITS.		
			
A5	ALIASING OCCURS IN ADCs WHEN THE FREQUENCY OF A SIGNAL IS TOO HIGH OR TOO LOW. ALL ADCs HAVE SAMPLE RATES WHICH TAKE SAMPLES OF SIGNALS AT SET TIME INTERVALS. IF A SIGNAL HAD TOO HIGH/LOW FREQUENCY, THE ADC CAN MISINTERPRET THE SIGNAL AND CREATE DISTORTION. ABOVE THE NYQUIST FREQUENCY AN ADC CANNOT TAKE ENOUGH SAMPLES PER CYCLE AND THE QUANTISATION LEVELS BECOME MORE AND MORE DISTINGUISHED. THE NYQUIST CRITERION MUST BE FOLLOWED TO AVOID ALIASING.		
			
Author yn unit	Author yn unit	Author yn unit	Author yn unit



Complete, fold and seal
(see note 2 below)

SURNAME: DE DONCKER

FORENAME(S): SCOTT

Examination Answer Books

12 Pages

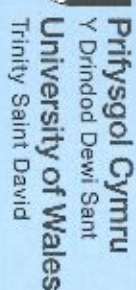
Instructions to Candidates

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.**

List the numbers of the questions you have attempted	Office Use
Ques A1	6
Ques A2	6
A3	4
A4	0
A5	2
A6	4
A7	4
A8	6.
B3	22
Office Use	54%

1	Student Number	1203234/2
2	Title of Examination Paper	Signals and Digital Communications
3	Module Code	PSDE S014
4	Date and Time of Examination	3/5/18 9:30am
5	Examination Venue	Coley S14 Gar
6	Seat Number	
7	Number of Answer Books handed in	1

(Gweler yr ochr arall am y fersiwn Cymraeg)



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 ei at seilo 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 arwyblyddu sgrïp annarllennadwy neu drefnu iddi gael ei theipio 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 thymu llinell drwyddynl.
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 gwyllwr/gwyfnyfr.
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	Teitl y Papur Arholiad	
3	Cod y Modiwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

(See the other side for English version)

Part A

A1 465 kHz $R = 50 \Omega$ $V_{max} = 18V$ $V_{min} = 4V$

a.

$$\text{modulation index (m)} = \frac{V_{max} - V_{min}}{V_{max} + V_{min}} = \frac{18 - 4}{18 + 4} = 0.63 \quad 2$$

b. Sideband Frequencies = $E_c - E_s$ and $E_c + E_s$.

$$E_c = \frac{V_{max} + V_{min}}{2} \quad E_s = \frac{V_{max} - V_{min}}{2}$$

$$E_c = \frac{18 + 4}{2} \quad E_s = \frac{18 - 4}{2}$$

$$E_c = 11 \quad E_s = 7$$

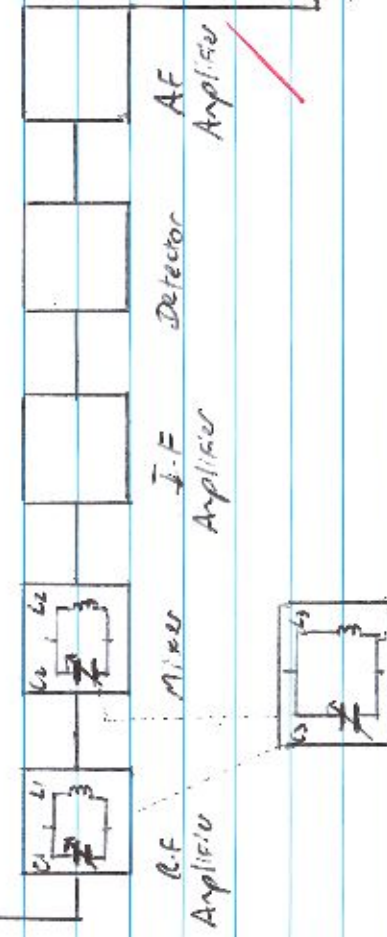
$$\text{Sideband Frequencies} = 11 - 7 = 4 \text{ Hz}$$

$$11 + 7 = 18 \text{ Hz}$$

$$\text{Amplitude (V)} = \frac{m E_c}{2} = \frac{0.63 \times 11}{2} = 3.465V$$

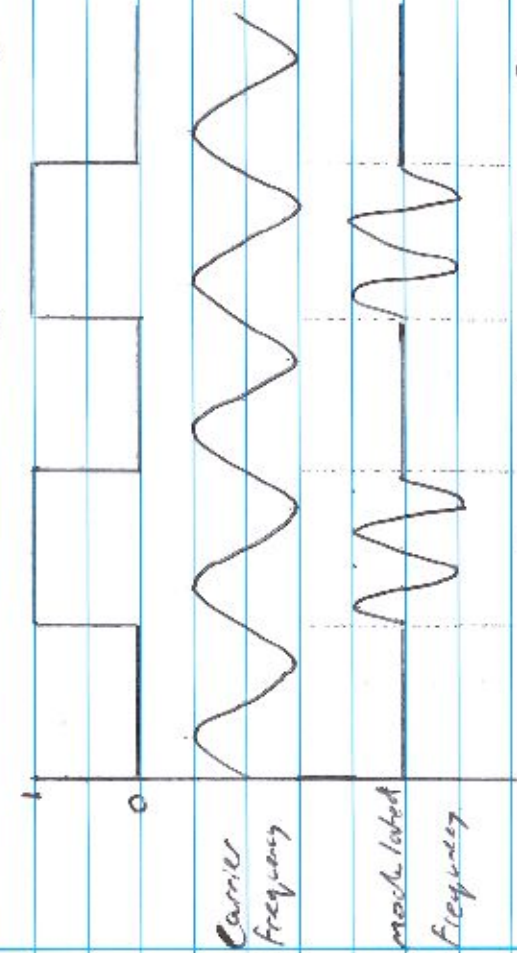
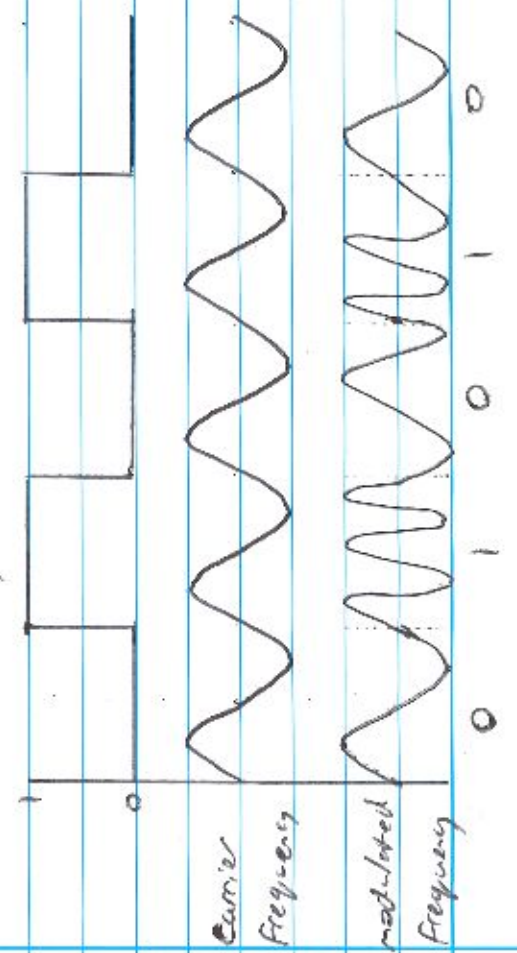
A2.

An Superheterodyne radio receiver



Oscillator

(Sends two grouped signals to C1 + C2)

Question No.	Examiner Only	Question No.	Examiner Only
Aerial - Receives the incoming signal from other stations on the frequency.	1	AS. Aliasing is an error that can occur when a received signal is less than 2x f of the original signal, and therefore appears to have a different waveform to the original signal.	2
R.F Amplifier - uses a ^{series} tuneable band pass filter that amplifies the carrier frequency.	0	A6. a. ASK/Amplitude Shift Keying	
Mixer - uses a sinusoidal wave that adjusts the frequency (carrier) into a fixed I.F frequency.	1	when the amplitude of a carrier waveform is modulated to represent digital data.	
I.F Amplifier - uses a series of high gain filters to amplify the now fixed I.F frequency.	1		
Detector - derives and separates the original AM audio signal from the carrier frequency.	1		
A.F Amplifier - Amplifies the audio signal so that it can be sent to and produced by a loud speaker.	1	b. FSK/Frequency Shift Keying	
A3. $d\phi = 0.4\text{mm}$ $k = 2.5$ $Z_0 = 50\Omega$	6	when the frequency of the signal is manipulated to show digital data.	
$Z_0 = \frac{138 \log \frac{D}{d}}{\sqrt{k}}$ $= \frac{138 \log \frac{D}{0.4}}{\sqrt{2.5}}$			
$50 = \frac{87.28 \log \frac{D}{0.4}}{0.4}$			
$\text{anti log } \frac{50}{87.28} = \frac{D}{0.4}$			
$3.74 = \frac{D}{0.4}$ $\therefore D = 3.74 \times 0.4 = 1.496\text{mm}$	14		14
	0		

A7 G = 99

message 1 = 652963 (58 digits)
 message 2 = 741294 (46 digits)

message 1 = $652963/99 = 6595.58$ $\therefore$ No errors.

message 2 = $741294/99 = 7487.81$ $\therefore$ Errors in message

A8

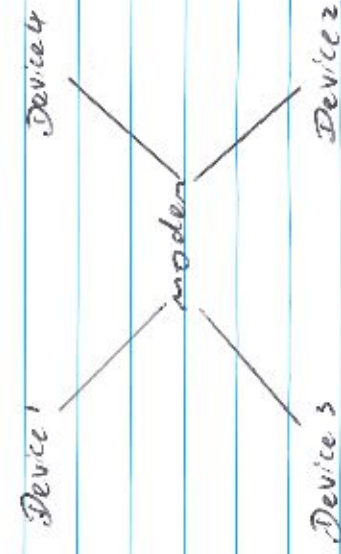
Bus network topology

When all devices in the network are linked in series with one another, with the modem being the start and end point.



Star network topology

When all devices in the network are linked directly to the modem as a centre point.



Question B3

a. IEEE 802.3 Ethernet Frame

7 bytes	1 byte	6 bytes	6 bytes	2 bytes	46-1500	4 bytes
Preamble	SFD	Data address	Source address	Length field	Data and Pad	FCS

Preamble - Provides Synchronisation Settings for each frame in the ethernet network

SFD - Contains the sequence 10101011

Data and Source address provides the data and location of data that has been transmitted in the frame.

Length field - Lists the number of bits in the frame.

Data and pad - has a byte range of between 46 - 1500 bytes

FCS - Provides error detection for each frame in the network

Data and Source address - either 2 or 6 bytes.

Can transmit data in the frame. A 10mb system is usually 6 bytes.

10

Question No.	Examiner Only	Question No.	Examiner Only
b. data link layer - Provides the link addresses between devices in the network		iii. Broadcast - This is when data is transmitted to all devices in the network	6
Physical layer - Provides hardware requirements for the system e.g. cable sizes etc.			
Transport layer - Transports data between devices in the system (end to end)			
Error detection layer - Provides error detection for data transmitted in the network			
Interface layer - Provides an interface for all devices in the network to use.			13
c. In Ethernet networks, CSMA is the concept of monitoring data transmitted in a network. If there is an error when data is transmitted, this data transmission is immediately blocked in the network. This is CSMA.			13
d. i. Unicast - This is when data is transmitted to one device in the network. All other devices discard the data even though they have the same address.			
ii. Multicast - This is when data is transmitted to some, but not all devices in the network. Once again devices with the incorrect address discard the data			
Answer yin ung	Rhify Cwestiwn	Answer yin ung	Rhify Cwestiwn

Complete, fold and seal
(see note 2 below)

SURNAME: Smith

FORENAME(S): Nathan, John

Examination Answer Books

12 Pages

Instructions to Candidates

- Please give the information requested in the boxes below.
- Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
- 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.
- Write your answers in ink.
- Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
- No part of this book is to be torn out; it must be handed in complete.
- If more books than one are used, fasten them together using the tags available from the invigilator(s).
- Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

(See the other side for English version)

1	Rhif Myfyriwr		Rhestrwch rifau'r cwestiynau a ymgaiswyd genych	At Ddibenion y Swyddfa
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			Cyfanswm

Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

- Rhowch yr holl wybodaeth y gofynnir ardan i yn y blychau isod.
- 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).
- Rhaid i'r atebion fod mewn llawysgriflen ddarlunadwy. Gall yr Arholiwr naill ai arwybysdu sgript annarlunadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
- Ysgrifennwch eich atebion mewn inc.
- Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
- Ni ddylid rhwngo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
- Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/gwyliwyr.
- 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: _____

1	Student Number	1103912/2	List the numbers of the questions you have attempted	Office Use
2	Title of Examination Paper	Signals and Digital Comms	Page A1	2
3	Module Code	PSDE - 5014	B1 A2	6
4	Date and Time of Examination	05/05/18 9:30	B3 A3	0
5	Examination Venue		A4	0
6	Seat Number		A5	0
7	Number of Answer Books handed in		A6	4
8			A7	4
9			A8	6
10			B1	7
11			B3	28
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
61				
62				
63				
64				
65				
66				
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94				
95				
96				
97				
98				
99				
100				
101				
102				
103				
104				
105				
106				
107				
108				
109				
110				
111				
112				
113				
114				
115				
116				
117				
118				
119				
120				
121				
122				
123				
124				
125				
126				
127				
128				
129				
130				
131				
132				
133				
134				
135				
136				
137				
138				
139				
140				
141				
142				
143				
144				
145				
146				
147				
148				
149				
150				
151				
152				
153				
154				
155				
156				
157				
158				
159				
160				
161				
162				
163				
164				
165				
166				
167				
168				
169				
170				
171				
172				
173				
174				
175				
176				
177				
178				
179				
180				
181				
182				
183				
184				
185				
186				
187				
188				
189				
190				
191				
192				
193				
194				
195				
196				
197				
198				
199				
200				
201				
202				
203				
204				
205				
206				
207				
208				
209				
210				
211				
212				
213				
214				
215				
216				
217				
218				
219				
220				
221				
222				
223				
224				
225				
226				
227				
228				
229				
230				
231				
232				
233				
234				
235				
236				
237				
238				
239				
240				
241				
242				
243				
244				
245				
246				
247				
248				
249				
250				
251				
252				
253				
254				
255				
256				
257				
258				
259				
260				
261				
262				
263				
264				
265				
266				
267				
268				
269				
270				
271				
272				
273				
274				
275				
276				
277				
278				
279				
280				
281				
282				
283				
284				
285				
286				
287				
288				
289				
290				
291				
292				
293				
294				
295				
296				
297				
298				
299				
300				
301				
302				
303				
304				
305				
306				
307				
308				
309				
310				
311				
312				
313				
314				
315				
316				
317				
318				
319				
320				
321				
322				
323				
324				
325				
326				
327				
328				
329				
330				
331				
332				
333				
334				
335				
336				
337				
338				
339				
340				
341				
342				
343				
344				
345				
346				
347				
348				
349				
350				
351				
352				
353				
354				
355				
356				
357				
358				
359				
360				
361				
362				
363				
364				
365				
366				
367				
368				
369				
370				
371				
372				
373				
374				
375				
376				
377				
378				
379				
380				
381				
382				
38				

part A

$$(A) m = \frac{V_{\max} - V_{\min}}{V_{\max} + V_{\min}} = \frac{V_{\text{modulation}}}{V_{\text{carrier}}}$$

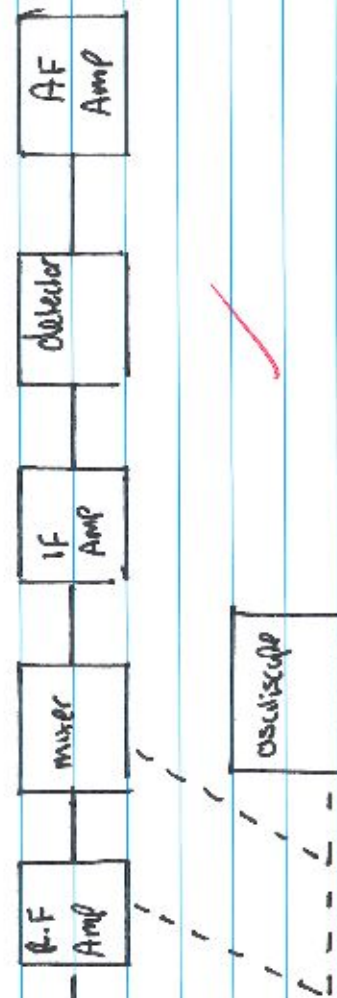
$$\frac{18 - 4}{18 + 4} = 0.63$$

$$V_{\min} = 6 - m E_c = 4 - 0.63 \times 4 = 1.48$$

$$V_{\max} = 4 + 0.63 \times 4 = 6.52$$

Receiver

(12)



Receiver - This device receives the radio signal and sends to the R.F. Amplifier.

Mixer - This takes the carrier signal and converts to the output IF frequency. Initial amplification. $\times$

IF amplifier - produces a clean clear AM signal with high gain amplifiers. $\checkmark$

detector - This recovers the sound or speech from the AM signal. $\checkmark$

AF amplifier - provides gain for the loudspeaker. $\checkmark$

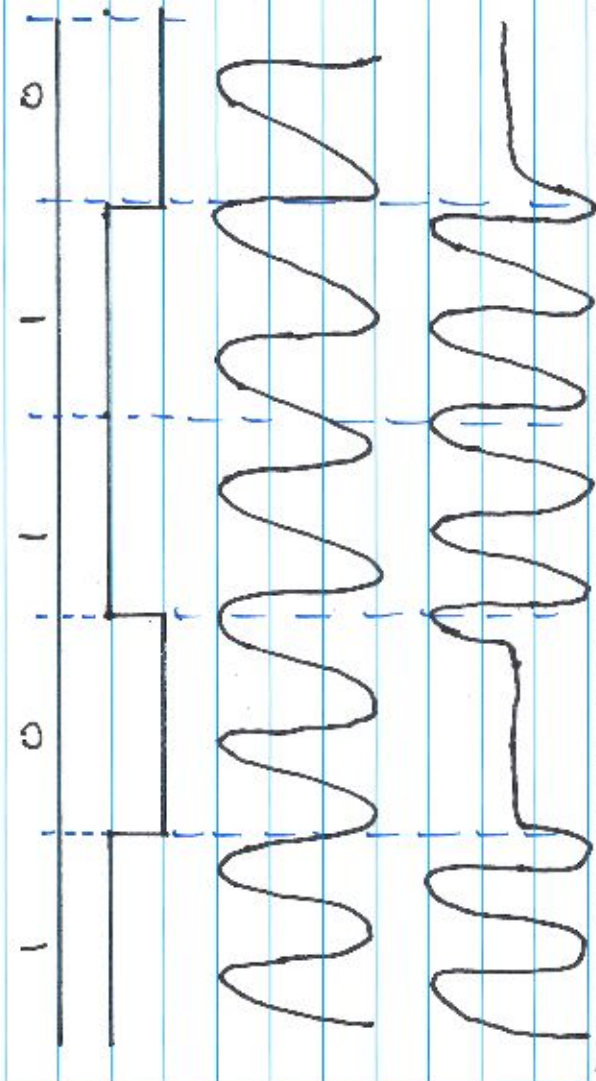
(A3)

(A5) Improper conversion of carrier signal causes aliasing.

②

(A6) ASK. This is where the amplitude of the carrier signal is changed to represent the amplitude in the digital signal. In other words the amplitude will change depending on the digital input.

10110

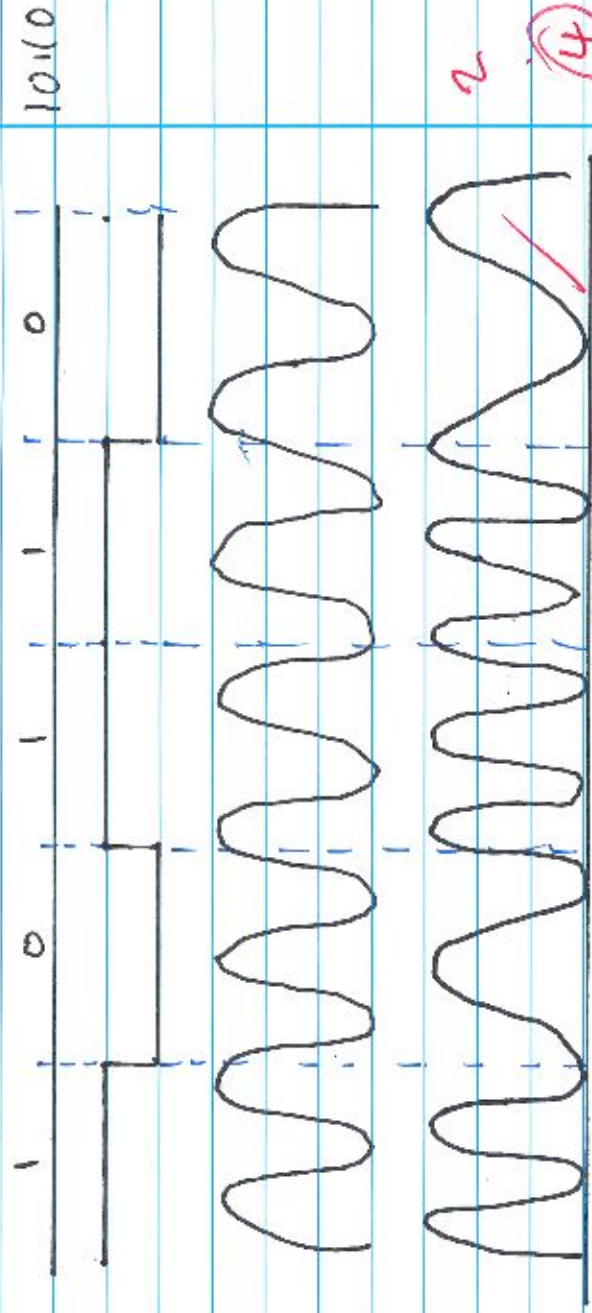


⑥

(A4)

⑦

FSK. This is were the frequency of the modulated signal will change to represent the digital input.



2
④

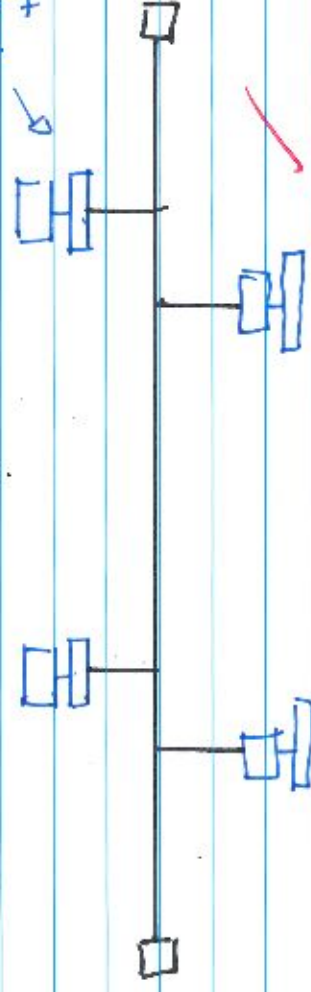
④7 Message 1, The message was divided with the value for '6' and the number given had the remainder 58, this was the same as the message sent meaning no error is found or visible.

Message 2. The same as above was carried out and the remainder for the values in message 2 was 81, this means there must be an error with message 2.

④

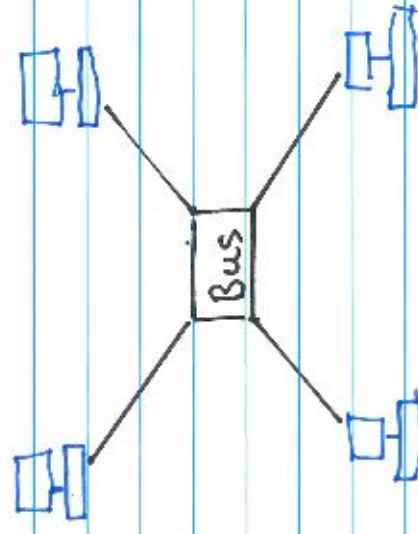
④8 Physical bus Topology.

These are computers + monitors.



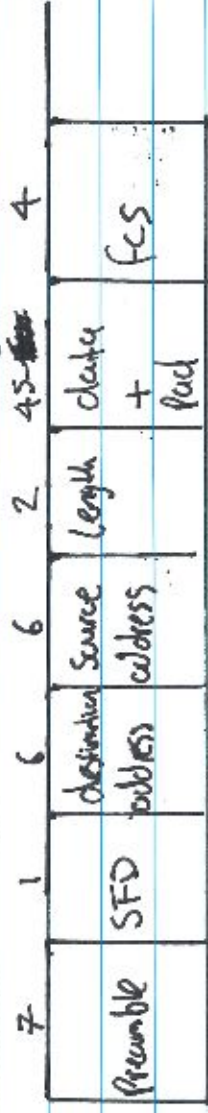
④ Physical Star/Logic topology.

These are computers + monitors.



⑥

Question B3.



bytes

2

preamble - Synchronises devices and indicates the start of the frame.

64b

SFD - has Set Sequence 10101011

destination and source address - These are either 2 or 6 bytes and both devices in the network must have the same format. 6 is most commonly used with LANs system. 2 is not used much anymore.

Length - States number of bytes in the data field.

data - transfers data from device to device. under 64b a pad is introduced.

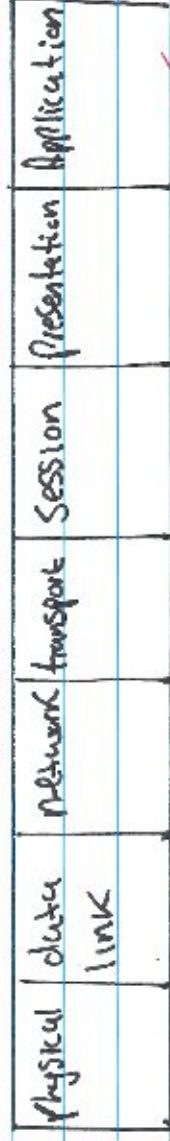
FCS - This is used as an error detection function.

8

(10)

points PA

OSI Network model



Physical layer - This defines connectors and interfaces.

data link - This is used to allow for messages to be sent and received.

- Allows data to be sent with logical addressing system
- error detection functions.

network layer - Allows data to be sent end to end with logical addressing system.

transport layer - Allows end to end communication between devices.

Session - Allows applications to build, manage and remove dialog. Track bytes which have been confirmed by end to end system.

Presentation - Allows messages to be read by applications

Application - This is the user interface the user will see. So the user will use this layer to access the network.

(8)

(C) CSMA used in ethernet

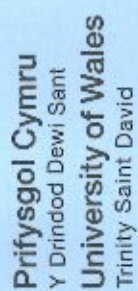
This is a collision detection network. If data is sent to the same address by devices at the same time a collision will occur. The collision detection will send a Jam Signal called the carrier which will send the devices into a 'back off mode', where they will wait a random period of time before sending data again. This random time stops the two devices sending the data at the same time again which would cause another collision.

Two devices in the same network cannot use the same path unless they need to communicate, if they need to communicate they will need to get permission.

d) Unicast is where one source sends data to one address in the network. All other addresses in the network may receive this data or message but will discard it as it doesn't match their address.

Multicast is where one source sends data to a number of addresses but not all addresses. Again the other addresses in the network will receive a copy of data but will discard it.

Broadcast is where a number of sources send data to all addresses in the network to receive the data or message. These broadcasts can be blocked by a router.



112 Pages

Complete, fold and seal
(see note 2 below)

SURNAME: beer

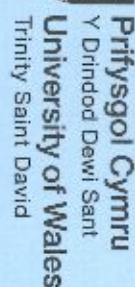
FORENAME(S): Joshua George

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	1203262/2
2	Title of Examination Paper	Signals + Digi COMMS
3	Module Code	PSE 5014
4	Date and Time of Examination	3/5/18 9:30 - 11:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tüdaler

Cyfarwyddiadau i Ymgeiswyr

1. Rhewch yr holl wybodaeth y golyminr arndani yn y blychau isod.
2. Rhwng eich enw yn y lle a ddarparwyd ar y dde, plwgwch ef a'i 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 anwybyddu sgript annarllennadwy neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgriennwch eich atebion mewn linc.
5. Dechnewch 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 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.

Llenwch, plygwch a seliwch (igweler nodyn 2 isod)

(igweler nodyn 2 isod)

CYFENWYBODAETHYD

ENW(AU) CYNTAF:

1	Rhif Myfyriwr	
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	

(See the other side for English version)

$$A3. Z_0 = \log \frac{138}{\sqrt{K}} \left(\frac{D}{d} \right)$$

$$50 = \log \frac{138}{\sqrt{2.5}} \left(\frac{D}{0.4} \right)$$

$$50 = \log 87.279 \left(\frac{D}{0.4} \right)$$

$$\text{antilog } 50 = \frac{D}{0.4}$$

$$10^{87.279} = \frac{D}{0.4}$$

$$3.74 \times 0.4 = D$$

$$D = 1.496 \text{ mm (3 d.p.)}$$

A4.

$$A1. a) E_G = 18 \quad m = \frac{E_S}{E_G}$$

$$E_S = 4$$

$$m = \frac{4}{18} = 0.2$$

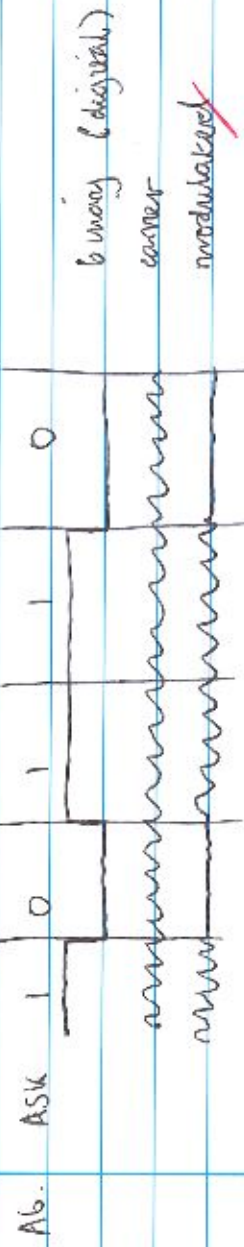
$$b) V = \frac{m E_G}{2} = \frac{0.2 \times 18}{2} = 2$$

$$c) f_{\text{subband}} = \frac{1}{2} m^2 P_{\text{carrier}} = \frac{1}{2} (0.2)^2 \times 465 \times 10^3$$

$$= 11.481 \text{ kHz}$$

A4. A successive approximation ADC works by taking a constant stream of data (or analogue signals) and approximating at certain points the values of the data. These are turned into binary values, with the resolution of the ADC depending on the quantisation error.

A5. Aliasing is where the analogue signal is sampled too slowly or infrequently. This in turn with cause a false representation of the original signal as the original frequency is lost.
Such an example below



Amplitude shift keying will alter the carrier signal's amplitude to match the digital signal



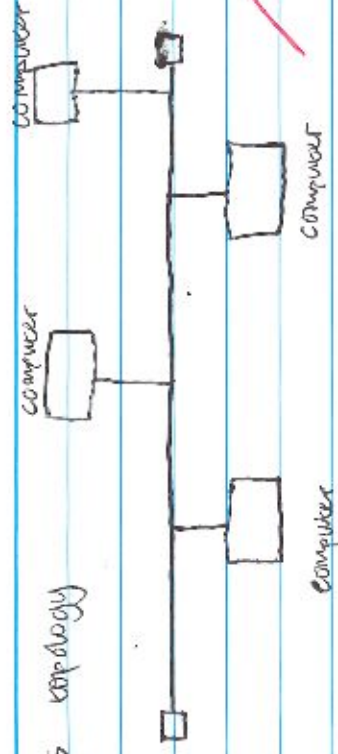
Frequency shift keying will alter the frequency of the carrier signal to match and match the digital signal.

A7 Message 1 = $\frac{652963}{99} = 6595.58$ remainder = 58 ✓
check = 58 ✓
both remainder and check match so no errors in message

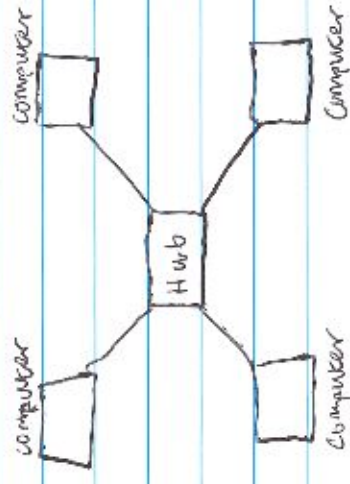
Message 2 = $\frac{741296}{99} = 7487.81$ remainder = 81 ✓
check = 46 ✓

discrepancy between remainder and check meaning errors in the message 2.

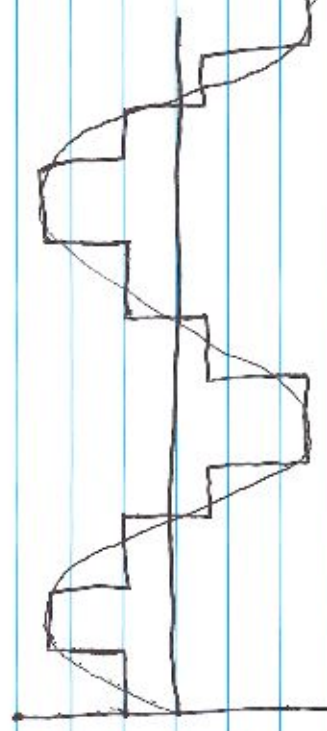
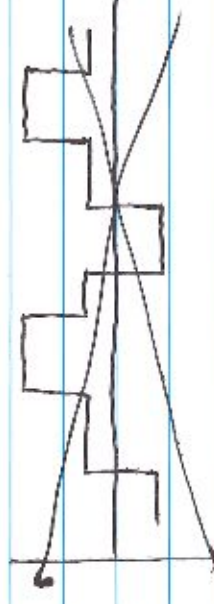
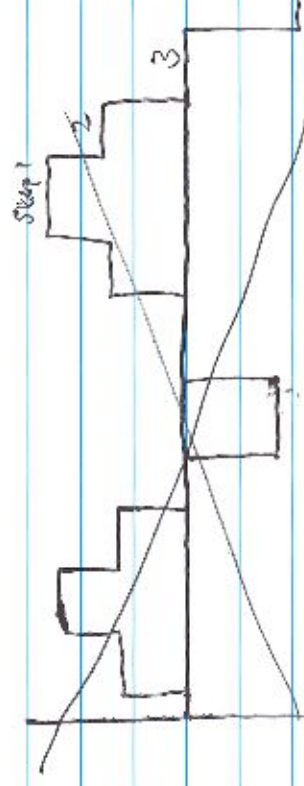
A8. Bus topology



Star topology



B2.6)



3 bit quantiser (3 steps)

digitalised analogue

B2 b) continued * quantisation error is when a constant stream of data (analogue signal) is approximated into a binary value. the quantisation error is the difference between the input voltage (analogue signal) and it's binary representation of the signal. It's resolution depends on the ADC.

c) A PCM achieves greater noise immunity when an analogue signal is being the original signal and adding it to a carrier signal. As the decoder the carrier signal (known) is taken off to leave the original. This reduces noise as the signal is stronger.

f) Resolution is the quantisation error in the ADC. The greater the quantised levels the better the resolution.

B3 a) bytes

7	1	6	6	2	46-1500	4
preamble	SFD	Device address	Source address	Length	Data	FCS
					and PAD	

Preamble = starts new frame and synchronises devices

SFD = sequence = 10101011

Device / source address = Device address is chosen between 2 and 6 bytes, once chosen all devices use this number of bytes. 10 bits uses 6 bytes which makes 2 bytes obsolete.

* b) Physical

Data link

Network

Transmission

Session

Presentation

Application

c) The concept of CSMA, computer device needs to see if transmission medium is busy. It recognises multiple devices use the network and checks for any collisions. If there are any it will go into back off mode.

d) i) Unicast = A single device is selected to receive the data from a network. This could be for protocol data.

ii) Multicast = only selected devices will receive and use the data from a network, all other devices receive but will ignore and discard.

iii) Broadcast = broadcasts to the whole network. Broadcast is unique and can only broadcast, no hardware. Routers will block broadcasts on the network.

B3 a) continued *

Length = This is how long the data stream will be

Data and PAD = is the data is less than 46 bytes it will be padded out with data, usually zeros

FCS = Frame check sequence will check to see if there are any errors in the message. It does this by using a calculation between the source and destination signals.

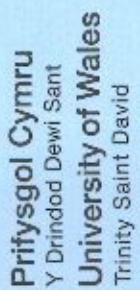
B2 d) i) $V_{QNR} = q / \sqrt{N}$ $q = \text{voltage range} / N$

Voltage range = 24V 5Vrms 3 kHz peak max

$$24 / 3 \times 10^3 = q = 4 \times 10^{-3}$$

$$V_{QNR} = q / \sqrt{N} = 4 \times 10^{-3} / \sqrt{N} = 1.34 \times 10^{-3} \text{ (2 d.p.)}$$

$$\text{ii) } SQNR = \text{rms} / V_{QNR} = 5 / 2.31 \times 10^{-3} = 2165.06$$



Complete, fold and seal
(see note 2 below)

SURNAME: DYER

FORENAME(S): EMYR WYN

Examination Answer Books

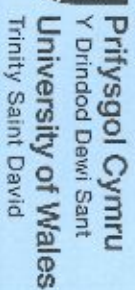
12 Pages

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	150300811
2	Title of Examination Paper	SIGNALS & DIGITAL COMMS
3	Module Code	PSDE5014
4	Date and Time of Examination	03/05/18 09:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	1

(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 of a'i seio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr mall ai anwybyddu sgrifft amarlennadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dau.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddyn.
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 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.

Llenwch, plygwch a seliwch (gweler nodyn 2 isod)

(gweler nodyn 2 isod)

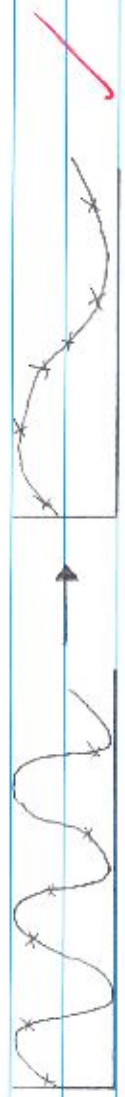
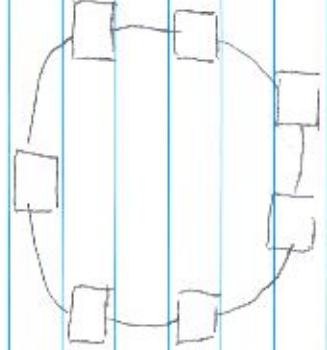
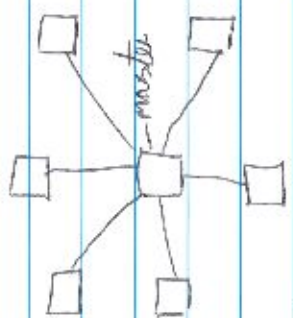
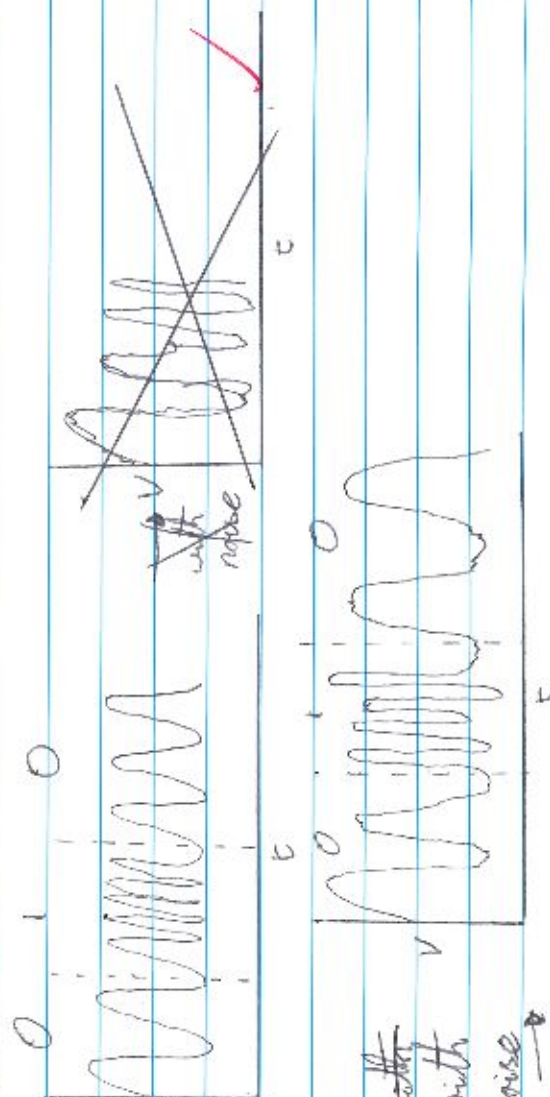
CYFENW:

ENW(AU) CYNTAF:

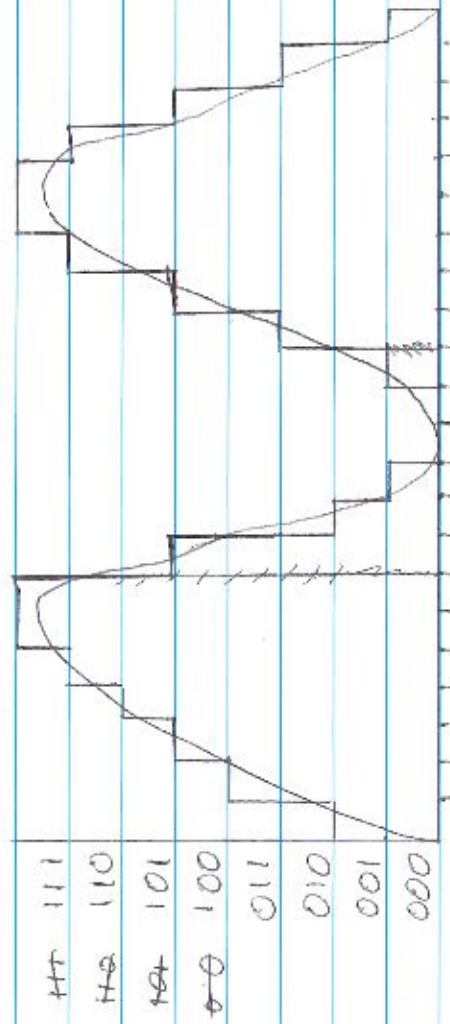
ENW(AU) CYNTAF: _____

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

(See the other side for English version)

Question No.	Examiner Only	Question No.	Examiner Only
A5.	Aliasing refers to the phenomena that occurs when a sampling rate cannot sufficiently sample a high frequency signal resulting in fewer plot points, which produces a converted signal of much lower frequency 	A7.	Message 1 = $652963_{99} = 6595.58$ remainder check digit confirms message integrity Message 2 = $741294_{99} = 7487.81$, remainder does not match check digit of 46, thus message has been corrupted and must be re-sent from source (4)
A6.a	ASK is a method of encoding binary data as changes in amplitude i.e. high for '1', low for '0'. The issue with ASK is that it is susceptible to interference noise, which can overlay the carrier signal and produce false binary states. 	A8.	Ring  In a ring topology, there is ~~the only~~ only node that may send data ~~to~~ holds a token that gives it In a ring topology, a token is passed one node to the next in a ring. Only the node holding the token may send data, and once the node's task is complete, it releases the token for the next node to send data. This topology is problematic as a node can hold up the ~~rest~~ other nodes by failing to release the token, or there could be a break in the line. Star  In a star topology, there is a master at the center of the network that links to each client node and handles communication both to and from. If an individual link between master and client is severed, the rest of the clients ~~should~~ be unaffected. However if the master goes down, then none of the clients may communicate. (6)
	FSK is a method by which a shift in frequency indicates a binary value i.e. high frequency for '1', low frequency for '0'. The benefit of FSK is that it is relatively impervious to noise as noise only interferes with amplitude. However, an issue with FSK is that it requires a greater bandwidth than ASK. 		
Author yn unig	Rhif y Cwestiwn	Author yn unig	Rhif y Cwestiwn

b.



At regular intervals, an analogue signal is sampled, and an approximation of the closest binary value is matched to the sampled amplitude. Quantisation error is the difference between the approximated value and the actual amplitude of the source signal. To rectify the error, the resolution could be increased by using a higher bit ADC (8-bit) so a narrower approximation range can be used.

c. Pulse code modulation noise immunity as binary signals are easier to distinguish after filtering than analogue values.

d. i. Dynamic Range = $20 \log_{10}(2^8) = 48.17 \text{ dB}$
 ii. SQNR =

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

In 16-Quadrature Amplitude Modulation, each coordinate holds 1 bits of data represents 1 bits of data, so each quadr holds 4 bits and the whole 4 quadr holds 16 bits. The co-ordinates identify a point in amplitude at a phase shift. The benefit of the phase shift is that it is readily more identifiable after filtering noise and ~~bandwidth~~ bandwidth may be used more efficiently. Each constellation represents 2 bits of data.

f. Resolution is the definition of how narrow the range used to ~~indicate~~ sample the ~~source~~ source signal, for example a resolution of 1V is too vague in comparison to 0.1mV where a point of amplitude may be more accurately measured.

B3 a.

Preamble	SDP	Destination	Source	Length	Payload	End of frame
7-bits	1-bit	MAC 6bits	MAC 6bits	2-bits	46-1500 bits	1-bit

The Preamble is used to identify that to signify that this is a frame. It is made of alternating binary digits.

Destination MAC is the address of the machine to which the frame is destined.

The source MAC is the address of the sending machine.

A MAC address is fixed and cannot be altered, though it can be cloned or tied to an IP address.

Length signifies the length of the frame.

If the payload is less than 46 bits, then the payload is padded out to total 46 bits to meet minimum frame size.

b. Application - concerns the handling of de-coded data by apps such as web browsers, SCADA, email

Presentation - how information is displayed to the user

Session - e.g. gRPC, HTTP - concerns handshake protocols between network nodes e.g. telnet

Transport - How data is sent between nodes

e.g. TCP, UDP

Network - Connection protocols between nodes

e.g. IPv6

Data Link - Ethernet protocols used in local connections

Physical - How data is sent over

Electronic signals and optical signals

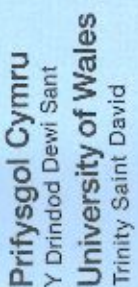
e.g. Fibre, RS232

c. Collision Sensing - Multiple Access is a protocol where conflicting communications are detected and resolved where one node acknowledges conflict, sends a jam flag and other traffic continues to completion. Once conflict is resolved, the jammed sender may resume.

d. Unicast - Data is sent to one address, and all other addresses ignore and discard received data.

Multicast - Data is sent to be received by multiple addresses, but not all.

Broadcast - Data is sent to be received by all addresses.



SURNAME: Jones

FORENAME(S): Toreff Owen

Examination Answer Books

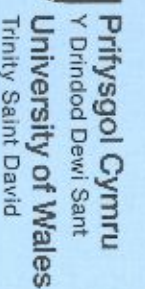
12 Pages

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	150299971
2	Title of Examination Paper	Signals + Digital Comm
3	Module Code	PSDE5014
4	Date and Time of Examination	3/5/18 9:30 AM
5	Examination Venue	
6	Seat Number	N/A
7	Number of Answer Books handed in	7

(Gweler yr ochr arall am y rersawn 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 seilio 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 amwybyddu sgrïp annarlennadwy, neu drefnu iddi gael ei theipio 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 drwyddynl.
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 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.

Llenwch, plygwch a seliwch (lawer nodw 2 isod)

(caweler nodyn 2 isodi)

CYFENW:

ENW(AU) CYNTAF:

1	Rhif Myfyriwr		Rhestrwch rifau'r cwestiynau a ymgaisiwyd gennych	At Ddibenion y Swyddfa
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		Cyfanswm	

(See the other side for English version)

Question No.	Examiner Only	Question No.	Examiner Only
A2	Receiver Receiver aerial - The purpose of the aerial is to receive signals in a particular band and forward them to the R.F. amp. R.F. Amplifier - This amplifies the received signal in preparation for the mixer while amplifying to a specific range. Mixer - The mixer is used to turn the input signal into a static 455KHz, it achieves this with the assistance of the oscillator. I.F. amplifier - Amplifies the ~~received~~ signal so that the detector can demodulate the message from it. Detector - Demodulates the message from the signal. A.F. amplifier - Amplifies the demodulated message so that it is of great enough amplitude to be played back by a speaker.		
A4	The successive approximation ADC works by halving the number of bytes ^{now by} & successively in order to determine ~~the~~ the input voltage is and then converts it to binary. The advantage of this is that it's fast operator at a reliable speed, but the disadvantages is that it takes longer to calculate than some other ADCs. AS. Aliasing is when high frequencies and low frequencies become indistinguishable by the ADC. Aliasing occurs when Nyquist criterion is violated. AG. a) Amplitude shift keying This is when the amplitude of a ^{message carrier} wave is changed in accordance with a message b) Frequency shift keying This is when the frequency is changed in accordance with a message in order to be transmitted.		
A5	Aliasing is when high frequencies and low frequencies become indistinguishable by the ADC. Aliasing occurs when Nyquist criterion is violated. AG. a) Amplitude shift keying This is when the amplitude of a ^{message carrier} wave is changed in accordance with a message b) Frequency shift keying This is when the frequency is changed in accordance with a message in order to be transmitted.		
A6	Aliasing is when high frequencies and low frequencies become indistinguishable by the ADC. Aliasing occurs when Nyquist criterion is violated. AG. a) Amplitude shift keying This is when the amplitude of a ^{message carrier} wave is changed in accordance with a message b) Frequency shift keying This is when the frequency is changed in accordance with a message in order to be transmitted.		
A7	Aliasing is when high frequencies and low frequencies become indistinguishable by the ADC. Aliasing occurs when Nyquist criterion is violated. AG. a) Amplitude shift keying This is when the amplitude of a ^{message carrier} wave is changed in accordance with a message b) Frequency shift keying This is when the frequency is changed in accordance with a message in order to be transmitted.		

Question No.

A7. $657963 \div 99 = 6595.58$
 $741284 \div 99 = 7487.81$

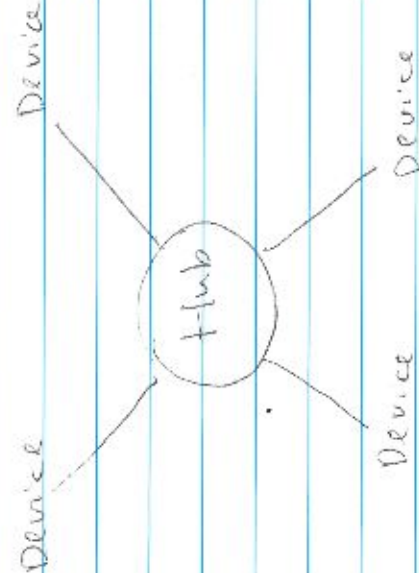
The first message had a remainder of 58, where digits 58 were meant to be checked - this is the correct value which gives no reason to believe that an error occurred. The second message had a remainder of 81, where digits 48 were meant to be checked - this indicates that an error has occurred.

A8. ~~Star~~ Bus



Data is not stored in a single area

Star



Data is stored through a hub

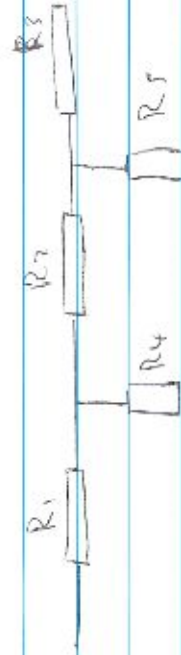
Question No.

Part B

B2

a) ~~Expto~~

R/ZR DAs work by having a number of registers in for serial, and then a number of registers in between them in parallel.



4

0

Examiner Only

Arholwr yn unig

Rhify Cwestiwn

Arholwr yn unig

Rhify Cwestiwn

B2



b)

In a 3 bit quantiser, the ADC only takes samples at 8 separate levels of amplitude as $2^3 = 8$. Increasing the resolution of the ADC would mean more samples could be taken and a more accurate binary representation of the wave could be reproduced.

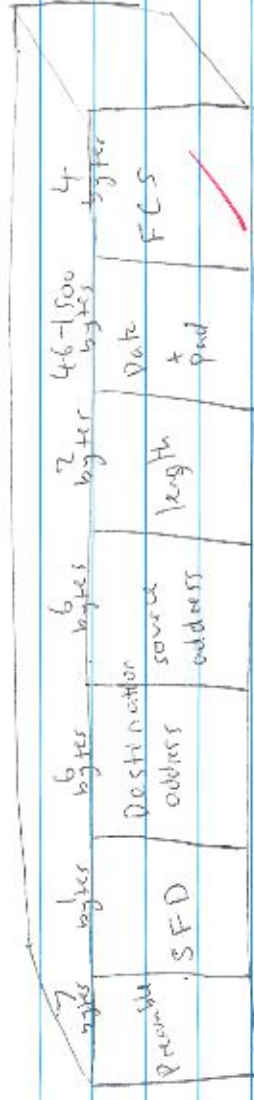
$$d) DR = 20 \log_{10}(N) = 20 \log_{10}(8) = 38.06$$

$$SNR = \text{rms signal voltage} / V_{qn}$$

f) The term resolution is used in describing ADCs is how many samples an ADC takes to reproduce a signal - an 8-bit resolution takes 256 samples whereas a 3-bit resolution takes 8 samples. Therefore if the resolution is too small, quantisation errors occur.

B3

a



Preamble - Indicates the start of a new frame and synchronizes conditions between devices

SFD - The start frame delimiter has the binary sequence 10101011.

Destination + Source address - Can either be 6 bytes or 2 bytes. All devices on the network need to be the same amount of bytes. 10Mbps network only use 6 bytes & 2 bytes are generally obsolete.

Length - Measures the amount of data being transmitted, if the amount of data is less than 46 bytes, more bytes are added (this is called the pad) and these bytes are normally just 0s.

Data + pad - the data being transmitted.

FCS - The frame check sequence acts as an error detector - it does this by making the sending and receiving device perform a calculation, if both calculations are correct, there is no reason to believe an error has occurred.

Question No.	Examiner Only	Question No.	Examiner Only
15)	Data-link layer Network layer Transport layer Session layer Presentation layer Application layer Data-link layer - The data-link layer provides error detection. It is the physical address which allows devices to connect to a network. Network layer - The network layer is in charge of providing a logical address on a network which allows data to be routed. Transport layer - The transport layer is used for communicating messages between devices across many layers. Session layer - tracks the data being transmitted and allows sessions to be established, managed and terminated between devices. Presentation layer - used for formatting data to be sent out to the network so that other devices can understand the data. Application layer - responsible for allowing the end-user to send and receive the transmitted data on a screen.	Question No. Examiner Only	Question No. Examiner Only
	16) C. CSMA Collision detection is used when two or more applications send data simultaneously in the same collision domain. These applications then back-off and send a jamming signal called a "carrier" which tells all connected devices to wait a random amount of time before attempting to transmit data again. This is an analogy that could be used for this. It is a bridge with two roads on it. Data can travel freely on the roads but must be granted permission to cross to the other side. When a collision detection occurs, only devices on the same collision domain are affected, not the entire network.	Question No. Examiner Only	Question No. Examiner Only
	17) CSMA/CD Collision detection is used when two or more applications send data simultaneously in the same collision domain. These applications then back-off and send a jamming signal called a "carrier" which tells all connected devices to wait a random amount of time before attempting to transmit data again. This is an analogy that could be used for this. It is a bridge with two roads on it. Data can travel freely on the roads but must be granted permission to cross to the other side. When a collision detection occurs, only devices on the same collision domain are affected, not the entire network.	Question No. Examiner Only	Question No. Examiner Only

[illegible]