



1
1
3

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 read 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	2316794
2	Title of Examination Paper	Signals and systems
3	Module Code	AcDA 4009
4	Date and Time of Examination	10/5/24 12:00
5	Examination Venue	310
6	Seat Number	17
7	Number of Answer Books handed in	

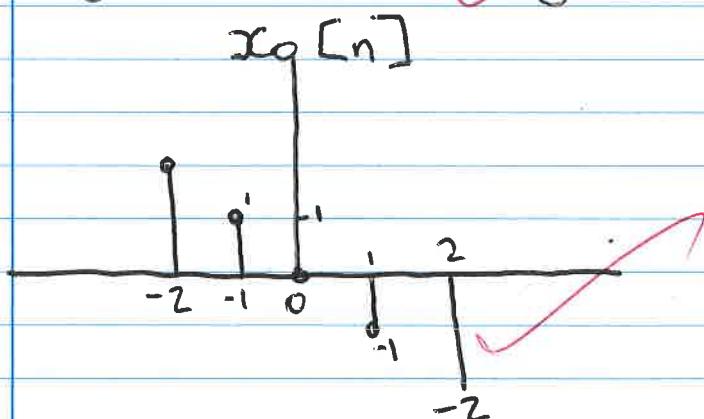
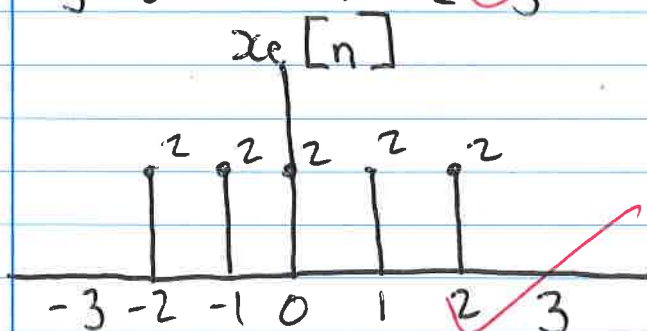
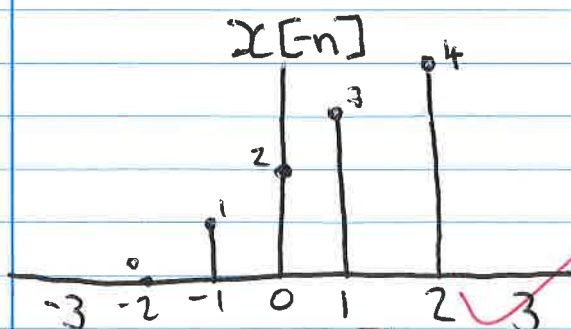
[illegible]
$$\frac{98}{100}$$

p21
25/5/24

1) a)

$$i) \quad x_e[n] = \frac{1}{2} (x[n] + x[-n])$$

$$x_o[n] = \frac{1}{2} (x[n] - x[-n])$$



ii)

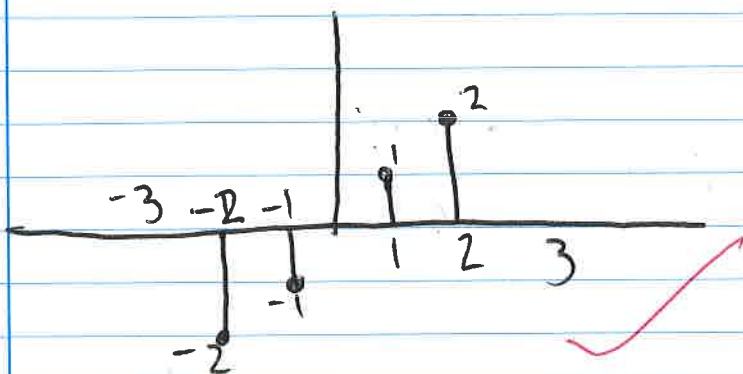
$$x_e[n] + x_o[n] = x[n]$$

$$= \frac{1}{2}(x[n] + x[-n]) + \frac{1}{2}(x[n] - x[-n])$$

$$= \frac{1}{2}x[n] + \frac{1}{2}x[-n] + \frac{1}{2}x[n] - \frac{1}{2}x[-n]$$

$$= \frac{1}{2}x[n] + \frac{1}{2}x[n]$$

$$= x[n]$$

iii) $w[-n]$ 

3

3

14

2

2

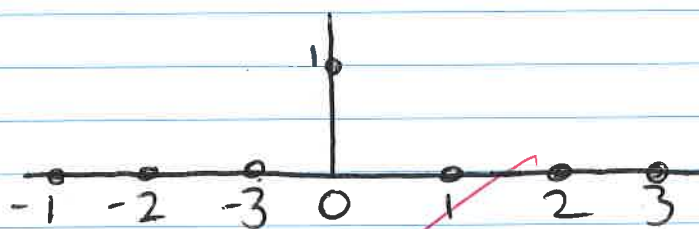
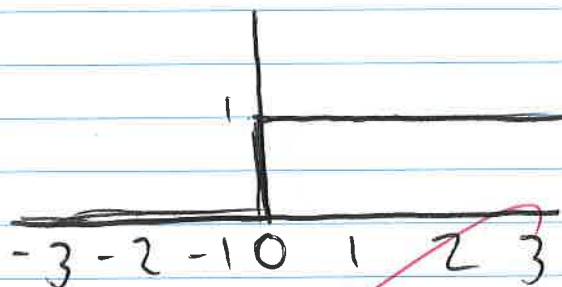
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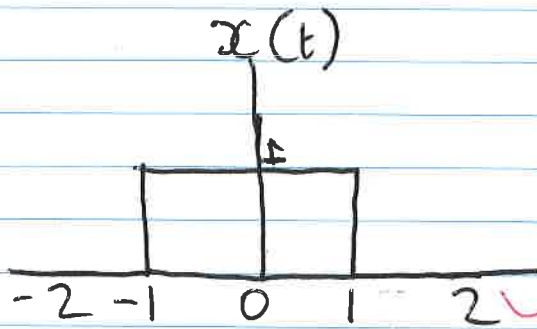
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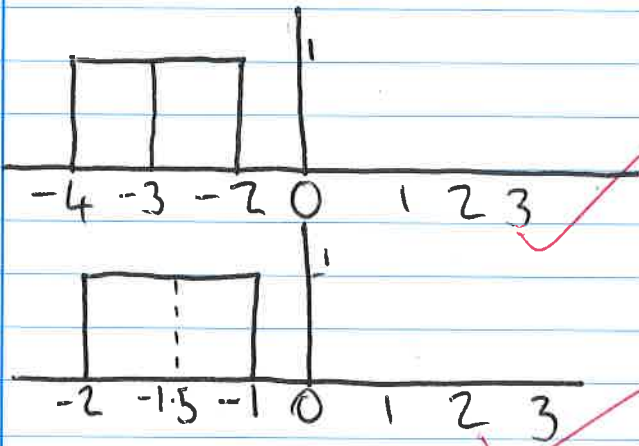
Q2)
a)i) $\delta[n]$ is a discrete unit impulse function $U[t]$ is a continuous unit step function

ii)

 $\delta[n]$  $U[t]$ 

b)
i)

ii)



Q3)

a)

i) I2C - inter integrated circuit

ii) I2C is a point-to-point, serial, Synchronous communication, uses a master slave mechanism

iii) I2C uses a master slave mechanism and makes use of 2 wires SDA and SCL, there can be multiple master and slave devices, The master initiates communication and generates the clock signal, it then addresses the slave, it sends requests and the slave responds, The start of communication is indicated by a High-Low

Transition on SDA while SCL is high, a Stop is indicated by a Low-High Transition, Data is transmitted in a byte-wise fashion and each byte is followed by an ~~ack~~ acknowledge bit so the slave can confirm successful Reception

iv)

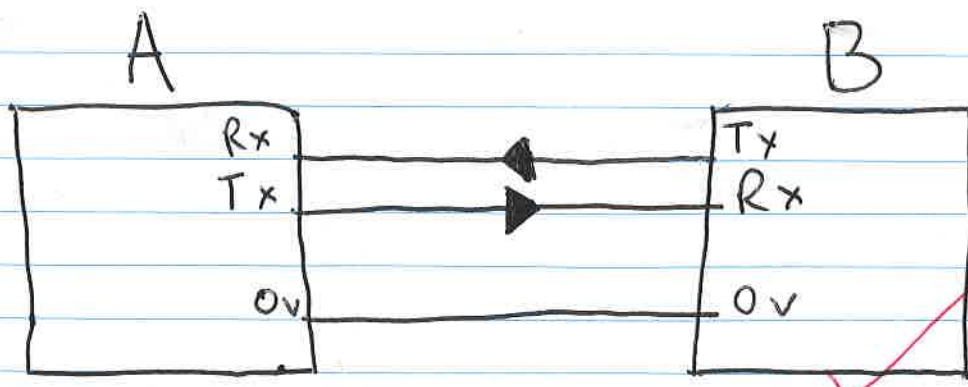
SDA - Serial Data, is used to carry ~~ser~~ bi-directional data from connected devices

SCL - Serial clock, synchronises communications, driven by the master device

v) IOT devices - I2C is used for communication ~~between~~ between sensor ic's such as temperature and humidity to a controlling microcontroller.

Consumer electronics - I2C could be used in sound bars to allow for the main audio processor to talk to other chips such as digital signal processors (DSPs) or volume control ic's

Q) 4)
a)
i)



ii) RS 232 is a asynchronous point-to-point Serial communication

~~iii)~~

iii) RS 232 uses a bi-polar supply meaning:

Logic 1 "mark" is -3 to -15V (typically -12V)
Logic 0 "space" is 3 to 15V (typically 12V)

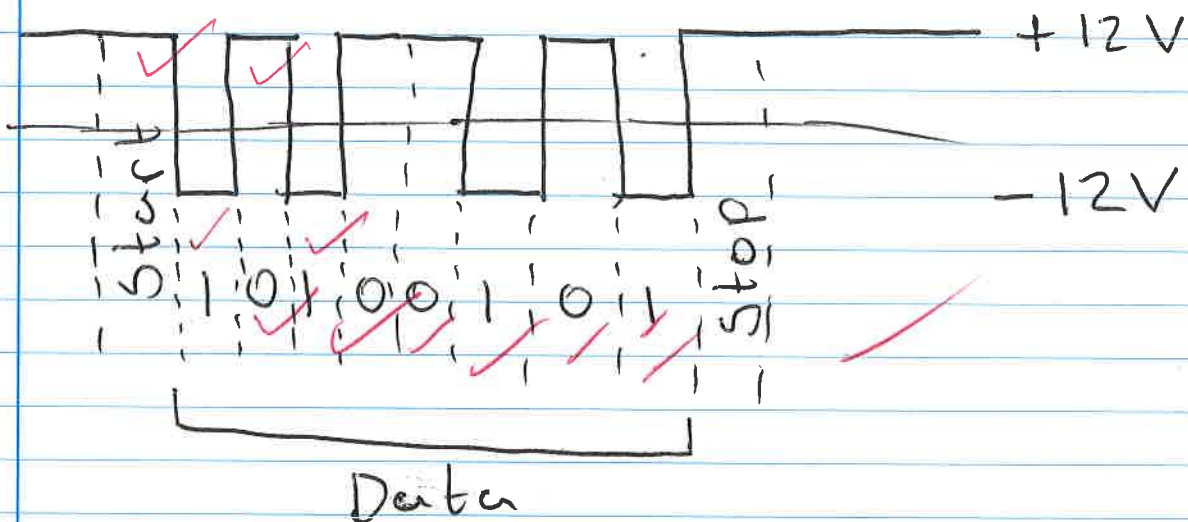
a typical RS 232 packet would consist of 1 start bit 8 data bits and 1 stop bit

RS 232 is asynchronous meaning devices attempting to communicate require to be configured with the same baud rate or bits per second e.g 9600

iv) industrial automation and control -
RS 232 can be used for a programmable logic controller (PLC) to communicate with other equipment such as a Human machine interface (HMI) ✓

peripherals - RS 232 is used on older barcode scanners, ticket printers and lab equipment, an adapter cable can be used for them to communicate with modern computers ✓

v) $0xA5 = 1010\ 0101$

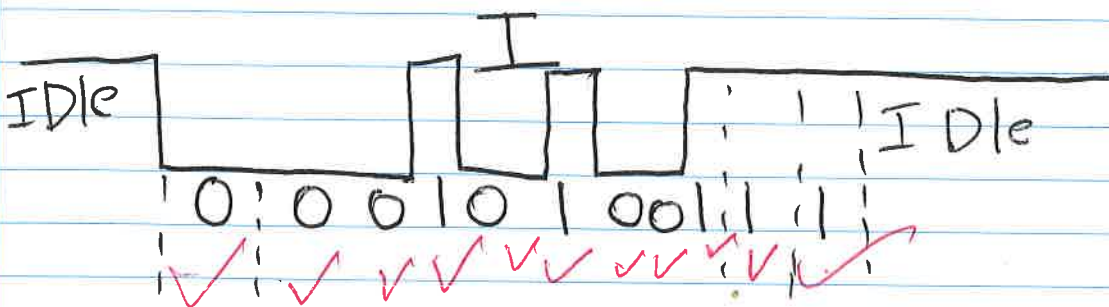
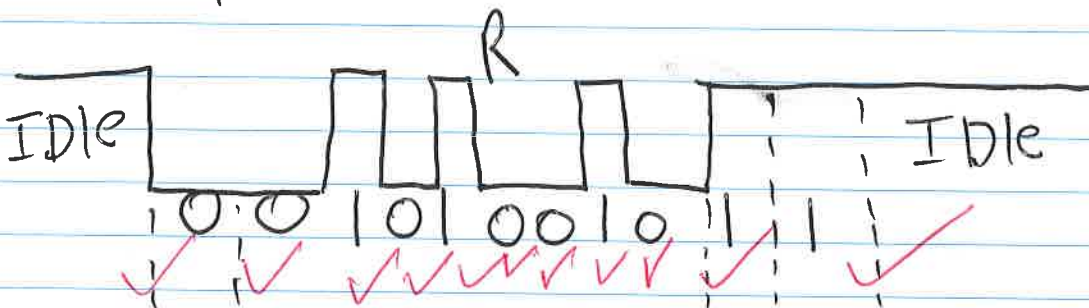
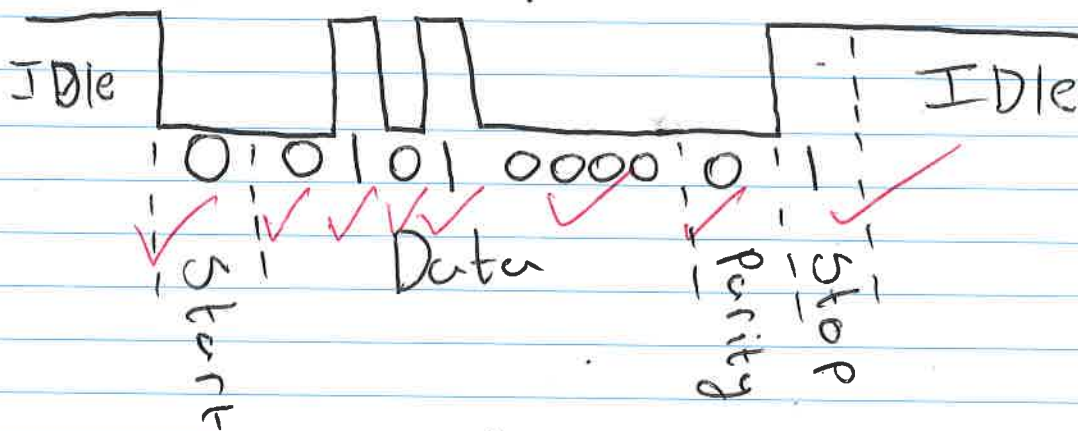


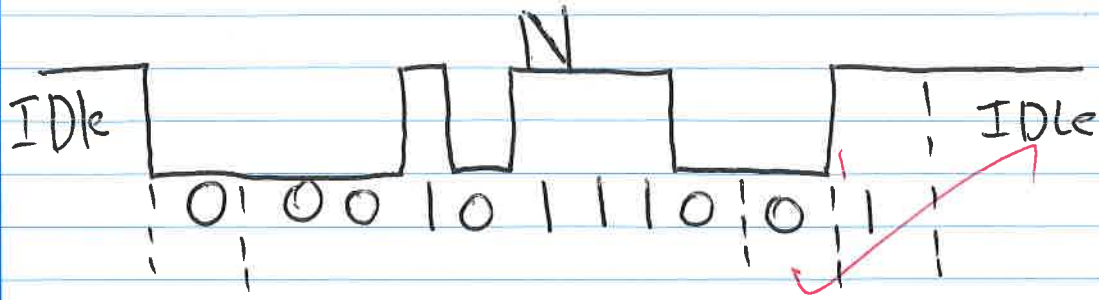
Q5)
a)
i)

"PRINT"

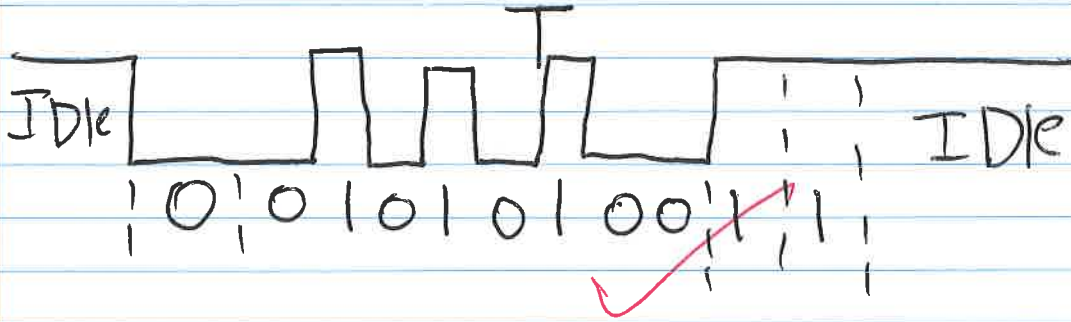
P -	50	-	^{msb} 0101 0000 ✓
R -	52	-	0101 0010 ✓
I -	49	-	0010 1001 ✓
N -	4E	-	0010 1110 ✓
T -	54	-	0101 0100 ✓

MSB first even parity
p





3



3

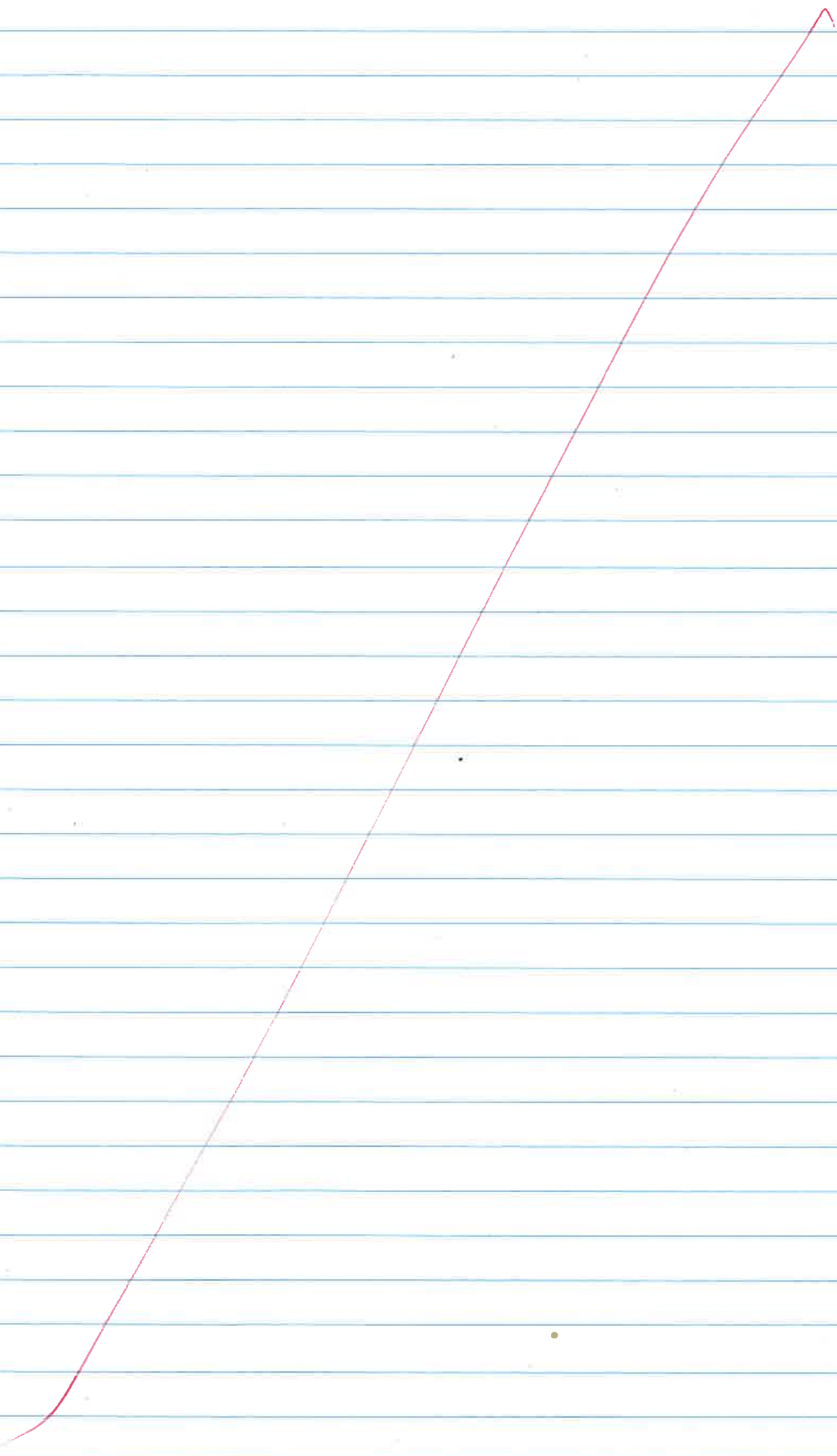
(6)

 $\frac{20}{20}$
 $\frac{20}{26}$



Question No.

Examiner Only



Arholwr yn unig

Rhif y Cwestiwn