

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	2317422
2	Title of Examination Paper	Transducers and Signal Conditioning
3	Module Code	ACDA:5006
4	Date and Time of Examination	07/01/25 15:00
5	Examination Venue	TQ 103
6	Seat Number	33
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

$$\frac{38}{50} \times 100 = 76\%$$

(1)

calibration is used to make sure the readings and measurements of a device is accurate.

there will be a copy of the device that is only used to calibrate all other machines and this will have an accurate ~~value~~ and known reading.

there will come a point in which the device falls outside of the allowed non linearity at which point it will need to be ~~re~~ recalibrated by a device where the measurements are known.

The calibration process will take place in a known environment with minimal factors to change the accuracy of the equipment.

This can include minimal noise, correct lighting, and lack of movement such as people moving or wind. Each device will be set up to as close a frequency as possible to the correct value to ensure the longevity in which it can be used before needing to be recalibrated.

8.

(2)

a) The purpose of this circuit is to stop voltage over a certain point of passing through. Also known as an over-voltage protection or OVP. ~~The voltage can be set to~~

2

b) The two Zener diodes going in opposite directions allow the current to flow both ways allowing minimal component count. they will have ~~set~~ voltage which they will ~~be allowed~~ a maximum set voltage which they will allow pass. If the voltage exceeds that limit then it will all be directed to ground to protect ~~and~~ the circuit. this can be used to stop excessive wear on components, destroying components.

and to stop unnecessary voltage through the circuit.
The R_1 resistor allows the circuit to be more accurate where for allowing the output to be more accurate.

③

a) graph

b) $x = 30$ $y = 5.97$ $y_{\text{should}} = 6.6$

Non linearity of 0.63

full range of graph is 15.12

$$\frac{0.63}{15.12} \times 100 = 4.16\%$$

$$c) \frac{12.41 - 2.71}{50} = \frac{15.12}{50} = 0.3024$$

sensitivity = 0.3024 V

④

a) very sensitive as an excess of chlorine can be harmful.
Will need to be accurate and precise to make sure the level is always controlled.
Will need readings from zero to above what is harmful for humans.
Temperatures that water can be used at is between 0°C and 100°C therefore important that those temperatures are not above and

below the max and min.

low non linearity as misreadings could be harmful.

- b) sensitive as customers need to see how much is being used updated throughout the day. ~~precision is more important than accuracy~~ accuracy is important as customers on a set amount could run out before the meter says. precision is not as important here but still needs a solid level to insure customers are using the correct amount. will need to satisfy in temperatures that gens work at.

not as low non linearity required here as misreadings won't be harmful. this also allows customers to use the smart meter for longer.

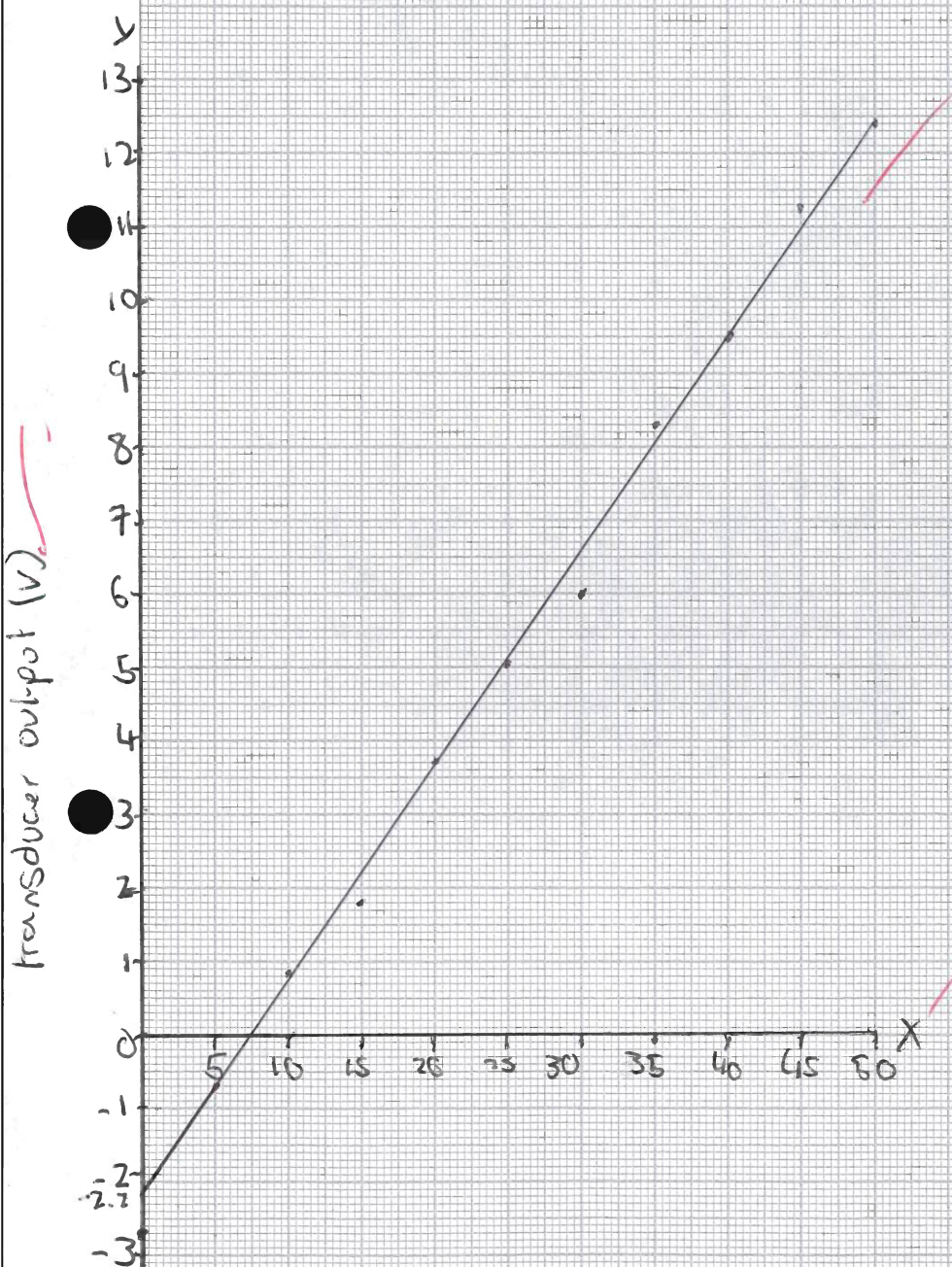
- ⑤ random errors are errors that happen due to conditions outside of the circuit. This can include weather such as wind or rain, noise or other movement.

systematic errors are errors that happen within the circuit. This can include incorrect voltage components that aren't correct or error margin is too large. random errors can be compensated for by changing the environment in some cases.

systematic errors can be solved by changing components such as a resistor or a higher resistance for more accuracy.

Rhys Jones 2317422

③ a)

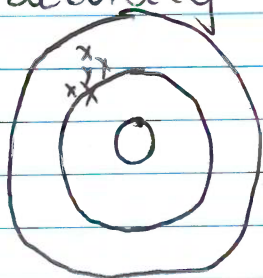


⑥

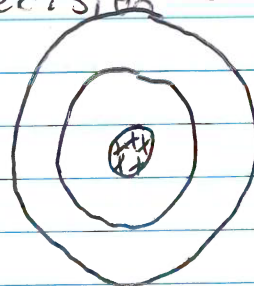
Accuracy is how close the ^{measurements} readings are to the true answer

precision is how close each measurement is to each other

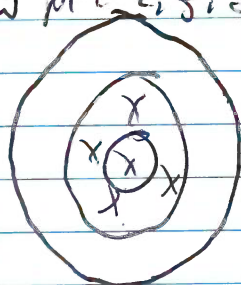
high precision
low accuracy



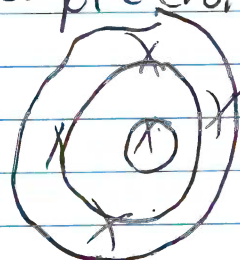
high accuracy and
precision



high accuracy
low precision



low accuracy
low precision



precision will be shown by how closely readings are after a few results. a high precision will have a low difference in readings. the average answer when the measurements are precise will be the same or very close to all or most of the answers.

Accuracy can be shown by how many times it has measured the reading correctly when the true answer is known.

(3)

Sensitivity = 0.3024 V

$$\frac{0.3024}{50} = 0.006048 \text{ V/R}^2$$

X