

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 the flap and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either accept legible 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	2316744
2	Title of Examination Paper	Transducers and signal conditioning
3	Module Code	AcDA 5006
4	Date and Time of Examination	07/11/25 3:00 PM
5	Examination Venue	iQ103
6	Seat Number	39
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

$$\frac{48}{50} \times 100 = 96\%$$

1) any instrument can only be taken to meet its specifications once it has been calibrated. an instrument can be assumed to have been calibrated when purchased from the manufacturer. calibration is performed by adjusting points within the instruments Range to agree with a second instrument kept for calibration.

~~The frequency~~ Over time an instruments characteristics will change. this will then require Re-calibration on a periodic basis. the frequency of these calibrations is determined by specialists based on a number of factors such as: working environment, type of instrument, company policy, customer requirements or legislative requirements.

The working environment can drastically change the characteristics of an instrument, during calibration the instrument should be in a similar environment to where it will be operating, ideally a temperature controlled environment is preferred. Environmental factors such as dust, humidity, vibration and temperature can influence an instrument.

2) a) The purpose of the circuit is over Voltage Protection (ovp), which works with ac Voltages.

B) D1 and D2 are Zener diodes these are used to ~~adjust the point~~ conduct the over voltage to ground, this is at a specific voltage based upon the used diodes, this threshold voltage can be calculated by adding the forward voltage of one diode with the reverse voltage of the other, this circuit also allows for clipping both positive and negative voltages.

R1 is used to limit current flow through the resistors and should be of sufficient value as to limit the current to below the maximum rated current of the diodes.

3)

a) completed on graph paper

B) from graph

$$\text{max deviation} = -2.4 - (-0.69) = -1.71$$

$$\text{Range} = 12.41 - -2.71 = 15.12$$

$$(1.71 \div 15.12) \times 100 = 11.31\%$$

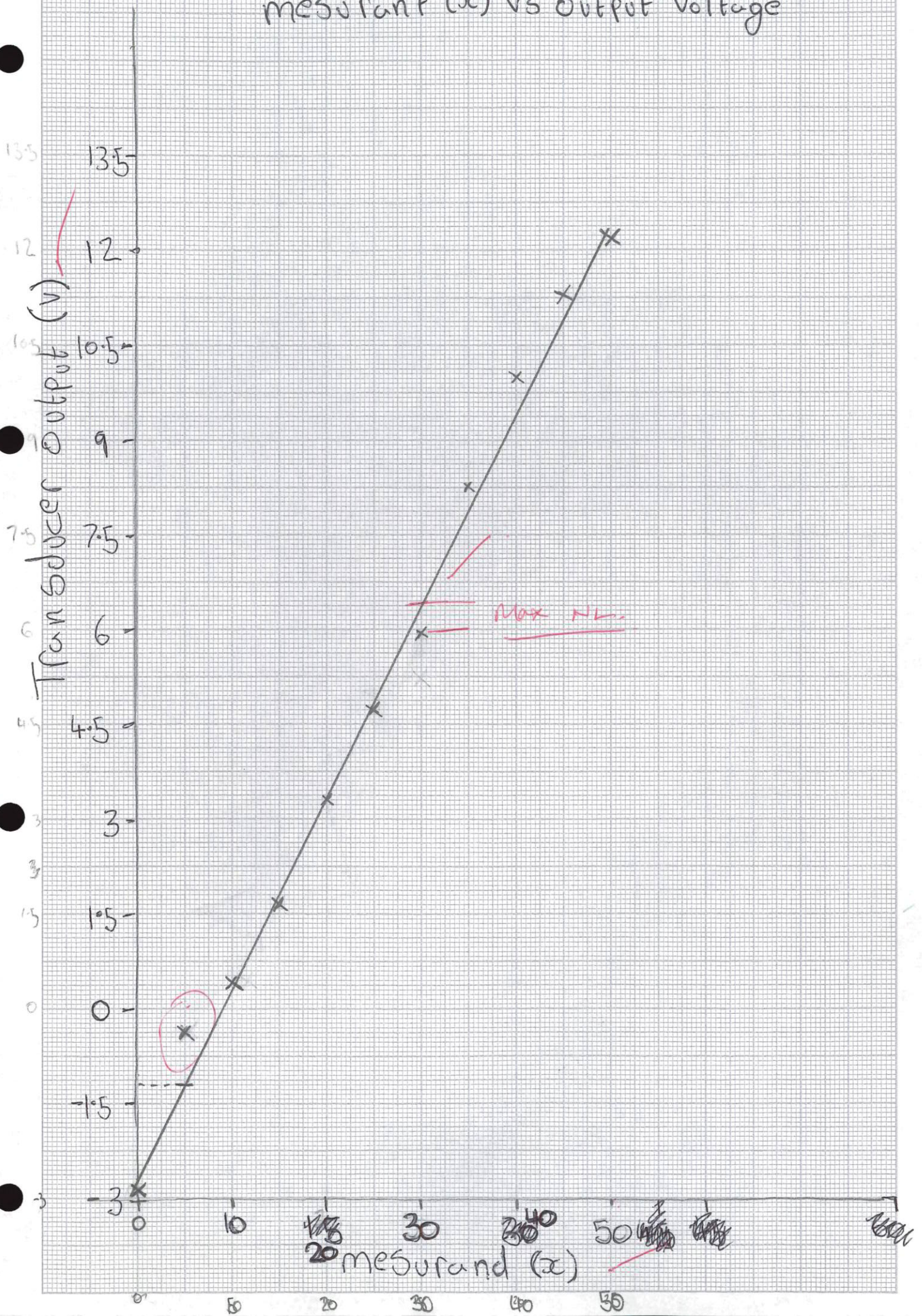
C)

$$\text{sensitivity} = \frac{\text{change in output}}{\text{change in input}}$$

$$\frac{12.41 - (-2.71)}{50 - 0} = 0.302$$

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mesurand (x) vs output Voltage



D) $Y = MX + C$ $C = \text{zero offset}$

$$12.41 = 0.302 \times 50 + C$$

$$12.41 = 15.1 + C$$

$$12.41 - 15.1 = C$$

$$C = -2.69$$

4)

Specification	Chlorination Plant	Smart gas meter
Cost	High cost due to industrial market	Low/medium cost due to commercial target
Operating Environment	Requires resistance to harsh chemical / outdoor conditions	Lower requirements as will be fitted indoors, however should be waterproof
Operating medium	must work with ~~other~~ fluids	must work with gas
Reliability	Extremely Reliable as failure could lead to health Hazards, would likely be in a Redundant system however	Standard Reliability for commercial device failure does not pose health risk, ~~except~~
Safety	must follow current industrial automation standards, must work in a fail-safe system	must follow current Gas Related legislation and be completely air tight
Measurement Range	0-500 L/hour	0-1 ~~L~~ L/hour
Sensitivity	high Sensitivity to ensure correct Volume of chlorine is maintained	Low Sensitivity as it is not required and would increase costs

Specification chlorine meter Gas meter

Power	Industrial standard	domestic 240 V
Supply	24V input	Ac input
Output signal	4-20mA current loop	Built in display / wifi App connectivity
Precision	Highly precise to ensure correct amount of chlorine	Low precision as is only for indication in domestic house

~~5)~~

5) Systematic errors are often Results of design issues within an instrument and can cause issues such as Zero drift and sensitivity drift whereas Random errors Source is not easily known and is often caused by fluorescent lighting, current carrying ~~wires~~ ^{wires} near signal cable, audio circuits / RF circuits and switching noise often the ~~the~~ influence from Random noise can be Reduced through averaging

6) precision is the specified freedom in a reading caused by random noise. Whereas Accuracy is the closeness of a reading, calculation or specification to the correct value.

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