

**Complete, fold and seal
(see note 2 below)**

SURNAME: Jones

FORENAME(S): Nicholas Tim

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	P149676
2	Title of Examination Paper	Transients and signal conditioning
3	Module Code	ACDA5006
4	Date and Time of Examination	15/5/19 12:00 PM
5	Examination Venue	102 310
6	Seat Number	G034
7	Number of Answer Books handed in	①

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

90-5%

90.5%

- 1) accuracy is the closeness of measured values to the actual quantity being measured. ✓

Precision is the closeness of multiple measured values of the same quantity ✓

eg



accuracy is good ✓



precision is good ✓

(5)

(5)

2)

$$\begin{aligned} \text{x axis kg} &= 0 \text{ to } 100 \\ \text{y axis mm} &= 0 \text{ to } 5 \end{aligned}$$

$$\begin{aligned} \frac{\Delta y}{\Delta x} \quad \text{SD} &= \frac{\Delta \text{sensitivity}}{\Delta^\circ \text{C}} \\ \text{ZD} &= \frac{\Delta \text{zero shift}}{\Delta^\circ \text{C}} \end{aligned}$$

a) on graph paper

- (3.5)

(3.5)

b) sensitivity @ $21^\circ \text{C} = \frac{1-0}{25-0} = \frac{1}{25}$

sensitivity @ $21^\circ \text{C} = 0.04 \text{ mm/kg}$ ✓

sensitivity @ $35^\circ \text{C} = \frac{1.3-0.2}{25-0} = \frac{1.1}{25}$

sensitivity @ $35^\circ \text{C} = 0.044 \text{ mm/kg}$ ✓

sensitivity drift

c) ~~zero drift~~ = ~~0.002~~ $\frac{0.044 - 0.04}{35 - 21}$ ✓

sensitivity drift = $\frac{0.004}{14} = 0.0002857$ ✓

sensitivity drift = $0.000286 \text{ (mm/kg)/}^\circ \text{C}$ ✓

(2)

(2)

$$\text{zero drift} = \frac{0.2 - 0}{35 - 21} = \frac{0.2}{14}$$

$$\text{zero drift} = 0.0143 \text{ (mm/kg)/}^\circ\text{C}$$

3)

a) Average measurement = $\frac{42.93}{10} = 4.293$

max ^{value} ~~deviation~~ = $4.296 - 4.293 = +0.003$

min value = $4.290 - 4.293 = -0.003$

Precision = $\pm 0.003 \text{ m}$

b) actual measurement is 4.276 m
Max measured value is 4.296

$$4.296 - 4.276 = 0.02$$

Maximum inaccuracy = $\pm 0.02 \text{ mm}$

c) actual measurement is 4.276

max value 4.430

min value 4.424

inaccuracy = $\overset{4.43}{4.30} - 4.276 = 0.024 \text{ mm}$

* d) Include a temperature sensor in the measuring device and include ~~into the calculations~~ the formula into calculation

5) x axis 0 - 100
y axis -3 - 12.5 volts

a) on graph paper - (4)

b) max Non Linearity = 3.5 ^{units} ~~3.5~~ ~~1.25 volts~~
~~max Non Linearity = 700 mV~~ 0.7V ✓

Full Scale deflection = 12.5 V

max Non Linearity % at Full Scale deflection =

$$\frac{0.7}{12.5} \times 100 = 5.6\% \quad \text{700} \quad \text{1.25 units} \times 100 = 28\%$$

ANS = 5.6%

c) Sensitivity $\frac{\Delta y}{\Delta x} = \frac{12-0}{100-14} = \frac{12}{86} = 0.13953$

Sensitivity = 0.13953 V/?

V/unit.

6)

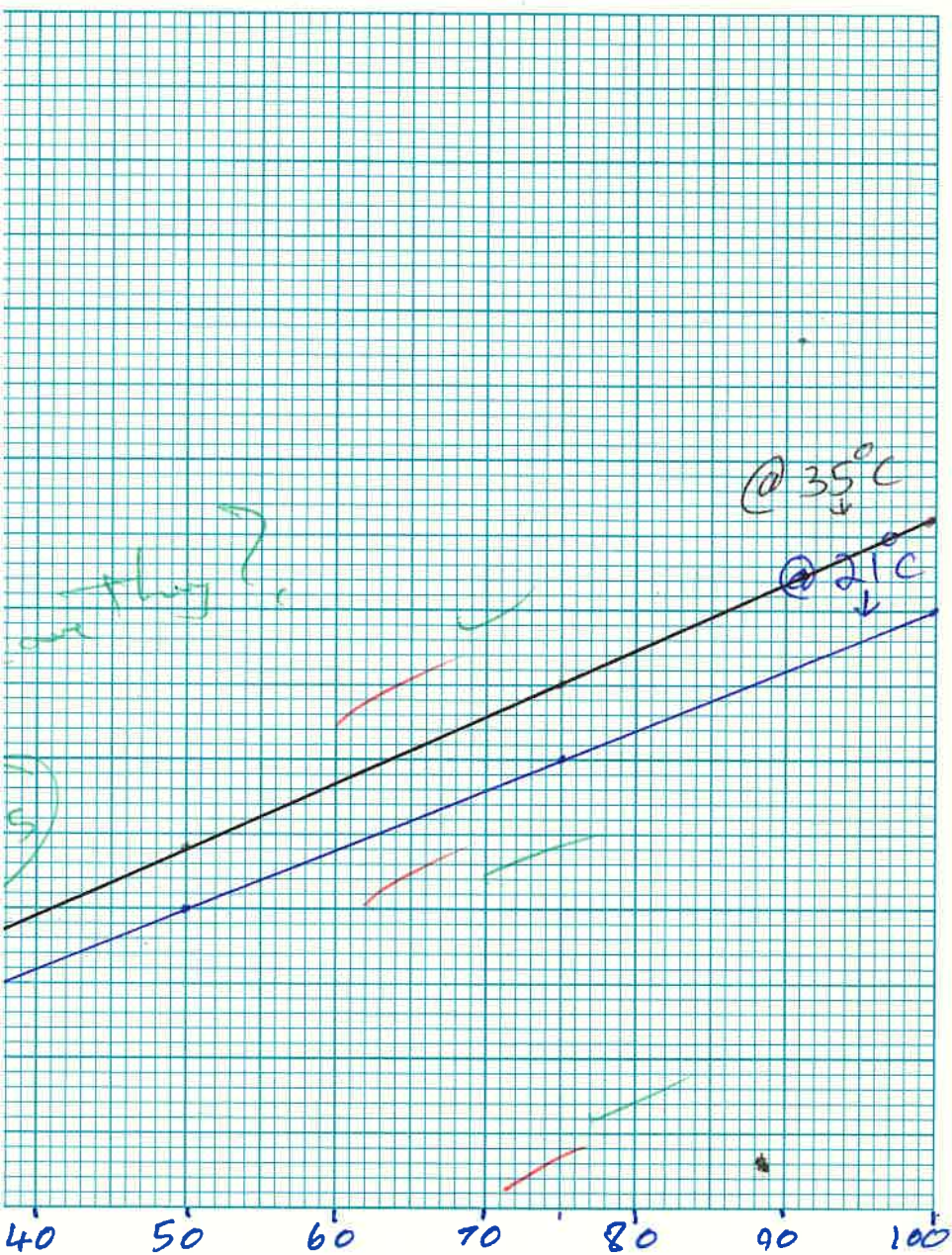
a) high pressure reading e.g. ^{2 bar} ~~30 psi~~ or more
needs to withstand harsh environment such as
high temperature and physical such as being
dropped or kicked ✓

b) Lower more precise measuring range under
1.5 bar
needs to withstand colder temperature at altitude
more care is needed ~~than~~ physically as it is
a safety critical device ✓ (3)

4) Random errors ~~error~~ can occur at anytime
~~if no change to input~~

Systematic errors are caused by a change in
the systems conditions ✓

e.g. a change in ambient temperature could
cause errors to occur. (5)



max Non
Linearity
3.5

12-0

100-14