Lab3: Exp. Setup

22/2/2016.

* Problem Statement: Exp design setup:
  - laboratory facility setup from labmanual
  - RTD sensor between 0°C & (40°C - 45°)

* Key words:
  * Device under test: DUT → RTD sensor.
    - we need to understand what is RTD sensor.

R * datasheet targeting electrical p.

* automated setup.

* must check the facility.

* 0°C & 40 - 45°C.

* Laboratory facility setup:

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* review

* Engg Design Process:

5 steps

define pb and determine requirements
↓ — Fn decomposition
generate alternatives
↓ — KOTA choose best alternative in stage of
Select and decide on final design concept (compare alternatives) — using KOTA.
↓
Model and Build → in lab 5
↓
Test / Evaluate

* steps are loop. back and forth.

① Define pb ✓

② determine Requirements ≡ list of specification

↙ MUST "demanded"

↘ WANT "wished for".

- automated setup

must

- setup building to give t° range between $0^\circ C$ and $45^\circ C$
- data output: must be a RTD sensor
→ (mono these are the initial specifications)
- Safety (since second part) flammable material.

RTD (ici) 6 want

- simple design by engg
- lab facility (they said "preferably")
- steps increments ↑
- Easy maintenance
- Easy to use by end user.

- must as a want: fail the project.
- want a must: more complex.

inlab1: deduce from pb statement → must / want

N.B: wants can be not clear, or directly from problem statement,

SQ1

- RTD: Resistance and temperature
→ the data sheet will be a graph of resistance and voltage

RTD: Resistance & voltage.

II - Generate alt. design concepts:

- concept: idea in here (not detailed)
- alternative: proposed ideas may be different.
- at least 3 ≠ concepts
- Main goal: Identify, evaluate and analyze alternatives.

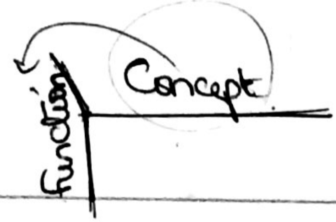
→ we need to decompose project = "Functional decomposition for complex systems"

- Functional decomposition of my design:

Step 1: Decompose into a series of functions

- device cool / Heat 40-45°
- temperature measuring
- resistance measuring
- smthg to plot data.

step 2:



Sb23

step 3: choose different combinations.

45:00 - design (alternative) =

KDTA

III - final design concept selection and decision:

.Peltier: : gives ΔT based on ΔV or ΔI
thermoelectric devices. (solid state device).

* Always keep second plate at room temperature.
↳ for more efficiency.

cooler
$\Delta T = 30°$
hotter 25C

* advantages:
① small
② Heating and cooling at same time
③ no enviro -ve effects
④ maintenance free.

Fan: to take heat away

. Sensors:

→ How to differentiate : output (is y axis).

. RTD : +ve temp. coefficient (PTC)
* Thermistor : -ve temp coefficient (NTC).

* Thermocouple : voltage or current
* IC sensor : (must have biasing circuit)
↳ zener breakdown voltage.

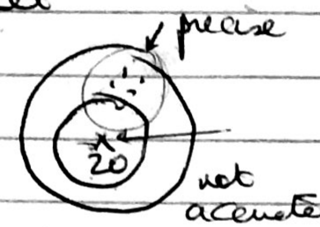
① Precision:
. IC : perfectly (linear): advantage since no need for equation every time
. RTD: almost (linear)

. accuracy: "Not from Graphs" → we need to repeat the exp. multiple times.

✓ sensitivity : related (to slope)
↳ IC sensor?

1:10-1:14 (linearity) | range

not from graph.
- • Accuracy: repeat multiple times to get the ideal result
- • Precise: the rate of precision



not for graph. → * stability → related to chemical p

not from graph → * response time: responsiveness.

(Lab 4)

DAQ: data acquisition

→ PCI 6251 (board)
or → USB plugged

• collect data from transducers and sensors

sensor → DAQ device ⇄ PC
may also from DAQ to DC motor

⚠ signal conditioning

• NI elvis and DAQ connection box → are just terminal device

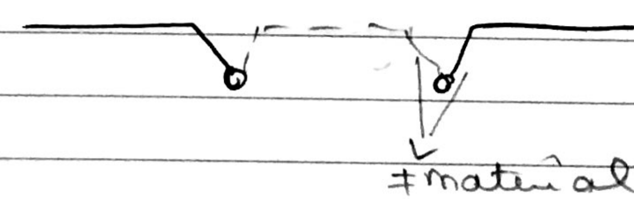
• NI elvis extra features: has instruments:
- * DMM
- * Fn generator
- • oscilloscope.

→ NI elvis is NOT a DAQ, it needs one.

Sensors suite:
. Peltier + DC Fan.
. socket: different types of sensors.

NB: Thermocouple: 2 wires molded together on tip
→ when T° change, each wire ≠ thermocouple coefficient ⇒ this ΔT creates a current Δ.

→ exactly Opposite Peltier = SeaBeck Effect.



· always cold Body to compare ΔT°: 0°C
↓
ΔT

Or: our lab digital thermometer
measures ≠ with Room t°.

III- Final design concept selection and decision:

KDTA table

. Design alternative		1	2	3
. Musts	×			
	×			
Check that all musts are checked.	×			
. Wants	Weight $0<W<1$	Rating Score out of 10 ($\frac{1}{10}$)	Rating Score	Rating Score
	0.5	5 2.5		

1 Score

*N.B: × Bunsen Burner : safety because flamable.

· RC: needs breadboard stuff.

IV - Model / Build the design:

× Peltier to heat / cool + DC Fan.
× IC sensor (easier) T°
× Resistance (Elvis + labview)
× DUT (RTD).

* Power supply from Elvis: Peltier voltage range:
→ take peltier tafalo and start trying: just testing peltier to know minor specifications
× take peltier to PS: ↑ voltage and write down temperature
× DC Fan to 12V
↓
NB: peltier have some time to reply = reponsiveness

× Tools: × PS
× Thermometer
× Peltier

⚠ we also need current given by Elvis

→ so check Peltier on maximum current 6t20 7a60

* consider stabilization time.
* Once we get 5V on voltage supply, switch I button to get current needed