Measurement and Instrumentation Laboratory (EE3P005)

EXPERIMENT-8

Study Characteristics of Thermistor

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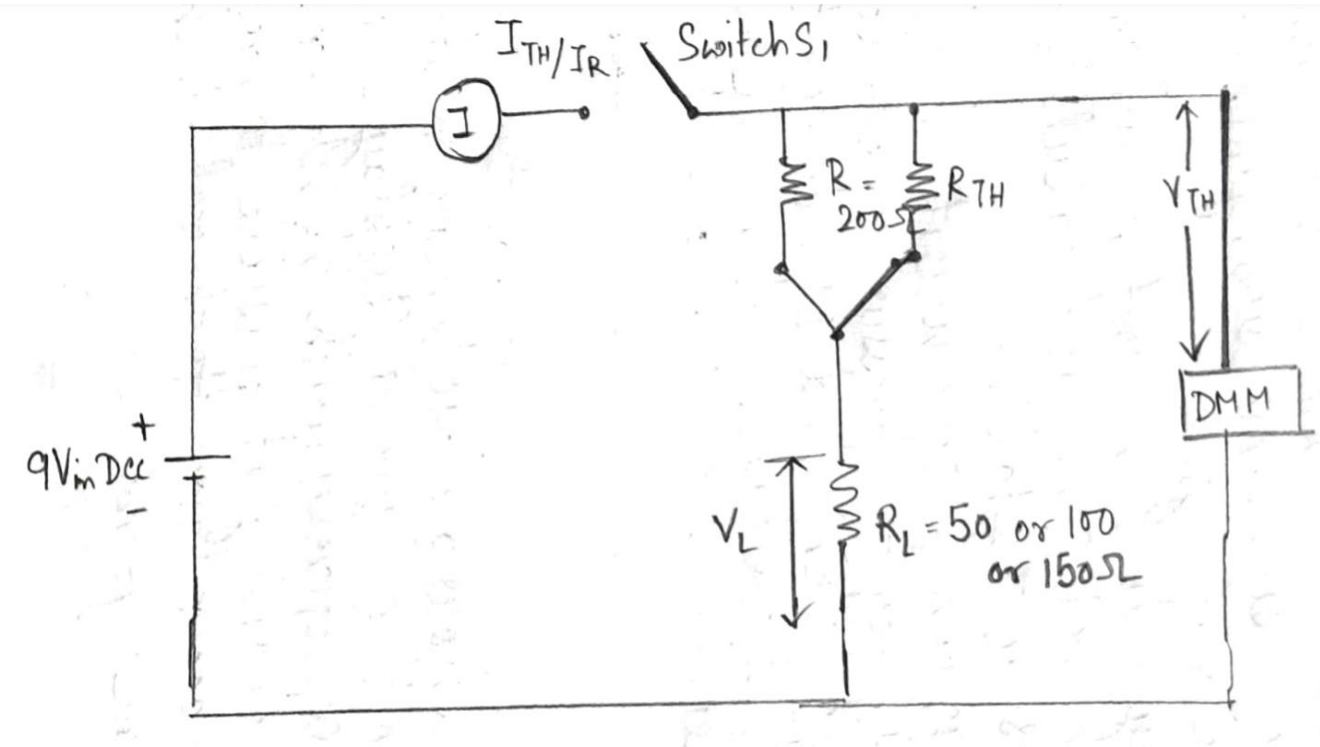
AIM OF THE EXPERIMENT:

To study the characteristics of Thermistor

CIRCUIT DIAGRAM:

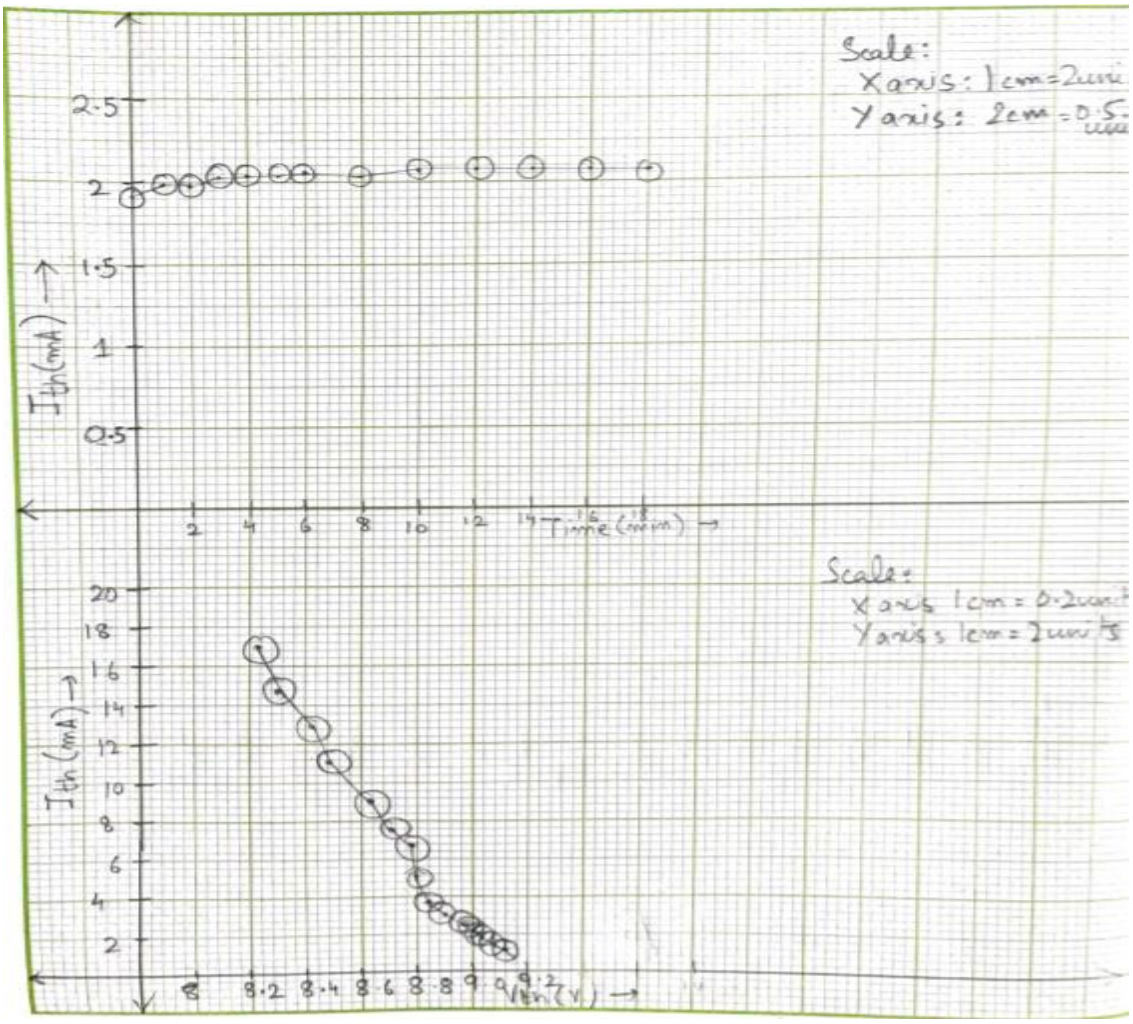


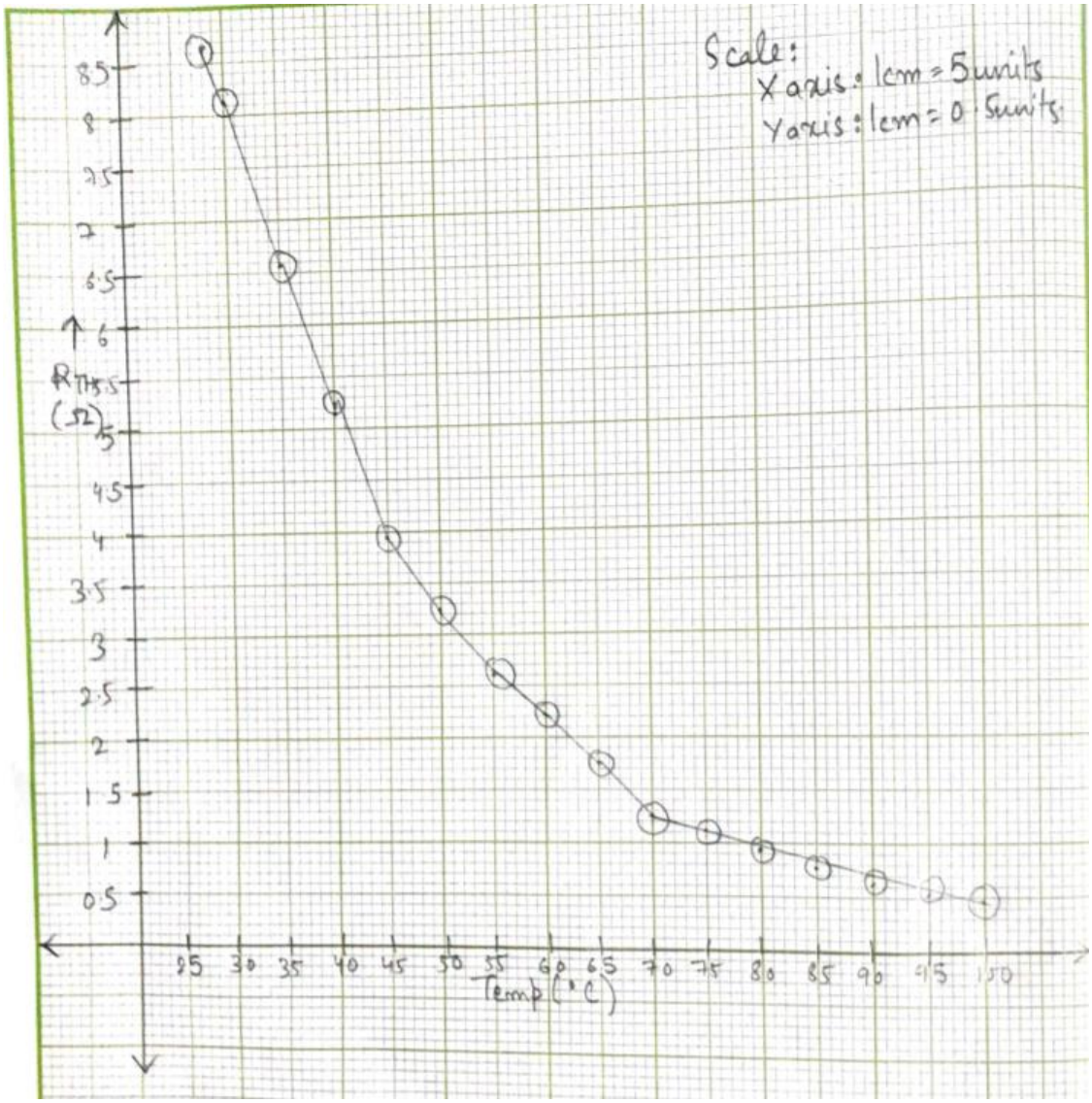
OBSERVATION:

Time (min)	I_{th} (mA)	$I_{R,min}$ (mA)
0	1·84	53·2
1	1·99	53·6
2	1·93	53·6
3	2·04	53·6
4	2·06	53·6
5	2·09	53·6
6	2·11	53·6
8	2·09	53·6
10	2·11	53·6
12	2·12	53·6
14	2·12	53·6
16	2·12	53·6
18	2·12	53·4

Temperature (°C)	I_{th} (mA)	V_{th} (V)	$R_{TH} = \frac{V_{th}}{I_{th}}$
28	1·05	9·11	8·67
30	1·12	9·1	8·125
35	1·39	9·08	6·53
40	1·73	9·07	5·24
45	2·27	9·04	3·98
50	2·77	9·018	3·25
55	3·45	8·97	2·6
60	3·99	8·94	2·24
65	5·05	8·88	1·75
70	6·8	8·8	1·29
75	7·68	8·74	1·13
80	8·9	8·66	0·97
85	10·99	8·55	0·77
90	13·45	8·42	0·62
95	15·45	8·32	0·53
100	17·55	8·21	0·46

GRAPH:





CONCLUSIONS

Hence, we successfully studied the characteristics of the Thermistor by drawing plots between temperature, resistance, Voltages and currents.

Applications:

- Measurement of Gas Composition.
- Current-Limiting devices for circuit protection as replacement for fuse(PTC).
- Used in everyday appliances such as fire alarms, ovens and refrigerators.
- Manufacturing: Used as a circuit breaker i.e., if temperature becomes dangerouslyhigh the thermistor will cause a circuit break.
- HVAC Refrigeration Application: Here thermistors are used to measure building andcontrol processes.

DISCUSSION

1. **What is the objective of this experiment?**

A. Objectives of the experiment are:

- To study the I-V, T-R, V-I characteristics of Thermistor.
- To observe the self- heating effect of current on the resistance of a thermistor.
- To determine the variation in resistance with time of current in thermistor.

2. **You studied another temperature detector RTD in another experiment. Please briefly compare difference in RTD and Thermistor?**

A. Differences between RTD and Thermistor:

S.No	RTD	Thermistor
1.	It is a type of wire whose resistance changes with change in the temperature	It is a temperature sensitive resistor whose resistance varies with temperature variation.
2.	It has a positive temperature quotient	It has a negative temperature quotient
3.	It has a low accuracy	It has a good accuracy
4.	It can be used for high temperatures up to 600^0C.	It can be used only for lower temperatures ranging from -50^0C to 130^0C.
5.	Good Stability	Less Stability
6.	Low amount of Self Heating	High Amount of Self Heating
7.	Output Response is Slow	Output Response is Fast
8.	Resistivity is High	Resistivity is Low
9.	It is cheaper	It is expensive

1. **Mathematically prove that Thermistor has a negative coefficient of resistance with temperature?**

Variation of R with temperature is given by

$$R = R_0 e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)} \rightarrow (1)$$

Thermo temparature coefficient,

$$\alpha_T = \frac{1}{R}\frac{dR}{dT}$$

Subtiting (1)

$$\alpha_T = \frac{1}{R}\frac{d}{dT}\left[R_0 e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)}\right]$$

$$\alpha_T = \frac{R_0}{R} e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)}\left(-\frac{\beta}{T^2}\right)$$

$$\alpha_T = \frac{R}{R} e^{0} \cdot \left(-\frac{\beta}{T^2}\right)$$

$$\alpha_T = \frac{-\beta}{T^2}$$

Since, β and T^2 are also positive,

α_T is negative.