**Experiment 3: Temperature Measurement**

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| **Sl. No.** | **Type of sensor** | **Output at ambient temperature (28°C)** | **Output at 0°C** |
| 1 | RTD | 109.7 Ω | 100.8 Ω |
| 2 | Thermistor | 11.73 kΩ | 30.25 kΩ |

**3.1 Study of different types of temperature sensors**

Procedure:

* The ice pot was filled with ice.
* The output of RTD and thermistor were observed by multimeter at ambient temperature by keeping in air.
* The sensor probes were put in ice pot and output was noted.

**3.2 Characteristics of RTD(PT100) and Thermistor**

Procedure:

* The thermometer and the bimetallic thermometer were used to note down actual temperatures.
* The ice bath was used for temperatures below the ambient temperature.
* Water bath was heated for temperatures above ambient temperature upto 100°C.
* Temperatures between 0°C and 100°C were maintained at intervals of 10°C and were measured by the RTD and Thermistor probes.

Conclusion:

* Thermistor shows decreasing hyperbolic plot with increasing temperatures.
* RTD shows linear increasing plot with increasing temperature.
* Therefore RTD is better for unknown temperature.

**3.3 Time constant for mercury thermometer**

Procedure:

* The water bath was heated to a temperature between 70-80°C.
* The beeper time was set to 2 seconds.
* All the measuring devices were kept at ambient temperatures.
* The devices were introduced in the water bath and reading were taken until steady state was reached.

Calculation:

Step change = (75-28)°C = 47°C  
63.2% of step change = 54.76°C  
Time constant = 5 sec

For bimetallic thermometer:

63.2% of step change = 47.176°C  
Time constant (from graph) = 21 sec

For RTD sensor:

63.2% of step change = 119.3376 Ω  
Time constant (from graph) = 7 sec

For thermistor:

63.2% of step change = 10 kΩ  
Time constant (from graph) = 4 sec

**Discussion:**

* The RTD giving a linear plot is easier to be used than the thermistor giving a hyperbolic plot.
* The actual temperatures are measured by thermometers which might give errors at attaining steady state is slow for them.
* The temperature might change before the outputs are taken.
* Thermistors are much cheaper than RTD.
* Thermistor has a semiconductor whose resistance changes with change in temperature.
* RTD has a metal whose resistance is temperature dependent.
* Thermistors can be better where the change in temperature is small as its variation is in kΩ and RTD in Ω.