CALIBRATION OF RESISTANCE TEMPERATURE DETECTOR (RTD) FOR TEMPERATURE MEASUREMENT.

Aim:
To calibrate the given RTD (PT-100) by using Thermometer

Apparatus:
Temperature sensor (RTD), Heating coil to heat water in water bath, Digital Temperature Indicator & Thermometer.

Theory: Resistance thermometers, also called **resistance temperature detectors (RTD)**, are temperature sensors that exploit the predictable changeinelectricalresistanceofsomematerialswithchangingtemperature. The resistance of RTD increases as the temperature increases. The RTD is linearly related over a wide temperature range. As they are almost in variably made of platinum, they are often called **platinum resistance thermometers.** There are many categories like carbon resistors, film and wire wound types are the most widely used. Platinum is widely used for sensor fabrication since it is the most stable of all the metals, is the least sensitive to contamination, and is capable of operating over a very wide range of temperature. The dynamic response of on RTD depends almost entirely on construction details. In this experiment PT-100 is considered as RTD sensor

Principle:
The principle of operation of RTD: is that the resistance of the conductor varies with the variation in temperature

The amount of change occurred in the resistance can be given by $R = Ro(1+ \alpha 1 T + \alpha 2 T^2 + \alpha 3 T^3 + + \alpha_n T^n)$

Where Ro is the resistance at zero temperature And α1, α2 ,α3 ……. αn are constants

Considering one term only, the equation becomes R =

Ro (1+ α t) α = temperature coefficient of resistance.

Fig: Resistance Temperature Detector.

Experimental procedure:

1. To connect the RTD sensor (PT-100) to pin connector.
2. Switch ‘ON’ the system the power indicator. The RED LED on the front panel will glow.

3. Immerse the transducer in the ice-bath, wait for 2-3 minutes so that the temperature equilibrium takes place and adjust the 0.00 reading on the display by adjusting Zero Pot.

4. Keep the RTD into the boiling water and adjust the display reading to 10

5. Make 0by adjusting through Span Pot 100^0 C..

6. Switch off the heater supply and allow the water and immersed RTD to cool down, and observe the bath temperature With thermometer For every 5^0 C drop in water temperature, note down the thermometer reading and the display temperature and note in observation table.

7. Calculate the Error, correction, % absolute % error and draw the graphs.

8. Keep the RTD in air in room temperature. The indicator will display room temperature**.**

Experimental procedure:

1. Check connection made and Switch ON the instrument by rocker switch at the front panel. The display glows to indicate the instrument is ON.

2. Allow the instrument in ON Position for 10 minutes for initial warm-up.

3. Pour around 3/4th full of water to the kettle and place RTD sensor and thermometer inside the kettle. Note down the Initial water temperature from the thermometer.

4. Select the sensor on which the experiment to be conducted through selection switch on the front panel. Adjust the initial set Potentiometer in the front panel till the display reads initial water temperature.

5. Switch on the heater, and wait till the water boils note down the reading in the thermometer and set final set potentiometer till the display reads boiling water temperature.

6. Remove the sensor from the boiling water bath and immerse it the cold water. Set the cold water temperature using initial set potentiometer.

7. Repeat the process till the display reads exact boiling water and cold water temperature. Change the water in the kettle with and reheat the water. Now the display starts showing exact temperature raise in the kettle.

8. Experiment is continued and readings are noted in steps of 10^0 C and temperature in the thermometer and the indicator readings are tabulated in tabular form.

Sl.no	Temp. of Water by thermometerTa oC	Temp. of Water by RTD, Tm oC	Error = (Tm–Ta) oC	Correction= (Ta–Tm) ^oC	Absolute %Error= [(Tm -Ta)/ Tm]*100
1		4	4		5.63 %
2					
3					

Specimen calculation:

Considering the first observation, the specimen calculations are as follows.

Temp. of water by Thermometer, Ta = 75 ^{o}C

Temp.of water by RTD,Tm = 71 ^{o}C

Error = (Tm -Ta) = 71 – 75 = - 4 ^{o}C

Correction = - error = (Ta–Tm) = 75 – 71 = + 4 ^{o}C

Absolute %Error = |[(Tm -Ta)/Tm]*100|= |[(71 – 75)/ 71]*100|=5.63 %

Graphs:

Draw the following graphs:

- Tm v/s Ta
- Tm v/s Correction
- Tm v/s Absolute % Error