Ain Shams University Credit Hours Engineering Program

Engineering Measurement MDP 141

Assignment 7

Temperature Measurement

Q1: What are the relationship between the molecular structure of matter and kinetic energy. Explain the relationship between kinetic energy and heat.

Q2: State the **zeros law** of thermodynamics. Explain its effect on measuring temperature.

Q3: Convert the temperature 85o F and 110o F into Kelvin, giving that C = (5/9)(F-32) , K = 273.16 + C.

Q4: Define and discuss the significance of the following terms, as they apply to temperature and temperature measurements:

- temperature standards
- fixed points

Q5: State the four different principles of measuring temperature

Q6: Using neat Illustrate the working principles of each of the following (4 marks)

- Alcohol thermometer
- Mercury thermometer
- Bi metal thermometer

Q7: Calculate the change in each of the following if the measuring temperature is 50^{o}C:

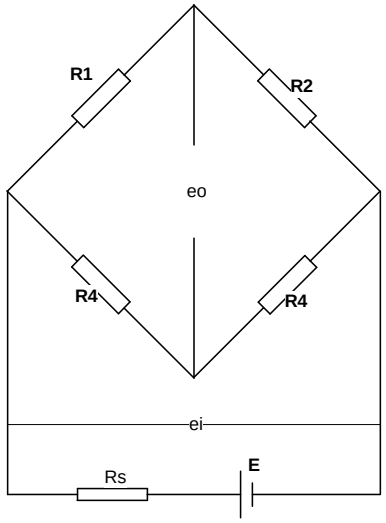
- Length of a steel rod whose length is 60 mm if the thermal coefficient of expansion is 12 * 10^{-6} m/ m^{o} C

- Resistance of a copper wire with resistance *0.5 Ω* at normal operating temperature . The temperature coefficient for copper is *4.29 x 10^{-3} (1/^{o}C)*.

- Resistance of a platinum wire that is 2 m in length and has diameter of 0.1 cm. The resistivity of platinum at 25oC is 9.8 10-6 Ω-cm.

- A wheatstone bridge is shown in Fig. 1. R1=120.6 Ω, R3 = R4 = 120 Ω and Rs =100Ω.

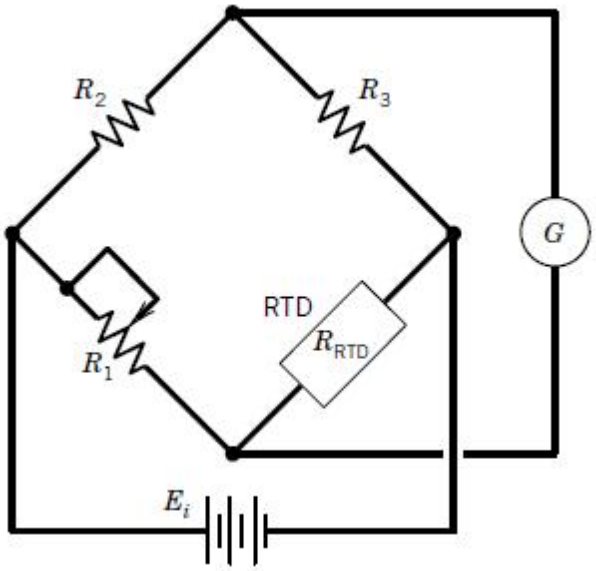
  a) What resistance must R2 have for resistance balance?



  b) If the value of resistance R_2 is changed to 120 Ω while the source voltage (E) is 12 V. What will be the reading of the meter over (e_o) ?

Q8: An RTD forms one arm of an equal-arm Wheatstone bridge, as shown in Figure below. The fixed resistances, R2 and R3 are equal to 25 Ω. The RTD has a resistance of 25 Ω at a temperature of 0o C and is used to measure a temperature that is steady in time. The resistance of the RTD over a small temperature range may be expressed, as in Equation, R = Ro [1 + α(T – To)]
Suppose the coefficient of resistance for this RTD is 0.003925o C-1. A temperature measurement is made by placing the RTD in the measuring

environment and balancing the bridge by adjusting R1. The value (required to balance the bridge is 37.36 Ω. Determine the RTD resistance then determine the temperature of the RTD



Q10: Give one word or few words

- A sensor having relatively large and negative temperature coefficient (……)
- A sensor based on thermal expansion of a solid (……)
- A sensor in which the electric resistance decrease as temperature increase (……)
- In controlling heating system using on/off, The system turns the heater on at one temperature and turns it off at another, higher temperature. (……)
- A sensor in which the electric resistance increase as temperature increase (……)

Q11: Assign a proper sensor to

- Control the temperature in the room without instant respond.

- Control the temperature in electric water tank

- Control the temperature in tea kettle

- Fire protection in a room based on temperature sensing

- Binary control on / off temperature control with high response

- Linear temperature control

- Change the resistance in material due to temperature change

- Convert change in temperature into electrical signal

- Sense temperature for a body which is not accessible for actual physical contact
