International Institute of Information Technology Bangalore
Dept. of Electronics and Communication Engineering

VLS512 - Sensors and signal conditioning circuits
Assignment - 1

1. Consider a system that measures the force of exerted over a resistive sensor as shown in Fig. 1. The sensor's resistance varies by 2 Ω when subjected to a change in force of 10 N. The circuit quantifies this change in resistance (ΔR) through voltage, expressed as $\Delta V = \Delta R/10$. Determine the sensitivity of;
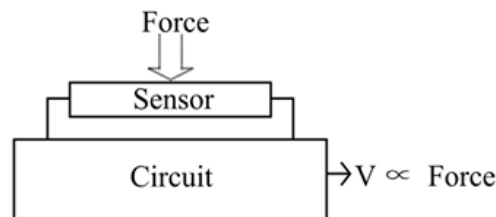a) Sensor b) Circuit.

Fig. 1

2. A temperature sensor initially reads 50°C for a constant input. After 2 hours, it reads 52°C without any change in input. Calculate the Drift in °C and also the % Drift.

3. The expected value of voltage to be measured is 150 V. However, the measurement gives a value of 149 V. Calculate
(i) Absolute error
(ii) relative percentage error in reading
(iii) Percentage error in full-scale if the scale range is 0 – 200 V.

4. A voltmeter gives the following readings for a constant input voltage: 10.02 V, 9.98 V, 10.01 V, 9.99 V, 10.00 V
   a. Determine the best value of measurement
   b. Determine the Standard deviation in measurement

5. A current of 2 A DC is to be measured. Which one of the following PMMC ammeters you would choose and why?
(a) 0 – 5 A, class 0.5
(b) 0 – 3 A, class 1.0.

6. The total Voltage V= $V_1 + V_2 + V_3$ is measured as, $V_1 = (10 \pm 0.25)$ V, $V_2 = (2 \pm 0.15)$ V and $V_3 = (5 \pm 0.5)$ V. Then what will be the value of voltage V measured? What will be %error in measuring Voltage V?

7. Consider a voltmeter measures the voltage across a charged capacitor as $V_C = 5$ V with error in reading of 2.5 %, whose capacitance measured by an LCR meter is given as C = 30 pF.

8. Determine the relative precision obtained by a series and parallel combination of n resistors of nominal value R Ω with a standard deviation σ.

9. For an input of 70 °C, a temperature measurement instrument gives:
      Output (increasing input): 7.25 V
      Output (decreasing input): 6.85 V
   For the same input, repeated measurements vary between 7.10 V and 7.18 V.
   Let the range of the instrument's output is 0 to 10 V. Then calculate:
      a. Hysteresis error (% FS) =
      b. Repeatability error (% FS)
      c. Systematic error (% FS)

10. A linear temperature sensor has:
      Initial sensitivity = 5 mV/°C
      Zero output = 100 mV at 0°C
    After 10 hours:
      Zero drift = +8 mV
      Sensitivity drift = −2%
    For an actual temperature of 60°C:
      a. Calculate initial output
      b. Calculate output after drift
      c. Determine the measurement error in °C

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