Con. 5194-09. (REVISED COURSE) SP-7376

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.
(2) Solve any **four** questions from remaining **six** questions.
(3) Assume **suitable** data whenever **necessary**.

1. Solve any **ten** :– 20
   (a) Justify sensitivity of thermistor is better than RTD.
   (b) Why LVDT O/p is similar. when core moves to the either side from NULL position by the same displacement ?
   (c) Why platinum material is selected while constructing RTD ?
   (d) Justify precise instruments may or may not be accurate.
   (e) Justify piezo electric transducers mostly suitable for dynamic measurement.
   (f) Why the O/p of potentiometric transducers measured across Load resistance ?
   (g) Justify RTD is Piezo-restive transducer.
   (h) Justify LVDT can be used as a primary as well as secondary transducer.
   (i) Instrument 'A' has 2% accuracy and 'B' has 5% accuracy, which is better ? Justify.
   (j) Clearly differentiate Repeatability and Reproducibility.
   (k) Classify level measurement methods.
   (l) Comment on sensitivity of linear and non-linear characteristics of transducer.

2. (a) Explain LVDT w.r.t. following :–
   (i) Construction 4
   (ii) Working 4
   (iii) Direction detection. 2
   (b) A variable potential divider has total reistance of 2 k Ω and is fed from a 10 V d.c. 10 supply. The out put is connected to a load resistance of 5 k Ω. Determine the loading errors for the wiper positions corresponding to k = $\frac{xi}{xt}$ = 0, 0.25, 0.5, 0.75 and 1.0. Use the results to plot a rough graph of error versus $\frac{xi}{xt}$.

3. (a) Explain thermocouple w.r.t. following :–
   (i) Working Principle 2
   (ii) Types 4
   (iii) Cold Junction Compensation. 4
   (b) The output of a LVDT is connected to a 5V voltmeter through an amplifier 10 whose amplification factor is 250. An out put of 2 mV appears across the terminals of LVDT when the core moves through a distance of 0.5 mm. Calculate sensitivity of the LVDT and that of the whole setup. The millivoltmeter scale has 100 divisions. The scale can read to 1/5 of a division. Calculate the resolution of the instrument in mm.

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4. (a) Explain Air purge method of liquid level measurement.   10

   (b) A thermistor has $R_o = 2500\ \Omega$ at $T_o = 25°C$. If B = 4150 k, determine the   4
   resistance of the thermistor at $-100°C$ and $+100°C$ temperature.

   (c) A platinum thermometer has a resistance of $100\ \Omega$ at $25°C$ 6

        (i) Find its resistance at $65°C$

        (ii) If the thermometer has a resistance of $150\ \Omega$, calculate the temperature.
          Assume $\alpha = 0.00392/°C$.

5. (a) Explain constant volume type and constant pressure type filled system thermometers.   10

   (b) Two resistors are having following ratings $R_1 = 37\ \Omega \pm 5\%$, $R_2 = 75\ \Omega \pm 5\%$ 10
   determine the magnitude. limiting error and probable error in percent if these
   resistances connected in series and parallel.

6. (a) (i) List different types of encoder.   2

        (ii) Draw and explain any one of them.   8

   (b) A radiation pyrometer indicates the temperature of a furnace as $975°C$ assuming   4
   a surface emissivity of 0.85. Subsequently, it was found that accurate value of
   emissivity was 0.78. Determine the error in the temp. Measurement of
   the furnace.

   (c) A voltage of 23.72 mV is measured with k type thermocouple at $25°C$ reference   6
   function temperature and $300°C$ hot junction temperature. Calculate output
   voltage with reference to $0°C$.

7. (a) What is metrology ? State limits, fits and gauges.   10

   (b) A quartz piezo-electric crystal having a thickness of 2 mm and voltage sensitivity   10
   of 0.055 V-+m/N is subjected to a pressure of $1.5\ N/m^2$. Calculate the voltage
   output if the permittivity of quartz is $40.6 \times 10^{-12}\ F/m$, calculate its charge
   sensitivity.