

- 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 :-

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- Justify sensitivity of thermistor is better than RTD.
- Why LVDT O/p is similar, when core moves to the either side from NULL position by the same displacement ?
- Why platinum material is selected while constructing RTD ?
- Justify precise instruments may or may not be accurate.
- Justify piezo electric transducers mostly suitable for dynamic measurement.
- Why the O/p of potentiometric transducers measured across Load resistance ?
- Justify RTD is Piezo-resistive transducer.
- Justify LVDT can be used as a primary as well as secondary transducer.
- Instrument 'A' has 2% accuracy and 'B' has 5% accuracy, which is better ? Justify.
- Clearly differentiate Repeatability and Reproducibility.
- Classify level measurement methods.
- Comment on sensitivity of linear and non-linear characteristics of transducer.

2. (a) Explain LVDT w.r.t. following :-

- Construction 4
- Working 4
- Direction detection. 2

(b) A variable potential divider has total resistance of $2\text{ k}\Omega$ and is fed from a 10 V d.c. supply. The out put is connected to a load resistance of $5\text{ k}\Omega$. Determine the loading errors for the wiper positions corresponding to $k = \frac{x_i}{x_t} = 0, 0.25, 0.5, 0.75$ and 1.0 . Use the results to plot a rough graph of error versus $\frac{x_i}{x_t}$.

3. (a) Explain thermocouple w.r.t. following :-

- Working Principle 2
- Types 4
- Cold Junction Compensation. 4

(b) The output of a LVDT is connected to a 5 V voltmeter through an amplifier 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 $R_0 = 2500 \Omega$ at $T_0 = 25^\circ\text{C}$. If $B = 4150 \text{ k}$, determine the resistance of the thermistor at -100°C and $+100^\circ\text{C}$ temperature. 4
 (c) A platinum thermometer has a resistance of 100Ω at 25°C 6
 (i) Find its resistance at 65°C
 (ii) If the thermometer has a resistance of 150Ω , calculate the temperature. Assume $\alpha = 0.00392/^\circ\text{C}$.
5. (a) Explain constant volume type and constant pressure type filled system thermometers. 10
 (b) Two resistors are having following ratings $R_1 = 37 \Omega \pm 5\%$, $R_2 = 75 \Omega \pm 5\%$ determine the magnitude, limiting error and probable error in percent if these resistances connected in series and parallel. 10
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 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. 4
 (c) A voltage of 23.72 mV is measured with k type thermocouple at 25°C reference function temperature and 300°C hot junction temperature. Calculate output voltage with reference to 0°C . 6
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 of $0.055 \text{ V}\cdot\text{m}/\text{N}$ is subjected to a pressure of $1.5 \text{ N}/\text{m}^2$. Calculate the voltage output if the permittivity of quartz is $40.6 \times 10^{-12} \text{ F}/\text{m}$, calculate its charge sensitivity. 10
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