

Instructions to the candidates if any:-

1. Question No 1 is compulsory
2. Attempt any three questions from the remaining five questions
3. Assume suitable data wherever necessary
4. Figures to the right indicates full marks

Q. No. 1

- a. Write short notes on [15]
 - i. Control Valve Characteristic.
 - ii. Classification of Instruments.
 - iii. Ultrasonic Level Measurement.
- b. A stepper motor turns 10° per step and must rotate at 250 rpm. Find the input pulse rate in pulses per second. [05]

Q. No. 2

- a. A platinum RTD PT 100 measures 100Ω at $0^\circ C$ and 139.1Ω at $100^\circ C$. Calculate the resistance of the RTD at $50^\circ C$, also calculate temperature when resistance is 110Ω . [06]
- b. Explain probability of failure on demand and Risk reduction factor in SIL with an example. [06]
- c. Write a short note on Rupture disk and Relief valve. [08]

Q. No. 3

- a. Explain electromagnetic type of flow measurement. [06]
- b. A temperature sensor can measure temperature from $40^\circ C$ to $250^\circ C$. A measurement results in a value of $130^\circ C$. Calculate the error
 - i. If accuracy is $\pm 0.5 \%$ of full scale
 - ii. If the accuracy is $\pm 0.6 \%$ of the span. [06]
- c. Explain layer of protection analysis [LOPA] in details [08]

Q. No. 4

- a. Discuss elastic type of sensing elements. [06]
- b. Explain the concept of calibration and discuss its types [08]

- c. What is the gauge pressure due to column of a liquid having density of 1000 kg/m^3 at a depth of 0.02 m and 0.1 m . [06]

Q. No. 5

- a. Discuss the working principle of
- Capacitive sensing elements. [08]
 - Resistive sensing elements [06]
- b. Write a short note on ladder programming [06]
- c. Consider using a Wheatstone bridge having $R_1 = 200 \Omega$ and $R_2 = 2000 \Omega$ to measure a resistance R_m , of a temperature sensor. Suppose resistance of the temperature sensor, R_m , in Ω , is related to the temperature T in $^\circ\text{C}$, by the equation

$$R_m = 1500 + 25T$$

The temperature is expected to vary over the range 0 to 100°C . Over what range must R_3 vary in order for the bridge to measure temperature over the range 0 to 100°C ? [08]

Q. No. 6

Write short notes on the following [Any Four] [20]

- DAQ Cards
- Turbine flow meter
- ✓ Static Characteristics of instruments.
- ✓ Hot wire anemometer
- ✓ Errors in measurement
