(3 Hours)   **[Total Marks: 80]**

N.B.:   (1) Question No.1 is compulsory.

   (2) Solve any three questions out of remaining five questions.

   (3) Assume suitable data if required.

Q.1 a) Write classification of instrument in brief.   **6**

   b) A temperature sensor can measure temperatures from 32°F to 202°F. A measurements result in a value of 79°F. Calculate the error if the accuracy is   **6**
   (i)   ±0.55% of full scale value
   (ii)   ±0.7% of span
   (iii)   ±0.82% of reading
   What are the possible temperatures in each case?

   c) A Piezoelectric sensor is made up of quartz. The voltage sensitivity for quartz is about 0.075 V/(m.Pa). How much pressure in bars should be applied, to create a potential difference of 15V, if the thickness of the material is 4cm?   **8**

Q.2 a) Write short note on relief valve.   **6**

   b) Explain the piezoelectric type sensing element.   **6**

   c) A barium titanate crystal has the dimensions of 5mmx5mmx1.25mm. The force acting on it is 5N. The charge sensitivity of barium titanate is 150pC/N and its permittivity is 12.5×10^{-9} F/m. If the modulus of elasticity of barium titanate is 12×10^{6} N/m². Calculate the strain and capacitance   **8**

Q.3 a) For a platinum resistance thermometer, the resistance at 20°C is 121Ω, the resistance coefficient of temperature of wire is 0.004/°C, find the resistance at 40°C and the temperature at which resistance will be 8.5 Ω   **6**

   b) Write short note on bourdon tube pressure gauge.   **6**

   c) Explain the importance of calibration and also state calibration of pressure sensors using the dead weight piston gauge.   **8**

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Q.4 **a)** Explain (Linear variable differential Transformer) LVDT? **6**

b) A valve must allow 150 gallons per minute (GPM) of ethyl alcohol having a specific gravity of 0.8. The maximum allowable pressure drop across the valve is 50psi. The piping geometry factor is 1.0. Determine the valve sizing coefficient and select the required valve size from the following table:- **6**

C_v	0.3	3	14	35	55	108	174
Valve size (inches)	1/4	1/2	1	1½	2	3	4

c) Explain the electromagnetic flow meter. **8**

Q.5 **a)** Explain ultrasonic level measurement in detail? **5**

b) A DAQ card has 16bit resolution and 10-50mA analog current loop is used to record above atmospheric pressures. Even a slight change in pressure (~Pa) needs to be detected. What is the maximum absolute pressure that can be measured? What is the analog input in mA for a pressure change of 10kPa? **10**

c) A stepper motor turns 10°/step and must rotate at 350rpm. What input pulse rate in per sec is required? For the same input pulse rate if rotation is 280rpm, then what is the angle of turn per step? **5**

Q.6 Write short notes on: (any four) **20**

    a)   DAQ
    b)   LOPA
    c)   Signal conditioning
    d)   Programmable logic controller
    e)   Mechanical amplifier

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