



Notes: Exam in two pages

Answer ALL the Following Questions (Assume any missing data)

Question (1):

25 Marks

- A- What is meant by positive displacement flow meters? In addition, give an example. (4marks)
- B- Define; Accuracy, Precision, and Linearity. (4marks)
- C- Describe the idea and the principle of operation of the following: McLeod gauge and Pirni pressure gauge. (8marks)
- D- Describe with a sketch the construction of inductive pressure transducer and how it is work.?. (4marks)
- E- Define the piezoelectric effect. Write notes about piezoelectric pressure transducer. (5marks)

Question (2):

25 Marks

- A- A diaphragm gauge is constructed of spring steel to measure a pressure of 7 MPa \pm 1% The diameter of diaphragm (d) is (12.5 \pm 0.25) mm. Calculate the thickness (t) of diaphragm, if the maximum deflection d_m is 0.33 of thickness t. Also, calculate the uncertainty in d_m in mm and %. Given : Young's modulus $E = 200 \times 10^6$ Pa, Poisson's ratio $\epsilon = 0.28$, uncertainty in thickness is $\pm 2\%$., $\left\{ d_m = \frac{3(1 - \epsilon^2) P \cdot d^4}{E \cdot t^3} \right\}$ (10 marks)
- B- What is your information about the Rota-meter.? Also, in a Rota-meter, derive the expression formula for volume flow rate. (Q^0) then. Prove that $\rho_{bob} = 2\rho_{fluid}$ (10 marks)
- C- A U-tube manometer uses tubes of 0.5 cm and 1.5 cm diameters for two legs. When subjected to a certain pressure, the difference in height of the two fluid columns is 30 cm Hg (mercury). What would have been the reading if both tubes where the same diameters? The measurement is performed for air ($\rho = 0$). (5 marks)

Question (3):**25 Marks**

A-A 10 Cm diameter edged orifice plate is used to meter the steady flow of 20°C water through a 20 cm pipe. Flange taps are used and the pressure drop measured is 50 Cm of Hg. Determine the pipe flow rate. Take $C_d = 0.68$ and $S_{Hg} = 13.6$. (7 marks)

B-Write notes on Hot-Wire Anemometer (construction, material), then explain and sketch the constant temperature method (CTA) applied in hot-wire anemometer measurements. (6 marks)

C- Explain, how you can measure very high pressure up to 7000 bar, illustrating the device idea and material of it.? (4 marks)

D- Why it is important to measure the level of fluids. Name the methods of measuring level. Explain one of them. (4 marks)

E- Describe the idea and working of Ultrasonic flow meters. State the advantages of these flow meters. (4 marks)

Question (4):**25 Marks**

A- Explain, how are very high temperatures measured? (7 marks)

B- Describe, how can two dissimilar metals are jointed together be measured the temperature? (5marks)

C-What are the thermistors? State the idea of working, materials, construction and relation between input and output. (3 marks)

E- A bimetallic strip of 15 cm length and 2 mm thickness for each metal. The element is straight at 30 °C. Determine the radius of curvature when the element is placed at 200 °C . What would be the movement of the free end in a direction perpendicular to its original direction? Use the following relation for the radius of curvature $R = [(1+\alpha_B \cdot \Delta t)/(\alpha_A - \alpha_B)\Delta t]\sigma$. Where σ is the strip thickness, $\alpha_A = 14 \times 10^{-6}(1/^\circ\text{C})$, $\alpha_B = 1.7 \times 10^{-6}(1/^\circ\text{C})$. If $\alpha_B = 0$, what will be the change in the answer? (10 marks)

With our best wishes

Q1a,b,c Q3b,c,Q4a,b	Q2	Q2c, -Q4e
A5, A10 AND A13	Q5, Q11	C5, C14
Knowledge & Understanding Skills	Professional Skills	Professional Skills