



Department : Electrical and Control Engineering

Lecturer : Staff

Course : Instrumentation & Measurements

Course Code: EE 218

Date 18 / 1 / 2015

Time : 2 hours

Marks: 40

Final Exam

Answer all the following questions

(Q - 1) Specification of measuring instruments:(8 marks)

- a) **Define four only of the following items:**
Resolution – Precision – Drift – Linearity – Transfer function – Error – Sensitivity – Range.
- b) Gas pressure measurements in a supply line are given as:
100; 96; 97; 103; 105; 99
Calculate the Coefficient of variation?
- c) Suppose a room temperature from 20 to 35 °C is converted to voltage from 15 to 90 mV.
i- Derive the equation representing the converter.
ii- What voltage does a temperature of 25 °C represents.

(Q - 2) Pressure:(8 marks)

- a) **Draw and explain** the principle of operation of the following transducers:
i- Bellows
ii- Linear Variable Differential Transformer (LVDT)
State the advantages and disadvantages of these transducers.
- b) If gage factor is 2, and a strain of 1.5×10^{-3} is applied to strain gage resistance. Find the offset voltage of bridge, when the voltage source applied the bridge is 10 V, and all resistances in bridge are 500 Ω .

(Q - 3) Level:(8 marks)

- a) **Draw and explain** the principle of operation of the bubble tube level measured.
- b) In a capacitance level gauge, if the separation distance between the two square electrodes is 10 cm. The capacitance C when the tank is empty is 300 pF. Certain quantity of liquid is poured in the tank and the capacitance is dropped to 200 pF. If the liquid dielectric constant is 0.5 and the air dielectric constant is 1. Find the height of the liquid in the tank ($\epsilon_0 = 8.85$ pF/m).

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(Q - 4) Temperature: (8 marks)

- a) *What are the main differences* between the Resistance Temperature Detector (RTD), and the Thermistor?
- b) *Explain and draw* the thermal radiation pyrometer. *State the advantages and disadvantages* of this instrument.
- c) A resistance temperature detector (RTD) arranged in a bridge with each arm 50 Ω and 10 volt supply. If the temperature of the sensor changed such that the meter indicates 1 volt, the material has temperature coefficient of 0.005 °C. The resistance at 0 °C is 100 Ω. Find the sensor temperature and the power consumed in it.



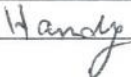
(Q - 5) Flow: (8 marks)

- a) Starting by the continuity equation and the law of conservation of energy, prove that:

$$Q = A_1 A_2 \sqrt{\frac{2\Delta P}{\rho(A_1^2 - A_2^2)}}$$

- b) *Explain* the main function and construction of the Nozzle flow-meter. *State the advantages and disadvantages* of this instrument.
- c) A nozzle flow meter indicates a pressure drop of 20 cm of water when the flow rate is 100 lit/min. *What* would be the flow rate when the pressure drop is 40 cm of water?

GOOD LUCK

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