

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-V Examination-Nov/Dec.-2011

Subject code: 151402

Date: 26/11/2011

Subject Name: Food Process Instrumentation and Control

Time: 2.30 pm -5.00 pm

Total marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define flow? Explain different types of flow. Depending upon their physical principle list the flow meters. Derive the following expression **07**

$$Q_v = E A_2 \sqrt{\frac{2g(p_1 - p_2)}{\rho}}$$

- (b)** Define the followings **07**
1. Sensitivity
 2. Threshold
 3. Drag force
 4. Total Immersion thermometer
 5. Analog transducer
 6. Diaphragm and Bellows
 7. LVDT type pressure transducers

- Q.2 (a)** What is International Practical Temperature Scale (IPTS). Give the typical value of primary “Fixed” point of Boiling point of water, Triple point of water. Explain the working of Bimetallic and Helical thermometer. **07**
- (b)** List out different electrical methods of measurement. Describe the working of RTD with diagram. **07**

OR

- (b)** Describe the working principles of the followings with diagram;
1. Purge type liquid level meter
 2. Bubbler method for specific gravity

- Q.3 (a)** What scales are used for measuring specific gravity of a liquid? Discuss the importance of specific gravity measurement in industrial process and describe an instrument used for continuous monitoring of specific gravity. **07**
- (b)** What do you understand from strain gauge? Define Gauge factor. Describe Bonded and Unbonded strain gauge. **07**

OR

- Q.3 (a)** List out different advantages and limitations of thermocouple. **07**
- For a certain thermistor $\beta = 3140\text{K}$ and the resistance at 27°C is known to be 1050Ω . The thermistor is used for temperature measurement and the resistance measured is as 2330Ω . Find the measured temperature.

- (b) How would you define thermocouples? Discuss Seebeck effect, Peltier effect. List out different types of thermocouples with materials of constructions. **07**

- Q.4 (a)** What are transducers? Explain analog and digital transducers. Discuss different factors to be kept in mind for the selection of transducers. **07**

- (b) Describe the working principles of rotameter. Prove that **07**

$$Q_v = CE A_2 \sqrt{\left(\frac{\rho_2 - \rho_1}{\rho_1} \right) \frac{2g V_f}{A_f}}$$

OR

- Q.4 (a)** Explain in brief the followings; **07**

1. Target flow meter
2. Magnetic flow meter

- Q.4 (b)** A nozzle is fitted in a horizontal pipe of diameter 15cm, carrying a gas of density 1.15 kg/m^3 , for the purpose of flow measurement. The differential pressure head indicated by U tube manometer containing oil of specific gravity 0.8 is 10cm. if the coefficient of discharge and diameter of nozzle are 0.8 and 5cm respectively. Determine the flow of gas through the nozzle flow meter. **07**

- Q.5 (a)** A copper-constantan thermocouple was found to have linear calibration between 0°C to 400°C with emf at maximum temperature (reference junction temperature 0°C) equal to 20.68mV. (a) Determine the correction which must be made to the indicated emf if the cold junction temperature is 25°C . (b) if the indicated emf is 8.92mV in the thermocouple circuit, determine the temperature of the hot junction. **07**

- (b) The power radiated from the hot piece of metal was measured by the radiation pyrometer and the temperature was determined as 820°C assuming the surface emissivity of 0.75. Later it was found that the accurate value of emissivity was 0.69. Find the error in temperature determination. **07**

OR

- Q.5 (a)** Describe various pressure terms with diagram. List out different types of moderate pressure measuring instruments. Discuss LVDT type pressure transducers. **07**

- (b) List out different types of high and low pressure measuring instruments. Discuss McLeod Gauge in detail. **07**
