

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – WINTER 2013****Subject Code: 151402****Date: 04-12-2013****Subject Name: Food Process Instrumentation and Control****Time: 10.30 am - 01.00 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) 1. The resistance of a wire is 60Ω at 25°C and 65Ω at 75°C . Find the resistance of wire at 0°C and value of temperature coefficient at 0°C . **07**

2. The field resistance of a DC machine is 50Ω at 20°C . The resistance increases to 55Ω at 50°C . Find the temperature coefficient of the resistance material.

(b) A $6\text{V}/2.5\text{mA}$ relay is connected in the output stage of a transistor. The coil is made of aluminium having $\alpha = 0.004$. The resistance of a coil is 600Ω at 32°C . Calculate the resistance of a coil at 42°C **07**

Q.2 (a) Write a short note on first order systems. What is sensitivity? The spring balance sensitivity at 25°C and 35°C is 20mm/kg and 35 mm/kg . What is the value of sensitivity drift/ $^{\circ}\text{C}$ for a given spring balance? **07**

(b) State the advantages and limitations of thermocouple. What are the different arrangements of thermocouple in which emf will not change? Explain in short how a thermistor differs from a thermocouple as a temperature sensor. **07**

OR

(b) What is transducer? List out different factors for selection of transducers. Discuss bonded and un-bonded strain gauge. **07**

Q.3 (a) Explain the following terms **07**

1. Dead space
2. Resolution
3. Linearity
4. Closed loop systems
5. Partially immersed thermometer
6. Peltier effect
7. Disadvantages of mercury

(b) Explain the working principle of metallic resistance thermometer with detailed diagram. **07**

OR

Q.3 (a) Derive a standard equation for first order instrument. Write in detail about feed forward control system. **07**

(b) Discuss the followings in brief with diagram. **07**

1. Knudson gauge
2. Target flow meter

- Q.4 (a)** A rotameter uses a cylindrical float 0.02m height and 0.02m in diameter, which is tapered at 5° from the bottom inlet. The float reaches to the height of 0.025m with a given flow rate. If the discharge coefficient is 0.5 and the maximum and minimum diameter of the tube is 0.04 and 0.03m respectively. Assume no significance of velocity approach factor. Calculate the maximum flow rate if float density is 4 times the fluid density. **07**
- (b)** What is strain gauge? Discuss balance and unbalance bridge with diagram. **07**
- OR**
- Q.4 (a)** Draw the diagram only of the followings **07**
1. Purge liquid level meter
 2. Ratio turbidity meter
 3. Hair hygrometer
 4. Mercury in glass thermometer
- (b)** Give the working principle of McLeod gauge with diagram. Discuss Bubbler method and capillary tube viscometer. **07**
- Q.5 (a)** Define different types of flow. List out different types of flow meters. Explain the working principle of magnetic flow meter with diagram. **07**
- (b)** What is thermocouple? List out its factor of selection. Give a table containing types of thermocouple, material of construction and temperature range. **07**
- OR**
- Q.5 (a)** With the principle of Bernoulli's theorem obtain an expression for the volume flow rate of a one dimensional incompressible fluid flow through a horizontal pipe installed with an orifice meter. Define Vena contracta, Discharge coefficient and Reynolds number **07**
- (b)** Describe the significance of specific gravity measurement. Discuss different commercial specific gravity measurement scale. State the principle of working of LVDT type hydrometer. **07**
