

TE - sem - VI (CBSSGS) chemical - Instrumentation

Q.P. Code : 574102

23/11/16

(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.

1. a) Write short notes on: 15  
 i) Rupture Discs  
 ii) Bourdon tube pressure gauge  
 iii) Ultrasonic method for Level Measurement
- b) A component manufacture constructs certain resistances to be anywhere 5  
 between  $1.14 \text{ K}\Omega$  and  $1.26 \text{ K}\Omega$  and He classifies them to be  $1.2 \text{ K}\Omega$   
 resistors.  
 What is the absolute error? What tolerance should be stated?
2. a) A thermocouple gives an output of  $0.4 \text{ mV}$  for each degree change in 6  
 temperature. What will be the word length required when its output passes  
 through an analogue-to-digital converter if temperatures from  $0$  to  $200^\circ\text{C}$   
 are to be measured with a resolution of  $0.5^\circ\text{C}$ ?
- b) A stepper motor has a 30-teeth gear with a  $5^\circ$  angle of tum per step. For a 6  
 desired rotational speed of  $200 \text{ rpm}$ , what input pulse rate (in pulses per  
 second) is required?
- c) Write a short note on control valve characteristics. 8
- 3 a) Explain Wheatstone bridge in detail. 5  
 b) The plate separation of a parallel plate capacitor was changed from 5 inches 5  
 to 3 inches. Will the capacitance increase or decrease? What is the percent  
 change in capacitance?
- c) Write short notes on 10  
 i) Basic process control scheme with diagram.  
 ii) Layers of protection analysis (LOPA) methods
- 4 a) A Platinum resistance thermometer has a resistance of  $100\Omega$  at  $0^\circ\text{C}$  and the 6  
 value of temperature coefficient of resistance is  $0.00385$ . In operation the  
 resistance is  $101 \Omega$ . calculate the temperature.
- b) Explain importance of calibration also explain calibration of Rotameter. 8

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- c) A DAQ card of 12 bit resolution and 20-60 mA analog current loop is used to record above atmospheric pressures. Even a slight change in pressure (~ 1 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 10 kPa? 6
5. a) The output of a thermocouple measuring temperatures from 20°C to 180 °C is linearly represented by the standard current range of 4-20 mA. Then, 10
- (i) What is the current at 110°C?
  - (ii) What temperature does a current of 8.4 mA represent?
  - (iii) What is the current at 130°C?
  - (iv) What temperature does a current of 10 mA .
- b) Explain ultrasonic method for level measurement in detail 5
- c) State the principal involved in following sensing elements- 5
- i. Linear Variable Differential Transformer.
  - ii. Resistance Temperature Detector.
  - iii. Flapper Nozzle
  - iv. Bellow pressure sensor
  - v. Resistance strain gauge
6. Write short notes on (any four): 20
- a) Turbine type flow meter
  - b) Mechanical amplifier
  - c) Hot wire anemometer
  - d) Programmable logic controller.
  - e) piezo electric sensing element

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