CHEMICAL ENGINEERING DEPARTMENT

End-semester exam, December 2018

B.Tech. (Chemical), Fall Semester, 2018 - 19

Course Code : CH13102 **Duration** : 3 h.

Course Name : Process Instrumentation **Max. Marks** : 60

Faculty-In-Charge : Dr Dipesh S Patle

Specific Instruction to Students

i. Answer the questions sequentially

ii. Use of non-programmable scientific calculator is permitted

Part A: Answer all questions

1.

i. Which of the following is an undesirable dynamic characteristic of an instrument?
   - A. Reproducibility
   - B. Static error
   - C. Dead zone
   - D. Time lag

ii. Which of the following temperature measuring instruments need not touch the object whose temperature is being measured?
   - A. Radiation/infrared pyrometer
   - B. Filled system thermometer
   - C. Mercury in glass thermometer
   - D. Thermo electric pyrometer

iii. Which of the following is a desirable characteristic of an instrument?
   - A. High drift
   - B. Poor reproducibility
   - C. High fidelity
   - D. High measuring lag

iv. Which of the following effect is useful in thermocouples?
   - A. Seebeck
   - B. Thomson
   - C. Pelitier
   - D. None of the above

v. Working principle of radiation pyrometer is based on the
   - A. Wiens's law
   - B. Kirchoff law
   - C. Stefan-Boltzman law
   - D. Seebeck effect

[5 x1 = 5M]

2. A level sensor, having an operating range of 0.5-20 m, is used in an industry. The sensor, having a transmitter, transmits the level readings in standard voltage form (i.e. 1 VDC to 5 VDC). For this sensor, (a) find out the level when the output from the sensor is 3 VDC. (b) find out the gain (c) what is the 'ZERO' and (d) what is the SPAN.

[2+1+1+1 =5 M]

3. Explain why it is important to understand the dynamics of the instrument e.g. first order or second order dynamics. Discuss their typical dynamics in terms of oscillation and response.

[2+3 =5 M]

4. Write any three temperature sensors that are based on electrical effects. Describe in details how a RTD works.

[2+3 =5 M]

5. Write a short note on the ionization gage instrument for pressure measurement. Also, draw a neat labeled schematic.

[3+2 =5 M]

6. Explain how an Ultrasonic Probe can be used for level measurement. Discuss it in terms of accuracy and limitations.

[5 M]

Part 2: Answer the following

7. Describe how pH of a solution is measured electronically. Draw a neat labelled schematic. Explain why temperature correction is necessary for pH meter reading?

[4+2+4= 10 M]

8. Describe chromatography method for analyzing multicomponent systems? Also, explain how a mass spectroscopy works. Discuss why mass spectroscopy is often integrated with gas chromatography.

[4+4+2= 10 M]

9. Explain the working principle of an orifice-flowmeter with the help of a schematic. State its major demerits in real application in the industry for flow measurement. Derive an expression for the calculation of flowrate (Q) (Hint: use Bernoulli's equation).

[3+2+5 = 10 M]

or

10. Explain the working principle of a ventury-flowmeter with the help of a schematic. State its major (de)merits in real application in the industry for flow measurement. Derive an expression for the calculation of flowrate (Q) (Hint: use Bernoulli's equation).

[3+2+5 = 10 M]

Good Luck