

Code.No: 07A50806

R07

SET-1

III B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
PROCESS INSTRUMENTATION
(CHEMICAL ENGINEERING)

Time: 3hours**Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- 1.a) For ordinary mercury-in-glass thermometer name the parts that might constitute the primary element and the indicating element.
- b) A thermometer is calibrated from 325 to 400°F. The accuracy is specified to be within ± 0.25 percent. What is the maximum static error in units? [8+8]
2. It is desired to measure the temperature (about 1100°F) in a furnace having a highly oxidising atmosphere. The temperature changes so rapidly that a bare thermocouple must be used. Which type would you select? Why? Explain its construction and working principle. [16]
- 3.a) What is the principle of radiation pyrometer? Give a detailed note on radiation pyrometer and how it works. What are its advantages and disadvantages?
- b) What are thermocouples? Classify them. Explain the working of thermocouples as temperature measuring instrument. [8+8]
- 4.a) Air absorbs strongly at and below 1900 Å. In what type spectrometer would this be a serious effect. Explain.
- b) Fluorite absorbs strongly at and below 1250 Å. At these wavelengths mirrors would be substituted for lenses in a spectrometer. What could be used in the place of a prism? [8+8]
5. Discuss in detail the applicability of (a) Elastic Transducers and (b) Elastic Diaphragms in the measurement of pressure? [16]
- 6.a) What is the direct measurement of liquid level?
- b) Describe various methods of direct measurement of liquid level? [4+12]
7. What is the difference between head flow meters and area flow meters? Explain the working of the both types of flow meters? [16]
8. Discuss the three types of indicating scales of an indicating instrument with figures. [16]

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Time: 3hours**Max.Marks:80**

Answer any FIVE questions
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1. A nitrogen thermometer bulb is made of copper with a 0.75 in. inside diameter. The volumetric coefficient of expansion of copper is about 28×10^{-6} per °F. The temperature range of the instrument is 100 to 600°F, and the pressure range of the system must be 500 Psi. Neglecting the volume of capillary and spiral, determine:
 - a) The initial pressure in the bulb at 100°F
 - b) The required inside length of the bulb.
 - c) The initial pressure in the bulb if thermal expansion of the bulb is considered and if the length of the bulb computed in part b) is used. [16]
2. An Iron Constantan thermocouple is used with a carbon steel thermal well at a temperature of 700°F. It is suggested that the well be filled with mercury to improve response. Should you adopt the suggestion? Give two reasons. [16]
- 3.a) Discuss pressure spring thermometer
 b) Explain with neat sketches the measurement of temperature using resistance thermometers. What is the advantage of using resistance thermometers? [6+10]
- 4.a) The amount of light absorbed in passing through a translucent substance is proportional to the amount falling on a surface at a given depth from the face and also proportional to the depth of the surface from the face. From this statement derive Beer's law?
 b) List the methods of composition analysis that provides continuous indication of composition. [6+10]
5. Discuss briefly the static accuracy and response of pressure gauges. How is calibration done for pressure gauges? [16]
6. Explain the principle of working of pressure transducers. What are its advantages and disadvantages? [16]
7. Name the instrument used for viscosity measurement. Describe the working principle of any viscosity measuring device with neat sketch. [16]
8. Write short note on:
 - a) Measurement of interface level.
 - b) Recording instruments. [8+8]

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SET-3

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Time: 3hours**Max.Marks:80**

Answer any FIVE questions
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- 1.a) The temperature of a furnace is raised at the rate of 300°F per hr. The instrument must not be in error by more than 10°F. What maximum time constant is permissible if the instrument has a first order type response?
- b) A mercury thermometer is made from an Invar tube, 0.050 in. inside diameter. It is evacuated and filled with mercury to a height of 5.0 in. at 68°F. Using simple law of liquid expansion, find the height of the column when the thermometer is completely immersed in a liquid of temperature 600°F. [8+8]
- 2.a) Describe the functioning of a resistance thermometer with help of a simple Wheatstone bridge circuit.
- b) What are the possible improvements in the simple Wheatstone bridge circuit? [10+6]
- 3.a) Explain the working of radiation and optical pyrometers. What is the use of radiation pyrometers?
- b) Discuss briefly the basic concepts of response of first order type instruments. [8+8]
- 4.a) Discuss how the analysis of moisture can be done.
- b) Explain the principle and working of gas chromatography and give its uses. [6+10]
- 5.a) What is the procedure adopted for measurement of pressure in corrosive liquids?
- b) Explain the measurement of absolute pressure by using the McLeod gauges and their range? [8+8]
6. Discuss with neat diagram, the function of liquid column manometers. Indicate its application. [16]
7. Explain the construction and operation of an area flow meter with a neat diagram? [16]
8. a) Write a note on Process analysis.
- b) Compare and contrast between pneumatic transmission and electronic transmission. [8+8]

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Time: 3hours**Max.Marks:80**

Answer any FIVE questions
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- 1.a) What is the Seebeck effect? Explain.
- b) Explain in detail the dynamic characteristics of an instrument. [8+8]
2. Define the three laws of thermoelectric circuits composed of homogeneous conductors. [16]
3. Name some commonly used industrial thermocouples, and what are their desirable properties? Explain any commonly used thermocouple. [16]
- 4.a) What are the principles in spectroscopic analysis by absorption, emission, fluorescence, and mass spectroscopy?
- b) Define Beer's law. [12+4]
- 5.a) What is gauge pressure?
- b) Describe the principle of operation of a simple U-tube manometer? [4+12]
- 6.a) Describe a system to determine the flow rate of dry materials continuously with a sketch?
- b) Explain briefly instrument used for measuring pressure in open vessels. [8+8]
7. Compare the different types of flow meters? Draw a neat diagram of any one of them. [16]
- 8.a) Give a step-wise procedure for analyzing a process and applying instrumentation?.
- b) Discuss one type of transmitting method of signals in instrumentation. [8+8]

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