

**III B.Tech. I Semester Regular Examinations, November -2005**

**PROCESS INSTRUMENTATION**

**(Chemical Engineering)**

**Time: 3 hours**

**Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

\*\*\*\*\*

1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. Why lead wires are preferred as connecting wires in thermocouples. Explain. [16]
3. Explain the principle involved in spectroscopic analysis of the composition of a gaseous mixture. Describe the working of an IR spectrometer. [16]
4. What is humidity? Explain its importance. Describe how moisture in fibre materials is measured by infra-red transmission technique. [16]
5. What are the various designs of manometers used to measure pressure. [16]
6. Explain any one method of measuring level of dry materials. [16]
7. Water flowing in a 75mm pipe line is measured by an orifice 58mm in Diameter. The orifice head is measured through vena contract taps. The Pressure differential is 274.32mmHg at 21<sup>0</sup>C. The temperature of the water is 150<sup>0</sup>C.Find the flow rate at 21<sup>0</sup>C. [16]
8. Describe various types of recording instruments used in process industries? Compare their merits and demerits. [16]

\*\*\*\*\*

**III B.Tech. I Semester Regular Examinations, November -2005**  
**PROCESS INSTRUMENTATION**  
**(Chemical Engineering)**

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

**Answer any FIVE Questions**  
**All Questions carry equal marks**

\*\*\*\*\*

1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. Enlist the different types of pyrometers. With a neat diagram, describe the working principles of one type of pyrometer. [16]
3. Write notes on:
  - (a) Colour measurement by spectrometer.
  - (b) Absorption spectroscopy. [8+8]
4. Dalton's law of partial pressures is important in humidity measurements. State this law. How is pressure of a gas mixture determined by this law. [16]
5. A tank of 40 ft height is filled by adding immiscible liquid 'A'(sp gr 0.7) above the liquid 'B' (so gr 0.9) to run out the bottom. If the pressure gauge is used to measure the pressure at the bottom of the tank. What is the range of the pressure gauge to indicate the full motion of the interface? [16]
6.
  - (a) Describe air trap system for liquid level measurement.
  - (b) Explain bubbler system for liquid level measurement with a neat diagram. [8+8]
7. State the differences and similarities among orifice, venturi and pitot tubes. Give suitable examples. [16]
8.
  - (a) Show how an orifice is connected in a pipe line through diagrams for the measurement of flow rate of
    - i. Steam
    - ii. Corrosive gas.
  - (b) Explain how viscosity compensation is provided in rotameters with appropriate sketches. [8+8]

\*\*\*\*\*

**III B.Tech. I Semester Regular Examinations, November -2005****PROCESS INSTRUMENTATION****(Chemical Engineering)****Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

\*\*\*\*\*

1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. With a neat sketch, explain the principle and working of Radiation pyrometers.

[16]

3. Why is composition analysis required in a process industry? Write briefly on the qualitative and quantitative measurements with suitable examples. Highlight about positive methods of composition analysis. [16]
4. Dalton's law of partial pressures is important in humidity measurements. State this law. How is pressure of a gas mixture determined by this law. [16]
5. What are the various designs of manometers used to measure pressure. [16]
6. A cylindrical vessel has plane ends , diameter 'd' and length 'l'. When the vessel is horizontal and contains water, find an expression for,  
(a) Volume contained versus height of liquid level from the bottom.  
(b) Weight contained versus pressure( pounds per square inch gage) at bottom of the vessel. [8+8]

7. An orifice meter equipped with flange taps is to be installed to measure the flow rate of crude oil to a cracking unit . The oil is flowing at 38<sup>0</sup>c through a 10 cm pipe. The maximum flow rate of oil is 80 m<sup>3</sup>/h . Mercury is used as manometer liquid and glycol is used as sealing liquid in the leads. Calculate

- (a) the diameter of orifice and
- (b) power loss. The power loss

Data: Density of mercury =13600 kg/m<sup>3</sup>Density of glycol = 1100 kg/m<sup>3</sup>

Reading of the manometer = 0.76 m

Discharge coefficient = 0.61.

The power loss and  $\beta$  are correlated by equation power loss =  $m\beta + C$ .It is given that at  $\beta=0.4$ , power loss is 0.81 and at  $\beta=0.6$ ,

power loss = 0.62

[8+8]

8. (a) What are the essential differences between a strip chart recorder, circular chart recorder and an x-y recorder? Explain the working of x-y recorder with a figure.

- (b) When an indicating instrument is used. Discuss the three types of indicating scales with figures. [8+8]

★ ★ ★ ★ ★

**III B.Tech. I Semester Regular Examinations, November -2005**

**PROCESS INSTRUMENTATION**

**(Chemical Engineering)**

**Time: 3 hours**

**Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

\*\*\*\*\*

1. (a) Define an instrument. What are the requirements of an instrument?  
(b) Explain the static characteristics of an instrument. [8+8]
2. (a) Explain with a neat sketch the operation of a self balancing potentiometer used for measuring thermocouple signals.  
(b) Discuss its advantages over the direct reading millivoltmeter. [10+6]
3. Explain the principle involved in spectroscopic analysis of the composition of a gaseous mixture. Describe the working of an IR spectrometer. [16]
4. What is humidity? Explain its importance. Describe how moisture in fibre materials is measured by infra-red transmission technique. [16]
5. Explain in detail the applicability, range, advantages and disadvantages of a metallic and non metallic diaphragm pressure elements [16]
6. (a) Write in detail the methods available for measuring density.  
(b) Explain various methods of direct measurement of liquid level. [8+8]
7. Discuss the various head flow metres used in industries with neat sketches. [16]
8. (a) Show how an orifice is connected in a pipe line through diagrams for the measurement of flow rate of
  - i. Steam
  - ii. Corrosive gas.  
(b) Explain how viscosity compensation is provided in rotameters with appropriate sketches. [8+8]

\*\*\*\*\*