Code No: RR310805 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
PROCESS INSTRUMENTATION
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. Discuss with a neat circuit the working principles of resistance thermometer. [16]
3. (a) Describe the construction and working of an infrared absorption spectrometer with a figure.
   (b) Explain the method of finding concentration of a component from a spectrogram. [8+8]
4. (a) Describe the dew point method of measurement of absolute humidity.
   (b) Write the principle of gas analysis by thermal conductivity. [8+8]
5. With a neat diagram explain the working of a Dead weight Piston gauge to measure the pressure [16]
6. (a) Explain displacement meter for measuring specific gravity with a neat diagram.
   (b) Write about differential pressure manometers for measuring liquid level. [8+8]
7. (a) Explain the three types of tapping positions with figures in a fluid flow line with orifice flow meters ?
   (b) Design an orifice for a flow rate of 0.5m^3 per min of water in a pipe line of 25 cm line to produce a head of 25cm of mercury if the water temperature is 50^0 c and manometer temperature is 20^0c.
   Data: Density of water at 50^oc : 0.988
   Density of water at 20^oc : 0.998
   Density of mercury at 20^oc : 13,544 Kg/m^3
   Viscosity of water at 50^oc = 0.55×10^{-3} NS/m^2
   Discharge coefficient = 0.6 [6+10]
8. (a) A venturi meter is used for measuring water flow. The inside diameter of the pipe is 50 cm and the throat diameter of the venturi is 25 cm . An automatic controller holds the differential pressure constant 25cm Hg at 22^0 C. However, in the day time the water temperature is 40^0C and at night it is 15^0 C. By what percentage does the flow rate change at night time.
   Data: Density of Hg = 1360 kg/m^3
   Density of water at 40^0C = 0.990
   Density of water at 15^0C =0.999

(b) Suggest suitable flow meters for measurement of flow rate of the following.

i. Very large flow rates of water.

ii. Raw sewage in partially filled pipes as channels.

iii. Corrosive liquids.

iv. High viscosity liquids like tars. [8+8]

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Code No: RR310805 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2006
PROCESS INSTRUMENTATION
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. (a) Explain the advantages of resistance temperature measurements.
   (b) Discuss the use of Callendar's equation in resistance thermometers. [8+8]
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. Why is H ion concentration measured? Explain the most common industrial method of measuring PH. Find the relation between composition and H value. [16]
5. With a neat diagram explain the constructional features and the working of an Electric Pressure gauge [16]
6. (a) Describe the operation of any two instruments for the measurement of liquid level in a tank which will give a pneumatic signal as the output.
   (b) Name different types of material whose resistances change with temperature. What are they used for ? give examples for instruments developed making use of the above properties. [8+8]
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 21^0C. The temperature of the water is 150^0C.Find the flow rate at 21^0C. [16]
8. Describe the important features of instrumentation diagram and illustrate with a typical chemical plant. [16]

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Code No: RR310805 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2006
PROCESS INSTRUMENTATION
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What are the different elements of a measuring instrument? Describe in detail.[16]
2. Discuss with a neat circuit the working principles of resistance thermometer. [16]
3. How does a glass electrode work for the determination of PH.? What is an asymmetry potential? How is it taken care of? [16]
4. What are the commonly employed detectors in a gas chromatography. How are analysis data presented in this system. [16]
5. What are the various designs of manometers used to measure pressure. [16]
6. (a) Write the relation between head and float displacement.
   (b) Explain differential pressure manometer for measuring liquid level [6+10]
7. Describe the open channel metres with neat sketch and obtain the relevant equations used to find the flow rate [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]

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Code No: RR310805 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2006
PROCESS INSTRUMENTATION
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss installation errors and equipment errors. How can they be eliminated or minimized? [16]

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 millivolmeter. [10+6]

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. Write briefly on detectors used in a High performance liquid chromatograph. High light the creteria for their selection. [16]

5. (a) What are the various absolute pressure measuring gauges and their ranges.
   (b) Explain the working principles of the thermocouple gauge and the ionic gauge for vaccum measurement using schematic diagrams. [4+12]

6. How do you measure the level in pressure vessels. Explain with the help of neat diagrams. [16]

7. Describe the working principle of a rotameter with a sketch and discuss the merits and demerits. [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]

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