

NATIONAL INSTITUTE OF TECHNOLOGY, CALICUT  
DEPARTMENT OF CHEMICAL ENGINEERING  
III YEAR B.TECH CHEMICAL ENGINEERING- SEMESTER -V  
END SEMESTER EXAMINATION MONSOON 2014  
CH3004 - Process Instrumentation

Date: 15.12.14

Time: 9.30 am – 12.30 pm

Maximum marks: 50

Answer the following Questions  
Missing data's may be suitably assumed

1. a). A dead zone in a pyrometer is 0.125 of the span. The instrument is calibrated from 800°C to 8000°C. What temperature change must occur before it is detected? (2)  
b). What are the human error and theoretical error encountered in measurements? Explain with suitable examples? (2)  
c). Explain with the examples the terms static sensitivity, linearity, hysteresis and dead zone. (3)  
d). Explain the principle of operation of a pirani gauge with neat sketch. (3)
2. a). The resistance of a thermistor is 800  $\Omega$  at 50°C and 4 k $\Omega$  at the ice-point. Calculate the characteristic constants (A, B) for the thermistor and the variation in resistance between 25 and 105°C. (3)  
b). How does resistance change with temperature for resistance thermometers? Which is the best material for such thermometer? Compare its property with two other possible materials. (3)  
c). What are the different methods of very low temperature measurement? Explain the operation of any one temperature sensor. (4)
3. a). Explain the principle of operation of hot wire anemometer with a help of a schematic diagram. (3)  
b). A 2.280-in. orifice is installed in a 3-in. standard pipe. The orifice is arranged for a vena-contracta taps, and a mercury manometer reads 10.80 in. Hg at 80°F. The temperature of the flowing water is 200°F. Find the rate of flow in gallons per minute based on 60°F. (3)  
c). Describe one float type and one hydrostatic type level measurement in detail. (4)  
d). Explain mass flowmeter that uses the principle of conservation of angular momentum. How is its range affected? (4)
4. a) Describe the working principle of any one universal detector used in moisture analysis of gases. (4)  
b). Explain the principle of operation of IR absorption spectrophotometer. (4)  
c). Which electrodes are used for measurement of  $p^H$ ? Explain any one  $p^H$  meter in detail. (4)  
d). Describe the principle of operation of a HPLC with neat sketch. (4)

Data for:  
(3)

Density of Hg @ 80°F = 845 lb/ft<sup>3</sup>

" H<sub>2</sub>O @ 80°F = 62.2 lb/ft<sup>3</sup>

" @ 200°F = 60.1 lb/ft<sup>3</sup>

Density of H<sub>2</sub>O at 60°F = 62.4 lb/ft<sup>3</sup>

K = 0.728