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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2013

MECHANICAL ENGINEERING

6th SEMESTER

ME 9035 & MEASUREMENTS AND CONTROL

(Regulation 2008)

Time: 3 Hours Answer ALL Questions Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Distinguish between accuracy and precision.
2. List down the dynamic inputs in any measurement system
3. Draw the frequency characteristics of (i) a low pass filter and (ii) a band-stop filter
4. Classify the constant area flow meters.
5. What would be the major cause of error in the mercury-in-glass thermometer?
6. What are the factors to be considered for the selection of an instrument for a particular measurement application?
7. What are the basic elements of feedback control systems?
8. What is the function of a microprocessor?
9. What is the controller gain of a temperature controller with a 80% PB if its input range is 40°C to 90°C and its output is 4 mA to 20 mA?
10. Write down the steps in Experiment design protocol.

PART – B (5 x 16 = 80 Marks)

11 In a cooling experiment the system is presumed to behave as a first order system following a relation like

$$y = Ce^{-aT}$$

The following data points are collected.

y	0.9	0.8	0.4	0.3	0.2	0.1	0.01
T	0.1	0.5	0.9	1.2	1.7	2.3	4.6

Perform Least squares analysis to obtain the best values of C and T. Calculate the correlation coefficient for the least square fit.

12. (a) Explain the various types and functions of the following in respect of instrumentation system (i) Transducers (ii) Input circuit (iii) Signal Conditioning device (iv) Transmission device and (v) Terminal device

OR

(b) Two resistances are connected in series and parallel. The values of the resistances are R1=100.0±0.3Ω, R2=50±0.2Ω. calculate the equivalent resistance and its uncertainty in each of these cases. A 9 V battery is connected across the two resistance arrangements. What are the currents and the uncertainties in each case.

13. (a) Explain the importance of microprocessors and computers in transient temperature measurement also discuss the various functional elements used in the interfacing.

OR

(b) (i) Explain various methods used for the thermal conductivity measurement of solids. (10)
(ii) A Saybolt viscometer is used to measure the viscosity of liquid. The time recorded is 418±0.5 s. The density of the liquid measured as 780±0.23 kg/m^3. Estimate both kinematic and dynamic viscosity along with its uncertainty. (6)

14. (a) (i) Discuss various techniques used for the measurement of surface temperature of hot plate along with its error. (10)
(ii) The exhaust temperature of an internal combustion engine has been measured by a thermo- resistive temperature sensor. The sensor is connected as one limb of a Wheatstone bridge arrangement and the four resistances that constitute the bridge are each 200 Ohm. The bridge supply voltage is 5 volts, the output measuring instrument has an internal reistance of 50 Ohm and the temperature sensitivity of the sensor is 0.01 Ohm per degree temperature difference. Calculate the output voltage from the bridge corresponding to an exhaust temperature of 800°C.**(6)**

OR

(b) A venture is designed to measure flow in a tube of 8 cm ID. The flowing fluid is dry air at atmospheric pressure and room temperature of 25°C. The coefficient discharge for the venturi is 0.92. Use diameter ratio of 0.62 for the venture. What is the minimum flow rate that may be measured using this Venturi? What is the corresponding pressure drop in mm of water column?

15. (a) Design a system to control the level of water in the container to a constant level. If It uses a proportional controller with Kp equal to 10. The valve gives a flow rate of 10 m^3/h per percent of controller output, its flow rate being proportional to the controller input. If the controller output is initially set to 50% what will be the outflow from the container? If the outflow increases to 600 m^3/h, what will be the new controller output to maintain the water level constant?

OR

(b) Design a measurement system part of the control system for a furnace. It is necessary to monitor the rate at which the heating oil flows along a pipe. The output from the measurement system is to be an electric signal which can be used to adjust the speed of the oil pump. The system must be capable of operating continuously and automatically without adjustment for long periods of time. Also discuss the economics of the same.