B.E (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR / MAY 2012

MECHANICAL ENGINEERING BRANCH

SIXTH SEMESTER

77

ME 9035 MEASUREMENTS AND CONTROL

(REGULATIONS 2009)

Time : 3 h Max Marks : 100

Instructions: Use of approved charts and Tables are permitted

Answer all Questions

Part – A (10 x 2 = 20 Marks)

1. Define time constant.
2. Why instrument calibration is necessary?
3. Transducers change information about a quantity into information in another form. For the transducers Strain gauge and LVDT what information changes are occurring?
4. Define the term "filtering" and draw frequency characteristics of a high-pass filter.
5. State the law of intermediate temperatures for thermocouples.
6. List down the factors to be considered in the selection of flow meters.
7. How does the ionization gage is different from Pirani gage?
8. What are the main elements of control systems?
9. What do you meant by the term (i) Span (ii) Absolute deviation in respect of use in control systems?
10. What are the limitations of Automatic control systems?

Part – B (5 x 16 = 80 Marks)

11. A simple-float system is to be used to control the liquid level in a tank by controlling the amount of liquid entering the tank. Design such a system and state the mode of suitable control system adopted and discuss the criteria used to predict the performance of the control system developed.

12. (a) (i) A dimensionless group used in free-convection heat-transfer problem is Grashof number defined by

$$Gr = \frac{g\beta\Delta T x^3 \rho^2}{\mu^2}$$

Where g is the acceleration of gravity, β is rate of change of fluid volume per unit change in temperature per unit volume, ΔT is a temperature difference, x is a distance parameter and μ is the fluid dynamic viscosity. Determine suitable units for all parameters in the SI system which will cause Gr to be dimensionless. **(10)**

(ii)What is meant by Zeroth, First and Second order systems?Give suitable Examples **(6)**

OR

(b) (i) Clearly differentiate between random error and systematic error and discuss how to reduce the same if possible with specific examples. **(6)**

(ii) The relation between distance travelled "s" in time "t" by a particle subjected to constant acceleration "a" is given by the well-known formula

$$s = ut + \frac{at^2}{2}$$

Where "u" is the velocity at t=0. From an observation the following data is given: u=1±0.01 m/s, a=2.3±0.014 m/s^2 and t=15±0.005 s. What is the nominal distance traveled by the particle after 20 s and its uncertainty? **(10)**

13. (a) Discuss various types of transducers commonly used in Engineering applications based on their output, operating principle and its typical applications along with its reported accuracy level.

OR

(b) (i) A platinum resistance thermometer has a resistance of 0°C of 120Ω and forms one arm of a Wheatstone bridge. At this temperature the bridge is balanced with each of the other arms also being at 120 Ω. The temperature coefficient of resistance on the platinum is 0.0039°C^{-1}. What will be the output voltage for the change in temperature of 20°C if the instrument used to measure. It can be assumed to have infinite resistance and the supply voltage, with negligible internal resistance, for the bridge is 6.0 V? **(10)**

(ii) Draw a Signal linearization circuit and explain. **(6)**

14. (a) Name the common methods used for the measurement of temperature using radiation principle and explain the operating principles with neat schematic and discuss the uncertainties which may be involved.

OR

(b) (i) Explain various techniques used for the measurement of specific heat of both solid and liquid. **(8)**

(ii) A Saybolt viscometer is used to measure the viscosity of engine oil. The time recorded is 205±0.5 s. Calculate the kinematic viscosity along with its uncertainty. The specific gravity of the engine oil has been estimated as 0.8±0.02. Determine the dynamic viscosity of engine oil along with its uncertainty. **(8)**

15. (a) Explain the concept of PI, PD and PID controller and Determine the controller output of the PID controller having K_p as 4, T_i as 0.2 s, T_D as 0.5 s at time t = 0 and t = 2 s when there is an error input which starts at 0 at time t = 0 and increases at 1% / s.

OR

(b) (i) Discuss the operating principle of Direct Digital control system. **(8)**

(ii) Outline the generalized experimental planning and procedure for any Engineering application. **(8)**