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B.E / B. Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2012

MECHANICAL ENGINEERING BRANCH

VI SEMESTER

17

ME 9035 – MEASUREMENT AND CONTROLS

(REGULATIONS 2008)

Time : 3 hr

Max mark : 100

Instructions : Use of approved Tables, Charts are permitted

Answer ALL Questions

PART – A (10 x 2 = 20 Marks)

- 1 What is random error?
- 2 Define sensitivity.
- 3 What is meant by Zeroth, First and Second order systems?
- 4 What are the advantages of microprocessor data logging?
- 5 Distinguish between gage pressure, absolute pressure and vacuum.
- 6 Why emissivity is important in radiation measurements?
- 7 What is the purpose of actuator in a control system?
- 8 What is meant by proportional action in a process controller?
- 9 Name the most commonly used instruments for temperature control.
- 10 Outline the procedure that could be used to tune a control system.

PART – B (5 x 16 = 80 Marks)

11. Explain the elements that could be used for the following control systems and discuss (i) control the level of water in a tank (ii) control of the rate of flow of liquid along a pipe and (iii) control of the pressure in a pressurized tank.
12. (a) (i) Reynolds number used in fluid mechanics is defined as $Re = \frac{\rho u x}{\mu}$ where ρ is fluid density, u is the velocity, x is the dimension and μ is the dynamic viscosity. Determine sets of units for these four parameters that will make Reynolds number dimensionless. (10)

(ii) The following data are collected from an experiment. Estimate the standard deviation of the data collected. (6)

Reading	1	2	3	4	5	6	7	8	9	10
x (cm)	4.62	4.69	4.86	4.53	4.60	4.65	4.59	4.70	4.58	4.63

OR

(b) Two resistances are connected in series and parallel. The values of the resistance are $R_1 = 100.0 \pm 0.3 \Omega$ and $R_2 = 50 \pm 0.2 \Omega$. 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) (i) A thermometer is initially at a temperature of 20°C and is suddenly plunged into a liquid bath, which is maintained at 150°C . The thermometer indicated 95°C after the time interval of 4 seconds. Estimate the time constant for the thermometer (6)

(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 resistance 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 . (10)

OR

(b) Discuss the following transducers with neat schematic (i) LVDT (ii) Capacitive transducers (iii) Piezoelectric transducers and (iv) Photoelectric transducers.

14. (a) Explain various techniques used for the measurement of (i) Force (ii) Torque and (iii) Power

OR

(b) (i) What is Pitot tube? Explain its working principle (6)
(ii) What is the operating principle of Saybolt viscosimeter? Calculate the dynamic viscosity of oil using Saybolt viscosimeter if the density of the oil is 880 kg/m^3 . The time for drainage of the standard 60- mL sample is $140 \pm 1\text{ s}$. (10)

15. (a) Describe and compare the characteristics of (i) proportional control (ii) proportional plus integral control and (iii) proportional plus integral plus derivative control.

OR

(b) Explain the concept of using servo motors in mechanical, electrical, electronic and pneumatic control systems with examples.