Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 162005 Date: 07/01/2013

Subject Name: Electromechanical Measurements & Instruments

Time: 02.30 pm - 05.00 pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the construction and working principle of PMMC type instruments with neat diagram and derive its torque equation. Justify that these meters cannot be used for a.c.? **07**

(b) A moving coil ammeter has a fixed shunt of 0.02Ω, with a coil resistance of R = 1000Ω and potential difference of 500mV across it, full scale deflection is obtained: (a) To what shunted current does this correspond? (b) Calculate the value of R to give full scale deflection when shunted current I is (i) 10 A, and (ii) 70A, and (c) With what value of R is 40 % deflection obtained with I=100 A? **07**

Q.2 **(a)** What are the different difficulties encountered in the measurement of high resistance? Explain the working of a Megohm bridge with neat diagram. **07**

(b) Name the different mechanical tachometers. Sketch and explain the working of a centrifugal tachometer. **07**

OR

(b) The following reading are taken of a certain physical length with the help of micrometer screw : **07**
1.41,1.45,1.63,1.54,1.49,1.51,1.60,1.55,1.47,1.65 mm
Assuming that only random errors are present, calculate the arithmetic mean, the average deviation, standard deviation, variance and the probable error of the reading.

Q.3 **(a)** Explain in detail the construction and working principle of RVDT with its output characteristics. Mention its advantages and disadvantages. **07**

(b) A thermistor has a resistance of 3980 Ω at ice point (0^0 C) and 794 Ω at 50^0 C. The resistance-temperature relationship is given by $R_T = aR_0 \exp(b/T)$, calculate the constants *a* and *b*. Also calculate the range of resistance to be measured in case the temperature varies from 40^0 C to 100^0 C. **07**

OR

Q.3 **(a)** What is load cell? Prove that sensitivity of a column type load cell is 2(1+μ) times greater than the highest sensitivity achieved with a single active strain gauge in quarter bridge. **07**

(b) Explain "Thermoelectric"phenomena in thermocouple and describe any one technique for cold junction compensation in thermocouple in detail. **07**

Q.4 **(a)** Explain how by using a differential arrangement, a capacitive transducer which works on the principle of variation in capacitance with displacement between two plates, the response can be made linear and describe any one application of capacitive transducer for measurement of any industrial parameter. **07**

(b) What does dynamometer measure? Explain clearly the difference between absorption, transmission and driving type dynamometer. How does a mechanical friction dynamometer different from a hydraulic friction dynamometer? **07**

OR

Q.4 **(a)** Explain the term "standardization" of a potentiometer . Describe in detail the procedure of standardization of a d.c. potentiometer. **07**

Q.4 **(b)** Define the term standard and explain its importance in measurement work. What are the primary, secondary and working standards? **07**

Q.5 **(a)** A liquid thermometer has its glass bulb protected by a well. The thermometer is subjected to a temperature which is changing ±15°C every 100 second. Determine the maximum value of temperature indicated by thermometer. After how much time of actual occurrence of temperature, it will be indicated by the instrument? The measurement system may be idealized by the double capacity system with time constants of 20 second for the bulb and 40 second for the well. **07**

(b) Distinguish between and give appropriate examples in each case: **07**

[1] Self operated and power operated instrument

[2] Deflection and null output instrument

OR

Q.5 **(a)** State and explain the gaussion error distribution law. How is it applied in interpreting the experimental results? And what are the assumptions made for deriving the normal error distribution? **07**

(b) A strain gauge load cell consists of a solid steel cylinder which has four identical strain gauges mounted upon it is the poisson's arrangement. For each gauge the nominal resistance R=100 Ω, gauge factor F=2.0 and the gauge are connected electrically to the four arms of a Wheatstone bridge circuit which is energized with the supply voltage of 6 volts. Make calculations for the sensitivity of the load cell. The steel cylinder is 50 mm in diameter and for steel the modulus of elasticity E=200 GN/m^2 and the poisson's ratio μ=0.3 **07**

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