Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI • EXAMINATION – WINTER 2013

Subject Code: 162005   **Date: 04-12-2013**

Subject Name: Electromechanical Measurements and Instruments

Time: 02:30 pm to 05:00 pm   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain a block diagram of Generalized Measurement System with its functional elements in detail. Show a block diagram of pressure measurement using a Bourdon tube pressure gauge. **07**

(b) Describe the construction and working of PMMC instrument with neat sketch and its torque equation. **07**

Q.2 **(a)** Explain the following transducers in detail. **07**

(i) LVDT. (ii) Thermocouple.

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

OR

(b) What are "Systematic errors"? Explain briefly the following systematic errors: **07**

(i) Instrumental errors

(ii) Environmental errors

Q.3 **(a)** (i)Differentiate between the terms "Accuracy" and "Precision" with Suitable examples. **07**

(ii) Formulate the governing equation for a second-order system and spring mass system with damping.

(b) Describe in detail the "thermoelectric laws" (for thermocouples) and use of these laws. **07**

OR

Q.3 **(a)** 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.

(b) A barium titanate pick-up has the dimension of 5mm x 5mm x 1.25mm.The force action on it 5 N. The charge sensitivity of barium titanate is 150 pC/N and its permittivity is 12.5 x 10^{-9} F/m. If the modulus of elasticity of barium titanate is   12 X 10^6 N/m^2, calculate the strain. Also calculate the charge and the capacitance. **07**

Q.4 **(a)** What is load cell and prove that the 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 a quarter bridge. **07**

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

(i) Hysteresis and Dead zone   and (ii) Threshold and Resolution

OR

Q.4 **(a)** Explain the term "standardization" of a d.c. potentiometer in detail with suitable example. **07**

(b) Distinguish between and give appropriate example in each case: **07**
(i)Range and span
(ii)Error and accuracy

Q.5 **(a)** Describe different principle of operations of capacitive transducers with suitable example.   . **07**
(b) What are the different difficulties encountered in the measurement of high resistance? Explain the working of a Megohm bridge with neat diagram. **07**

OR

Q.5 **(a)** Give types of electrical filters and explain it. **07**
(b) Discuss the importance of time constant in appropriate measuring instrument. **07**
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 time interval of 3 seconds. Estimate the time constant for the thermometer.
Also calculate the indicated temperature after 5 time constants and comment upon this result.

****