

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014****Subject Code: 162005****Date: 26-05-2014****Subject Name: Electromechanical Measurements and Instruments****Time: 10:30 am - 01:00 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) Briefly discuss measurement methods giving examples. **07**
 (b) What are the difficulties encountered in the measurement of high resistances? Describe the loss of charge method for measurements of insulation resistance of cables. **07**

- Q.2** (a) Write a short note on 'Classification of Instruments' giving examples. **07**
 (b) Explain the constructional details and working operation of an attraction type moving iron instrument with the help of a neat diagram. Derive the equation for deflection, if spring control is used and comment upon the shape of scale. **07**

OR

- (b) Explain in detail the operation of Crompton's potentiometer for measurement of unknown emf. **07**

- Q.3** (a) Explain (i) calibration (ii) sensitivity (iii) overshoot giving suitable examples of each. **07**
 (b) Explain in detail how Rotary Variable Differential Transformer (RVDT) used for measurement of shaft torque. **07**

OR

- Q.3** (a) Derive an expression for the time response of first order system with a step input with neat sketches. **07**
 (b) Describe in detail different principles of operation of capacitive transducers and explain any one application of capacitive transducer. **07**

- Q.4** (a) The following data points are expected to follow a functional relationship $y = ax^b$. Obtain the value of a and b by least square method. **07**

x	1.21	1.35	2.4	2.75	4.5	5.1	7.1	8.1
y	1.20	1.82	5.0	8.8	19.5	32.5	55.0	80.0

- (b) Explain 'elastic force meters' giving examples and related sketches. **07**

OR

- Q.4** (a) Write a short note on 'Piezo-electric accelerometer' with neat sketch. **07**
 (b) Briefly explain the speed measurement with stroboscope. **07**

- Q.5** (a) Explain in detail the following characteristics of thermistors. **07**
 (i) the resistance – temperature characteristics
 (ii) the voltage-current characteristics
 (iii) the current-time characteristics

- (b) In order to measure strain in a cantilever beam, a single strain gauge of resistance 1 kilo-ohm, and gauge factor 2 and a temperature co-efficient $10 \times 10^{-6}/^{\circ}\text{C}$ is mounted on the beam and connected in one arm of a bridge circuit. The other three arms of the bridge are a resistance of 100 ohm each. The bridge detector resistance is 100 ohm and its sensitivity is 10mm per micro ampere. (i) Calculate the detector deflection for 0.1% strain. (ii) Calculate the change in effective strain indicated when the room temperature increased by 10°C . **07**

OR

- Q.5** (a) Draw the equivalent circuit of piezo-electric transducers and derive the expression for magnitude of voltage across the load by making simplifying assumptions. Prove that for medium and high frequencies the magnitude of the voltage across the load is independent of frequency. **07**
- (b) A capacitive transducer is made up of two concentric cylindrical electrodes. The outer diameter of the inner cylindrical electrode is 3 mm and the dielectric medium is air. The inner diameter of the outer electrode is 3.1 mm. Calculate the dielectric stress when a voltage of 100V is applied across the electrodes. Is it within safe limits? The length of electrodes is 20mm. Calculate the change in capacitance if the inner electrode is moved through a distance of 2mm. The breakdown strength of air is 3KV/mm. **07**
