## **GUJARAT TECHNOLOGICAL UNIVERSITY** BE - SEMESTER-VI • EXAMINATION – SUMMER • 2015

## Subject Code:162005Date:12/05/2015Subject Name: Electromechanical Measurements & InstrumentsTime:10.30AM-01.00PMTotal Marks: 70

Instructions:

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

Q.1	<b>(a)</b>	Explain (i)Range(ii)calibration	(iii)reproducibility with examples.	07
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- (b) Derive the expression for bridge sensitivity for a Wheatstone bridge with equal arms and justify for the maximum bridge sensitivity.
- Q.2 (a) Describe the construction and working of attraction type moving iron 07 instruments and derive its deflecting torque equation with advantages, disadvantages and sources of errors.
  - (b) Classify the measurement errors. Explain any one of them in detail.

OR

- (b) Explain giving example: (i)primary sensing element(ii)transducer 07 element(iii)manipulation element
- Q.3 (a) The iron losses in a ferromagnetic material used I a transformer vary with frequency, f, of the supply given to transformer. For a particular transformer these iron losses were determined at various frequencies with a constant flux density in the ferromagnetic material. The results are as follows:

	Frequency,f Hz	1100	1400	1700	2000				
	Iron losses, P, mW	46	62	94	122				

Assuming the iron losses to have general form  $P=Af^2 + Bf$ , determine the constants A and B to achieve best fit for the four measured values using method of least squares.

- (b) Explain in brief any two applications of D.C. potentiometers with neat sketches. 07 OR
- Q.3 (a) Derive the equation for time response of first order system subjected to step 07 input. Show the required figure.
  - (b) State the methods for measurement of low resistance and explain the operation 07 of Kelvin's double bridge with neat circuit diagram.
- Q.4 (a) Write a short note on 'Proving Ring' used for force measurement with neat 07 sketch.
  - (b) Write a short note on 'Torque measurement' giving neat sketch. 07

OR

- Q.4 (a) Briefly discuss the 'Use of Stroboscope' for speed measurement with neat 07 sketches.
  - (b) How acceleration can be measured? Discuss any one approach.
- Q.5 (a) Explain the working principle, construction and output characteristic of LVDT 07 with advantages and disadvantages.
  - (b) What is "Dummy gauge"? Explain the temperature compensation technique 07 using dummy gauge in strain gauge circuit.

07

07

- Q.5 (a) Describe in brief the different principles of operation of capacitive transducers 07 and explain any one application of capacitive transducers.
  - (b) A barium titanate pickup has the dimensions of 5 mm x 5 mm x 1.25 mm. The force acting on it is 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<sup>2</sup>, calculate the strain. Also calculate the charge and the capacitance.

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