Paper Code: IC502	Roll No.										

B.Tech.

(SEM V) ODD SEMESTER EXAMINATION 2015-16

TRANSDUCER AND SENSORS

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- ***All Questions carry equal marks. Provide suitable diagram where required*:-**

1. **Attempt any FOUR of the following questions:** **5 X 4=20**
   (a) What are the basic requirements for the selection of transducers?
   (b) Explain some of the major parameters of dynamic characteristics of the measurement system.
   (c) Explain the generalized block diagram of a measurement system.
   (d) What is accuracy? How it is different from precision?
   (e) Differentiate between active and passive transducers with example.
   (f) A RTD is used to measure the temperature between 0°C to 200°C. Given that resistance at t°C as $R_t = R_0 (1 + \alpha t + \beta t^2)$, $R_0 = 100.0\Omega$, $R_{100} = 138.50\Omega$ and $R_{200} = 175.83\Omega$. Calculate the nonlinearity at 100°C as a percent of full-scale deflection.

2. **Attempt any Four of the following questions:** **5 X 4=20**
   (a) How can a potentiometer used for the measurement of displacement?
   (b) What is LVDT? How it can be beneficial in displacement measurement?
   (c) The output of an LVDT is connected to a 5 V voltmeter through an amplifier with a gain of 250. The voltmeter scale has 100 divisions and the scale can be read upto $1/5^{th}$ of a division. An output of 2 mV appears across the terminals of the LVDT, when the core is displaced through a distance of 0.5 mm. Calculate sensitivity of LVDT and resolution of the instrument.
   (d) A strain gauge with gauge factor of 2 is fastened to a metallic member subjected to a stress of 1,000 kg/cm^2. The modulus of elasticity of the metal is 2 X 10^6 kg/cm^2. Calculate the % change in resistance of the strain gauge. What is the value of Poisson's ratio?
   (e) Explain how drag cup tachometer can be used for angular velocity measurement.
   (f) Write a note on digital displacement transducers.

3. **Attempt any TWO of the following questions:** **10 X 2=20**
   (a) Explain different types of torque transducers.
   (b) How is the semiconductor strain gauge different from other electrical strain gauges? Mention its advantages and disadvantages.

(c) A piezoelectric pickup has dimensions of 6 mm X 6 mm X 1.5 mm and a voltage sensitivity of 0.012 Vm/N. Relative permittivity is1,400 and modulus of elasticity is 12 X 10^{10} N/m^2. Explain piezoelectric effect and determine the following:

i. The output voltage
ii. Charge sensitivity
iii. Strain
iv. Charge generated and the capacitance when force applied is 10 N.

4. Attempt any TWO of the following questions: 10 X 2=20

(a) Write a note on the following:
   i. Electromagnetic flow meter
   ii. Vortex shedding flow meter
(b) Explain and classify different types of obstruction type flow meter.
(c) How can we use capacitive method for the measurement of level? Explain all types.

5. Attempt any TWO of the following questions: 10 X 2=20

(a) Classify and explain all the Non-Electrical method of temperature measurement.
(b) What are optical pyrometers? How do they work? Explain in detail.
(c) Draw a comparison between RTD and Thermocouple on the basis of working, properties, materials etc.