Code No: RR221002 **Set No.1**

II B.Tech. II Semester Regular Examinations, April/May -2005
TRANSDUCERS IN INSTRUMENTATION
(Common to Electronics & Instrumentation Engineering and Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Categorise various errors and explain the causes and suggest remedies.
   (b) The true value of voltage across a resistor is 50V. The measurement find a value of 49V. Calculate
      i. the absolute error
      ii. the percent error
      iii. the percent accuracy.

2. (a) A 2^{nd} order instrument has a natural frequency of 4 Hz and a damping ratio of 0.66. If the excitation frequency of the system is 6 Hz, determine the error due to the proximity of excitation frequency with the natural frequency of the system.
   (b) Derive the expression for time response of a 2^{nd} order system subjected to unit impulse input. Sketch its response.

3. (a) Define gauge factor G_f for an electrical strain gauge. Compare the characteristics of metallic and semi conductor type strain gauges.
   (b) Explain with the aid of a circuit diagram the principle of operation of a strain measurement system with temperature compensation technique.

4. (a) How the capacitive transducer is useful for the measurement of level of a non-conducting liquid.
   (b) Explain the principle of capacitive transducer which uses the principle of change in dielectric constant for measurement of displacement.

5. Explain clearly the concept of loading effects and frequency response of piezo electric transducer.

6. (a) What is meant by 'The Force-balance principle'.
   (b) List out the advantages and the disadvantages of Force-balance transducers and briefly explain their working with relevant diagram.

7. (a) Describe a thermocouple with suitable sketches.
   (b) Explain how it can be used to measure high temperature.

8. Describe the working and construction of resistance thermometers. Describe the materials used for RTDs along with their properties. Sketch this typical characteristic curve.

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Code No: RR221002 **Set No.2**

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TRANSDUCERS IN INSTRUMENTATION
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Classify various transducers and give an example of each and mention their applications.
   (b) What is the true value of voltage across the 500 KΩ resistor connected between terminals A and B as shown in figure 1 below ? What would a voltmeter with a sensitivity of 20 KΩ/v read on the following ranges: 50, 15,5 volts when connected across terminals C and D.

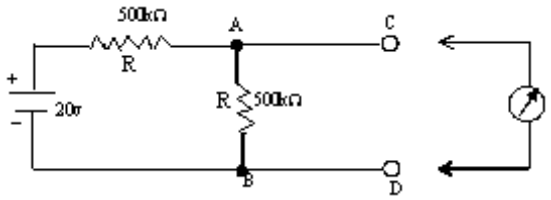

Figure 1:

2. (a) Define the terms
      i. precision
      ii. Dead space
      iii. Hysteresis
      iv. Resolution.
   (b) An RC circuit consists of 10μ F in series with a resistor of 5KΩ . A D.C voltage of 25 volts is suddenly applied across the circuit. Calculate the value of voltage after
      i. 4 msec.
      ii. 25 msec.

3. (a) Explain the construction and operation of thermistors.
   (b) A thermistor has a resistance of 3980Ω at the ice point (0^0 C) and 794 Ω at 50^0C. The resistance temperature relationship is given by R_T = a R_0 $e^{b/T}$. calculate the constants a and b.

4. (a) How the capacitive transducer is useful for the measurement of level of a non-conducting liquid.
   (b) Explain the principle of capacitive transducer which uses the principle of change in dielectric constant for measurement of displacement.

5. (a) A flat frequency response within 10% is required from a piezoelectric crystal. Find the value of minimum frequency for which it can be used if the time constant is 2ms. Find also the phase shift.
   (b) How will you measure oscillations using piezoelectric pick up.
6. (a) Draw the block diagram of the generalized feedback system of a Force-balance transducer and explain its each block.
   (b) Explain the dynamic response of Force-balance transducers to sinusoidal excitation with respect to sensitivity and phase angle.
7. What are the main factors considered for lead arrangement an RTD? Explain any one briefly.
8. Describe the working and construction of resistance thermometers. Describe the materials used for RTDs along with their properties. Sketch this typical characteristic curve.

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Code No: RR221002 **Set No.3**

II B.Tech. II Semester Regular Examinations, April/May -2005
TRANSDUCERS IN INSTRUMENTATION
(Common to Electronics & Instrumentation Engineering and Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain with a block diagram an instrumentation system and explain the function of various blocks.
   (b) The dead-zone of a certain plyrometer is 0.125 percent of the span. The calibration is 800^{o}C to 1800^{o}C what temperature change must occur before it is detected?

2. (a) Define the terms
      i. precision
      ii. Dead space
      iii. Hysteresis
      iv. Resolution.
   (b) An RC circuit consists of 10μ F in series with a resistor of 5KΩ . A D.C voltage of 25 volts is suddenly applied across the circuit. Calculate the value of voltage after
      i. 4 msec.
      ii. 25 msec.

3. (a) Name the different types of resistive strain gauges. Explain the principle of operation with suitable examples.
   (b) How is temperature effect compensated in strain gauges? Explain.

4. (a) Two plates of parallel plate capacitive transducer are 30mm apart and the space is filled with two different dielectric materials the material is 1cm thick with a dielectric constant of 5 and the other material is 20mm thick with a dielectric constant 10. If the capacitive transducer were to be made up of a single dielectric material. What is the dielectric constant of that material?
   (b) Give the AC servo bridge arrangement for variable capacitance devices and explain the same.

5. (a) Derive the expression for impulse response of piezo electric transducers.
   (b) Sketch the response curves.

6. (a) Explain the dynamic performance of feedback type acceleration transducer to sinusoidal excitation, with velocity compensation.

(b) Draw and explain the schematic diagram of feedback type angular-acceleration transducer with velocity compensation.

7. (a) What is a RTD? Where it is used?

   (b) Explain a 4 lead measurement scheme of temperature measurement using resistance thermometer.

8. Describe the working and construction of resistance thermometers. Describe the materials used for RTDs along with their properties. Sketch this typical characteristic curve.

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Code No: RR221002 **Set No.4**

II B.Tech. II Semester Regular Examinations, April/May -2005
TRANSDUCERS IN INSTRUMENTATION
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the following static characteristics with necessary examples and graphs:
   i. Accuracy
   ii. sensitivity
   iii. static error
   iv. Dead space
   v. Drift
   (b) A voltage has a true value of 1.50 volts. An Analog indicating instrument with a scale range of 0-2.50 volts shows a voltage of 1.46 volts. What are the values of absolute error and correction. Express the error as a traction of the true value and the full-scale deflection.

2. (a) Define the terms
   i. precision
   ii. Dead space
   iii. Hysteresis
   iv. Resolution.
   (b) An RC circuit consists of 10μ F in series with a resistor of 5KΩ . A D.C voltage of 25 volts is suddenly applied across the circuit. Calculate the value of voltage after
   i. 4 msec.
   ii. 25 msec.

3. (a) List the different types of strain gauges. Explain the construction and materials used for foil type strain gauges.
   (b) Discuss the advantages, disadvantages and application of bonded semiconductor gauges.

4. Explain the different principles of working of capacitive transducers.

5. (a) Derive the expressions for frequency response characteristics of piezo electric transducers.
   (b) Describe the uses of piezo electric materials and transducers.

6. (a) Draw the schematic diagram and explain about Rate-of-climb transducer.

(b) Draw the schematic diagram and explain about Gas-inertia angular-acceleration transducer.

7. (a) Describe the construction, theory and working of thermocouples.
   (b) Show how a thermo couple can be used as temperature Transducers

8. (a) List the detectors used in radiation and optical pyrometers.
   (b) Explain the factors affecting the static accuracy of filled in thermometers.

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