

B.E. (CST) Part-III 6th Semester Examination, 2007

Transducer and Instrumentation
(EE-611)

Time : 3 hours

Full Marks : 100

Use separate answerscript for each half.

Answer SIX questions, taking THREE from each half.

Two marks are reserved for neatness in each half.

FIRST HALF

1. a) Classify the transducers with examples.
b) State the advantages of electrical transducers.
c) Relate the terms “transfer function”, “sensitivity”, “dynamic range”, “accuracy”, “hysteresis” and “linearity” from the point of performance characteristics of a transducer. [5+5+6]
2. a) How capacitive transducer can be used for measurement of liquid level. Draw the schematic of the method and explain its operation.
b) State the advantage and disadvantages of capacitive transducers.
c) A pressure measuring instrument uses a capacitive transducer having a spacing of 4 mm between its diaphragms. A pressure of 600 kN/m² produces an average deflection of 0.3 mm of the diaphragms of the transducers. The transducer which has a capacitance of 300 PF before application of pressure is connected in an oscillator circuit having a frequency of 100 KHz. Determine the change in frequency of the oscillator, after the pressure is applied to the transducer. [5+5+6]
3. a) What is LVDT? Briefly describe its operating principle.
b) How a variation of LVDT can be used to sense the angular displacement? Draw the schematic of the scheme and explain its operation.
c) A resistance thermometer shows a temperature of 100°C when a current of 1 mA flows through it and a temperature 99°C when a current 0.8 mA flows through it. What is the correct temperature? [(2+5)+4+5]

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4. a) What is the Data Acquisition Systems (DAS)? Briefly explain the different components involved in it and their functions.
b) How angular speed of a rotary system can be obtained in terms of a digital pulse rate. Describe a method with diagram. [8+8]
5. Write short notes on any two of the following : [8×2]
 - a) Synchros
 - b) Strain ganges
 - c) Piezo-electric transducer
 - d) Thermister.

SECOND HALF

6. Design a second order low pass Butterworth filter. The high frequency cut-off of the filter is to be set at 10 kHz. Choose capacitors of value 0.01 microFarad. What is the pass band gain of the filter? How the filter circuit can be changed to get a high pass filter with low frequency cut-off at 10 kHz? [8+4+4]
7. With a circuit diagram and relevant waveforms explain the operation of a triangle-wave generator and find the expression through which the frequency of oscillation can be determined. [10+6]
8. Design a phase shift sinusoidal oscillator circuit with a phase leading network having frequency of oscillation as 47 kHz. Choose capacitance values to be 0.016 microFarad. What changes are needed to design the oscillator with phase lagging network? [10+6]
9. What are the important qualities of an instrumentation amplifier? Realise an instrumentation amplifier with three OPAMPs and resistors and explain its operation. How do you adjust the gain of an instrumentation amplifier? [6+6+4]
10. Write short notes on any two of the following : [8+8]
 - a) Flash type ADC
 - b) Isolation amplifier
 - c) Sample and Hold circuit
 - d) DAC using R-2R Ladder network.