(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2114 Roll No. | | | | | | | | | | |

B. Tech.

(SEMESTER-V) THEORY EXAMINATION, 2012-13

ELECTRICAL INSTRUMENTATION & PROCESS CONTROL

Time : 3 Hours] *[Total Marks : 100*

SECTION – A

Note : Attempt **all** questions : **2 × 10 = 20**

1. Differentiate between Active and Passive Transducers.
2. What is primary sensing element ? Name different types of pressure elements.
3. List out the various advantages of electrical transducers over mechanical transducers.
4. What is Piezo-resistive effect ?
5. Define sensitivity error and zero error with reference to transducers.
6. Draw the block diagram of an a.c. signal conditioning system.
7. Why Telemetry is necessary to use in an instrumentation system ?
8. What is Time Division Multiplexing (TDM).
9. What is smart sensor ?
10. What is process ? Explain process characteristics.

SECTION – B

Note : Attempt any **three** questions : **3 × 10 = 30**

1. Discuss the theory of strain gauges. Derive the formula $G_f = 1 + 2\upsilon$, G_f is the Gauge factor and υ the position's ratio.
2. Compare the resistance change produced by a strain of 150 micro strain if a strain gauge of nominal resistance of 120 ohm is used (i) when made of wire resistance having gauge factor of 2.13 and (ii) when made of a semi-conducting material having a gauge factor of 1.51.

3. Describe and explain working of LVDT for measurement of displacement. Discuss its advantages over other types.

4. What is an X-Y recorder ? Explain the working with the help of suitable diagram. Also describe its applications.

5. What are the important limitations of pneumatic controllers ? Give a brief description of pneumatic controller.

SECTION – C

Note : Attempt **all** questions : **5 × 10 = 50**

1. Describe the construction theory and working of thermocouples. Describe the different type of compensations used and also the methods of measurement of their output voltage.

OR

A barium titrate pickup has the dimensions of 5 mm × 5 mm ×1.25 mm. The force acting on it is 5 N. The charge sensitivity of barium titrate is 150 PC/N and its permittivity is 12.5×10^{-9} F/m. If the modulus of elasticity of barium titrate is 12×10^{6} N/m^2, calculate the strain. Also calculate the charge and the capacitance.

2. Explain the different principles of working of capacitive transducers. Explain how by using a differential arrangement, a capacitive transducer which works on the principle of variation of capacitance with displacement between two plates, the response can be made linear.

OR

An LVDT has an output of 6 V rms when the displacement is 0.4×10^{-3} mm. Determine the sensitivity of this instrument in V/mm. A 10 V voltmeter with 100 scale divisions is used to read the output. Two tenths of a division can be estimated with ease. Determine the resolution of the voltmeter. The arrangement is used in pressure transducer for measuring the deflection of a diaphragm. The diaphragm is deflected through 0.5×10^{-3} mm by a pressure of 1000 N/m^2. Determine the sensitivity and resolution of this instrument.

3. What is a Data Acquisition System (DAS) ? Discuss about its different elements. Draw the block diagram of Digital Data acquisition system and discuss various components.

OR

Explain the land line telemetering system using a synchro-transmitter-receiver pain used in torque transmission mode. Also discuss why is it essential to use Radio Frequency (R.F.) telemetry.

4. Explain the working principle of a storage oscilloscope. Give its salient features.

OR

Describe the basic components of a magnetic tape recorder used for instrumentation applications using direct recording techniques. Describe its advantages and disadvantages.

5. What are the basic control actions used in process controllers ? Give their brief description.

OR

(i) Explain working of the PID electronic controller giving block diagram.

(ii) What is ON-OFF controller ? Explain in brief its working.
