7. (a) Explain briefly the types of errors encountered in a transducer. 7

(b) What do you mean by semiconductor strain gauges? 7

8. (a) What is linear variable differential transformer (LVDT)? List the advantages and disadvantages of LVDT. 7

(b) The output of an LVDT is connected to a 10 A ammeter through an amplifier whose amplification factor is 200. An output of 3 mA appears across the terminals of LVDT when the core moves through a distance of 0·75 mm. Calculate the sensitivity of LVDT and that of the whole setup. The milliammeter scale has 100 divisions. The scale can be read to 1/10 of a division. Determine the resolution of the instrument in mm. 7

9. What do you mean by data acquisition systems (DASs)? Explain with the help of block diagram, single-channel and multi-channel DAS. 14

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B.Tech 6th Semester Exam., 2016

INSTRUMENTATION AND MEASUREMENT

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

(iv) Question No. 1 is compulsory.

1. Write True or False (any *seven*) : 2×7=14

(a) The equivalent binary number of decimal number 27 is 11011.

(b) The equivalent decimal number of binary number 101011 is 43.

(c) The temperature measured by a thermocouple is primary measurement.

(d) Environmental errors may be due to change in wind velocity.

(e) A second-order underdamped system has a damping factor of 0·8. It is subjected to a sinusoidal input of unit amplitude. It has resonant peak of 92%.

(f) A first-order thermometer has a time constant of 50 seconds. It is subjected to a sinusoidal input cycling at 0·002 Hz. The time lag of the instrument is 50 seconds.

(g) A set of readings has a wide range and therefore it has low precision.

(h) LVDT is a capacitive transducer.

(i) The most suitable device for measuring temperature of a furnace is optical pyrometer.

(j) Strain gauge cannot be used to measure pressure.

2. (a) Discuss the factors relating the selection of instruments. 5

(b) Describe briefly the main functions of the instruments with suitable examples. 9

3. (a) What are the main static characteristics of measuring instruments? Discuss the terms – accuracy, errors and correction. 9

(b) A pressure indicator showed a reading as 42 bar on a scale range of 0–50 bar. If the true value was 41·4 bar, determine (i) static error, (ii) static correction and (iii) relative static error. 5

(Continued)

4. The temperature of a furnace is found to vary sinusoidally between 520° C and 580° C with a periodic time of 50 seconds. A thermocouple system with a time constant of 10 seconds is employed to measure the furnace temperature. Determine—

(a) the maximum and minimum values that will be indicated by the thermocouple;

(b) the phase shift and the corresponding time lag between the temperature signals and the thermocouple input signals. 14

5. Discuss zero-, first- and second-order systems with suitable examples. 14

6. By using a micrometer screw, the following readings were taken of a certain physical length :

1·34, 1·38, 1·56, 1·47, 1·42, 1·44, 1·53, 1·48, 1·40 and 1·59 mm

Assuming that only random errors are present, calculate the following : 14

(a) Arithmetic mean

(b) Average deviation

(c) Standard deviation

(d) Variance

Turn Over)