53 (IE 502) TREN

2015

TRANSDUCER ENGINEERING

Paper : IE 502

Full Marks : 100

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

*Answer **any five** questions.*

1. (a) What are Systematic errors ? Explain
briefly the following systematic errors
with examples :   10

Instrumental error ; environmental
error ; observational error.

(b) In a temperature measurement test ; temperature were measured 100-times with variations in apparatus and procedure. The results are as follows :

Temperature (°C)	197	198	199	200	201	202	203	204	205
Frequency of occurrence	2	4	10	24	36	14	5	3	2

Calculate :

(i) AM

(ii) Average deviation

(iii) Standard deviation

(iv) Probable error of one reading

(v) Standard deviation of standard deviation. 5

(c) Define odds and uncertainty. What are the probable reasons for errors in instruments ? 5

2. *(a)* Differentiate between the terms :

'Accuracy' and 'Precision' with suitable examples. 5

(b) What is signal to noise ratio ? Explain the different types of noises.   5

(c) Sketch and explain the response of a first order system when subjected to a unit step signal.   10

3. *(a)* Define the following terms in short :   5

    * Speed of response
    * drift
    * Reproducibility
    * Sensitivity
    * Dynamic error.

(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 static error ; static correction ; and relative static error.   5

(c) Write the difference between static and dynamic characteristics. What are the different types of transducer ? Classify them with examples.   10

4. *(a)* A thermometer initially at a temperature of 15°C is suddenly plunged into a liquid maintained at 140°C. After a time interval of 4-seconds, the thermometer indicated a reading of 45°C.

Calculate —

* time constant of the thermometer

* the indicated temperature after five time constants. 6

(b) Explain how the dynamic characteristics of transducer change for zero, I and IInd order transducers. 10

(c) Explain the construction working principle of thermistor. 4

5. *(a)* What do you understand by the term loading effect as applied to measuring instruments ? Explain briefly. 5

(b) A pressure measuring system consists of a piezoelectric transducer, a charge amplifier and an UV-charge recorder and their sensitivities are — $6 \cdot 8 pC/bar$; $0 \cdot 0032 V/_{pC}$ and $16 mm/_V$ respectively. Now determine the deflection on the chart for a pressure change of 20 *bar*. 5

(c) What is strain gauge ? Explain its construction and working principle.

10

6. (a) Discuss the operating principle of resistance potentiometer with neat diagram. Also write the applications of it.

12

(b) Explain the working of LVDT with neat diagram.

8

7. Write short notes on : *(any four)* 5×4=20

* Fiber optic transducer.

* Dynamic characteristics

* Humidity Sensor

* SONAR

* Resolution & sensitivity.