53 (IE 302) FDIN

2019

FUNDAMENTALS OF INSTRUMENTATION

Paper : IE 302

Full Marks : 100

Time : Three hours

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

Answer ***any ten*** *questions out of* ***thirteen.***

1. *(a)* Write a short note on curve fitting using the Method of Least squares. 6

   (b) What are the human errors ? Explain. 4

2. *(a)* Explain with circuit diagram of op-amp based constant current source. 6

   (b) What is the systematic error ? Explain. 4

Contd.

3. *(a)* Using the Chi-square method, test whether the following set of reading follow the Gaussian distribution curve or not. Temperature readings are 75-80, 80-85, 85-90, 90-95, 95-100, 100-105, 105-110. Observed frequencies are 3, 7, 10, 13, 11, 8 and 4 respectively. 6

(b) How are Voltmeter and Ammeter calibrated ? 4

4. *(a)* How is the loading effect reduced in the temperature measurement using thermocouple ? Explain with diagram. 6

(b) A strain gauge has a gauge factor of 4. If it stretches from 0·45 *cm* to 0·455 *cm*, what is the percentage of change in resistance ? 4

5. *(a)* A 200μA ammeter has an internal resistance of 50Ω. For extending its range to measure 600μA, find the shunt resistance required. 6

(b) How to check the linearity of a system ? 4

6. *(a)* Explain the non-linearity effect in potentiometer-based voltage divider circuit. 6

(b) What are the advantages of current telemetry ? 4

7. *(a)* Draw the Gaussian distribution curve and equation. What is precision index ? 6

(b) What is standards ? Draw the traceability ladder. 4

8. *(a)* Define the following terms : 6

(i) Precision

(ii) Static sensitivity

(iii) Resolution.

(b) Write all fundamental SI units. 4

9. *(a)* In a certain manufacturing process, the length of shafts produced has a mean length of 400 *cm* and a standard deviation of 1 *cm*. If the shaft diameter range from 397 to 403 *cm* is accepted, how many rejections would you expect in a random list of 10,000 shafts ? 6

(b) What is "Rise time" and what is "Settling time"? 4

10. (a) Discuss the characteristics of an ideal operational amplifier. 6

(b) What is the input impedance of an inverting and non-inverting operational amplifier? 4

11. (a) Describe in brief, the following errors and its causes :
(i) Limiting errors (ii) Instrumental error
(iii) Environmental errors. 6

(b) Draw the instrumentation amplifier circuit with output equation and advantages. 4

12. (a) Draw the block diagram of weight measurement system and describe in brief all functional blocks. 6

(b) What is the difference between null-type and deflection-type bridge? 4

13. (a) The table given below of measure values.
Values are 52, 53, 54, 55, 56, 57, 58, 59 and frequency of occurrences are 5, 2, 4, 6, 8, 20, 12, 2. Calculate Mean, Mode, Median; Mean absolute deviation, Standard deviation. 6

(b) Define active and intelligent instrument. 4