Total number of printed pages-5

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.
- (a) Explain with circuit diagram of op-amp based constant current source.
  - (b) What is the systematic error? Explain.

Contd.

(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.

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- (b) How are Voltmeter and Ammeter calibrated?
- 4. (a) How is the loading effect reduced in the temperature measurement using thermocouple? Explain with diagram.
- (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?
- (a) A  $200\mu A$  ammeter has an internal resistance of  $50\Omega$ . For extending its range to measure  $600\mu A$ , find the shunt resistance required.

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

- 6. (a) Explain the non-linearity effect in potentiometer-based voltage divider circuit.
- (b) What are the advantages of current telemetry?
- 7. (a) Draw the Gaussian distribution curve and equation. What is precision index?
- (b) What is standards? Draw the traceability ladder. 4
- (a) Define the following terms:
- i) Precision
- ii) Static sensitivity
- (iii) Resolution.
- (b) Write all fundamental SI units.

(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?

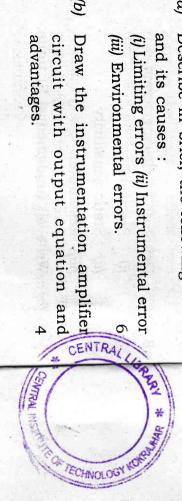
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- 6 What is "Rise time" "Settling time"? and what is
- 10. (a) Discuss the characteristics of an ideal operational amplifier. 6
- 6 What is the input impedance of an amplifier? inverting and non-inverting operational
- 11. (a) Describe in brief, the following errors

- *(b)*
- 12. (a) Draw the block diagram of weight measurement system and describe in brief all functional blocks.
- (b) What is the difference between nulltype and deflection-type bridge?

- 13. <u>a</u> The table given below of measure 59 and frequency of occurrences are 5, Values are 52, 53, 54, 55, 56, 57, 58, deviation, Standard deviation. Mode, 2, 4, 6, 8, 20, 12, 2. Calculate Mean, values. Median; Mean absolute
- *(b)* Define active and intelligent instrument.



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