53 (IE 302) FNIN

2017

FUNDAMENTAL OF INSTRUMENTATION

Paper : IE 302

Full Marks : 100

Time : Three hours

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

Answer ***any five*** : 5×20=100

1. *(a)* Draw the block diagram of weight measurement system and describe in brief all functional blocks. 8

   (b) Describe in brief the following errors and its causes : 6

   (i) Limiting errors,

   (ii) Instrumental errors

   (iii) Environmental errors

(c) Describe the significant of expression $y=mx+c$, for an instrument. 4

(d) Define active instruments. 2

2. (a) Explain temperature measurement using 4-wires RTD. 8

(b) If $R_1 = \frac{R_2 R_3}{R_4}$,

$R_2 = 100\Omega \pm 1\%$,

$R_3 = 200\Omega \pm 2\%$,

$R_4 = 300\Omega \pm 3\%$,

calculate the limiting resistance of R_1. 6

(c) Describe the different standards. 4

(d) Define intelligent instrument. 2

3. (a) The table given below of measure value. Values are 53, 54, 55, 56, 57, 58, 59 and frequencies of occurrences, 2, 4, 6, 8, 10, 6, 2. Calculate Mean, Mode, Median, Mean absolute deviation, Standard deviation. 8

(b) Define the following terms : 6

(i) Precision

(ii) Static Sensitivity

(iii) Linearity

(c) A $100\mu A$ ammeter has an internal resistance of 100Ω. For extending its range to measure $500\mu A$, find the shunt resistance required. 4

(d) Explain the advantages of current telemetry. 2

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

(b) What are the different methods of Calibration in measurement ? 6

(c) Explain the nonlinearity effect in potentiometer based voltage divider circuit. 4

(d) Why 4-20mA is used ? 2

5. *(a)* How the loading effect reduce in the temperature measurement using thermocouple ? Explain with diagram and mathematical example. 8

(b) Draw the Instrumentation amplifier circuit with output equation and advantages. 6

(c) "A Buffer can be used to reduce loading effect". Justify the statement. 4

(d) What is the difference between null type and defection type Bridge ? 2

6. *(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 203*cm* is acceptable, how many rejections would you expect in a random list of 1000 shafts ? 8

(b) A strain gauge has a gauge factor of 4. If it is stretches from 0·25*m* to 0·255*m*, what is the percentage change in resistance ? 6

(c) Discuss the characteristics of an ideal operational amplifier. 4

(d) What is the input impedance of a inverting operational amplifier ? 2
