Total No. of printed pages = 4

CAI-503/POI/5th Sem/2017/M

PRINCIPLES OF INSTRUMENTATION

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer any *five* questions.

1. (a) Discuss the static characteristics of an instrumentation system. 6

   (b) Define the following terms and find expression for them : 8

   (i) Peak time

   (ii) Peak overshoot

   (iii) Rise time

   (iv) Settling time.

[Turn over

2. (a) Derive the transfer function of an first order RC network.
If the network consists of a capacitor of 5μF in series with a resister of 10 KΩ. A DC voltage of 30V is suddenly applied across the circuit. Calculate the voltage after : 7

(i) 10ms and

(ii) 20ms.

(b) Explain the functioning of a basic type of strip chart recorder using a suitable diagram. Also, explain the different types of marking mechanisms and tracing system used in it. 7

3. (a) Describe the working of any *two* from the following devices : 8

(i) LED

(ii) LCD display

(iii) Seven segment display

(b) Differentiate the following : 6

(i) Indicating, recording and integrating instruments.

(ii) Analog and digital instruments.

4. (a) Name the important test signals and explain each of them with relevant mathematical expression. 6

(b) Derive the transfer function of a liquid level system when a input flow rate is suddenly increased from its steady state condition. 4

(c) A temperature sensitive transducer is subjected to a sudden temperature change. It takes 12 sec for the transducer to reach equilibrium condition (four times constant). How long will it take for the transducer to read half of the temperature difference ? 4

5. (a) Discuss the sources of noise in an Instrumentation system. Describe the methods used for reduction of noise. 4

(b) What is calibration ? Explain in brief the procedures involved in the calibration. 4

(c) Describe the construction and working of X-Y recorder using a neat sketch. 6

6. (a) Define Limiting Errors. Derive the expression for relative limiting error.

A 0-10A ammeter has a guaranteed accuracy of 1% of full scale reading. The current measured by the instrument is 2.5A. Calculate the limiting values of current and percentage limiting error. 6

(b) Define Gross Errors, Systematic Errors, and Random Errors. Also mention the causes of these errors. 5

(c) Two resistors have the following ratings $R_1 = 100\Omega \pm 2\%$ and $R_2 = 150\Omega \pm 1.5\%$. Determine the percentage limiting error and actual range of the resistance (equivalent) when these resistances are connected in series. 3

7. Write short notes on any *two* of the following :

(i) Dynamic characteristics of instruments

(ii) Data Logger system

(iii) Thermal system. 7×2=14