Total No. of printed pages = 5

CAI-503/PI/5th Sem/2014/N

PRINCIPLES OF INSTRUMENTATION

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer question No.1 and any *six* from the rest.

1. (a) Choose the appropriate answer : 1×5=5

(i) Which of the following static characteristics are desirable ?

(A) Accuracy

(B) Sensitivity

(C) Reproducibility

(D) All of the above.

[Turn over

(ii) A set of readings has a wide range and therefore it has

(A) Low precision

(B) High precision

(C) Low accuracy

(D) High accuracy.

(iii) Time constant of an RC circuit is given by :

(A) 1/RC

(B) R/C

(C) RC

(D) C/R

(iv) LED light emit

(A) only in red colour

(B) only in yellow colour

(C) only in green colour

(D) in red, green, yellow and amber colour.

(v) An LCD requires a power of

(A) 20 W

(B) 20 mW

(C) 20 μW

(D) 20 nW

(b) Fill in the blanks : 1×5=5

(i) The switching time for LED is of the order of ———.

(ii) The difference between measured value and true value of a quantity is called ——— .

(iii) Linear potentiometer is a ——— order system.

(iv) Digital instruments have input impedance of the order of ———.

(v) Characteristic equation of a second order system is given by ———.

2. (a) Define transfer function. Derive the transfer function of an nth order system. 2+5=7

(b) Draw the block diagram for an instrumentation system. 3

3. (a) Derive the response of a first order system subjected to step input and also find the dynamic and static error for the same. 6

(b) A thermometer has a time constant of 3.5s. It is quickly taken from the temperature 0°C to water bath having a temperature 100°C. What temperature will be indicated after 1.5s ? 4

4. (a) What are different standard test signals ? Sketch the standard test signals with their governing equations. 6

(b) An RC circuit consists of a capacitor of 1 μF in series with a resistor of 5 kΩ. A DC voltage of 50V is suddenly applied across the circuit. Calculate the value of voltage after 5 ms and 25 ms. 4

5. (a) Derive the transfer function of a second order system and also find its characteristic equation. 7

(b) A second order system has a mass of 8×10^{-3} kg and stiffness of 1000 N|m. Calculate the natural frequency and damping constant, if the system is critically damped. 3

6. (a) Draw the time domain specification of an underdamped second order system and define the following :

Rise time (t), Peak time (tp), Peak overshoot (Mp) and Settling time (ts). 3+4=7

(b) Discuss over damped, under damped and critically damped system with suitable diagrams. 3

7. Write the advantages of LEDs and LCDs. 5+5=10

8. (a) Explain the working of XY recorder and LCD. 3+3=6

(b) Describe the principle and working of CRT. 4

9. Write short notes on : 2×5=10

(a) Order of a system

(b) Accuracy and precision

(c) Drift

(d) Dead zone

(e) Sensitivity.