Total No. of printed pages = 8

END SEMESTER EXAMINATION–2021

Semester : 5th

Subject Code : CAI-503

PRINCIPLES OF INSTRUMENTATION

Full Marks – 70

Time – Three hours

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

Instructions :

(i) *All* questions of PART–A are compulsory.

(ii) Answer any *five* questions from PART–B.

PART – A

Marks – 25

1. Choose the correct answer : $1 \times 5 = 5$

   (i) Which of the following is not a dynamic characteristics ?

   (a) Speed of response

   (b) Fidelity

   (c) Dynamic error

   (d) Hysteresis

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(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) A 0-300V voltmeter has an error of ±2% of full scale deflection. What would be the range of readings if the true voltage is 30V?

(a) 24V-36V

(b) 29.4V-30.6V

(c) 20V-40V

(d) 30V-300V

(iv) Which of the following is not an Analog Recorder ?

(a) Strip-chart Recorder

(b) X-Y Recorder

(c) Magnetic Recorder

(d) All of these

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(v) For a Common anode 7-segment LED Display device, to display the number '0', the output of the associated Decoder must be

(a) 0000001 (b) 1111110

(c) 0000000 (d) 1111111

2. State whether the following statements are true or false. If it is 'false', state the correct one. $1\times10=10$

(i) Many manufacturers define the sensitivity of their instruments in terms of inverse sensitivity.

(ii) Precision is used in measurements to describe the consistency or the reproducibility of results.

(iii) The finest example of a first order system is potentiometer.

(iv) A quantity whose magnitude has a definite repeating time cycle is called a steady state periodic.

(v) Rise time is defined as the time required for the system to rise from 0% to 50% of its final value.

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(vi) To minimize parallax errors, highly accurate meters are provided with mirrored scales.

(vii) A digital voltmeter is essentially an A-D converter.

(viii) A CRO has usually a very low impedance at its input.

(ix) Data loggers are usually of digital types.

(x) Seven-segment displays may also be made up of LCDs.

3. Fill in the blanks : 10

(i) In an overdamped system damping ratio (ζ) value is _______.

(ii) A linear potentiometer can be considered as _______ order system.

(iii) The highest power of the complex variable "s" in the denominator of the transfer function determines the _____ of a system.

(iv) For a second order system the settling time for $\pm$ 2% tolerance band is ______.

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(v) The number of significant figures in the number 499.95 is _______.

(vi) When the drift occurs only over a portion of span of an instrument, it is called ______ drift.

(vii) The built-in potential of a Silicon based p-n diode is _______.

(viii) A strip-chart recorder records one or more variables with respect to _______.

(ix) Observational error is also termed as ______ error.

(x) LEDs are typically made up of Group III and ______ elements.

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PART–B

Marks – 45

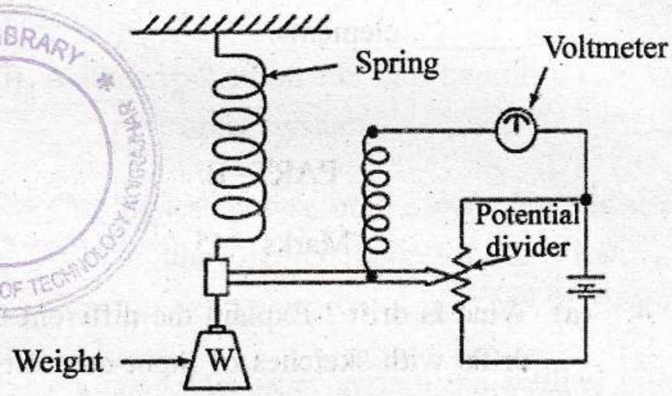
4. (a) What is drift ? Explain the different types of drifts with sketches of input-output relationships in each case. 7

(b) Differentiate between "Scale reading" and "Scale Span" of an instrument. 2

5. (a) With a suitable diagram explain the functional elements of a measurement system. Also highlight the basic and auxiliary elements in it. 5

(b) What are the different standard test signals used in a measurement system ? 4

6. (a) The following figure portrays a schematic diagram of a spring balance measuring device with electrical readout. Now you identify and write down the basic and auxiliary functional elements in it. 6



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(b) Explain the phenomenon of hysteresis in measurement system. 3

7. (a) A thermometer reads 95.450C and the static correction given in the correction curve is −080C. Determine the true value of the temperature. 2

(b) Make a classification of different types of errors that appear in a measurement process. 5

(c) A digital voltmeter has a readout range from 0 to 9,999 counts. Determine the resolution of the instrument in volt when the full scale reading is 9.999 V. 2

8. (a) What is a Recording Instrument ? What are the different types of Recording Instruments ? 3

(b) Briefly explain the working of any one of the following Recorders. 6

(i) Strip-chart recorder

(ii) X-Y recorder.

9. (a) Name the four different types of digital display devices. 2

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(b) Draw the circuit diagram of common-cathode seven segment LED display. 2

(c) Draw the block diagram of a CRO and briefly explain the function of each block. 5

10. (a) Discuss the different types of errors found in measuring instruments. 5

(b) What is Electrical Earthing ? List out the important components of Earthing system. 4

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