Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EEE/ICE)/SEM-4/EI-402/2010

2010

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Which is not desired characteristics of an instrument ?

a) Accuracy b) Fidelity

c) Speed of response d) None of these.

ii) The smallest change in the input variable being measured, that will cause a change in the output signal of the instrument is termed as

a) Hysteresis b) Drift

c) Resolution d) Threshold.

iii) For a second order system, the settling time is ± 2%, band is

a) $3/\xi\omega_n$ b) $5/\xi\omega_n$

c) $2/\xi\omega_n$ d) $4/\xi\omega_n$.

iv) A 0-10A ammeter has a guaranteed accuracy of 1% of full-scale deflection. The limiting error while reading 2.5A is

a) 1% b) 2%

c) 3% d) 4%.

v) In an instrument, the smallest measurable input is known as

a) Threshold b) Resolution

c) Dead zone d) Sensitivity.

vi) Pirani gauge is used to measure

a) Temperature b) High pressure

c) Low pressure d) Flow.

vii) Two resistance 100Ω ± 5Ω and 150Ω ± 15Ω are connected in series. If the deviations are standard deviation, the resultant resistance can be expressed as

a) 250Ω ± 20Ω b) 250Ω ± 10Ω

c) 250Ω ± 15.8Ω d) 250Ω ± 10.6Ω.

viii) In a Q-meter, the value of shunt resistance connected across the oscillator is typically of the order of

a) Ω b) mΩ

c) μΩ d) kΩ.

ix) A true rms responding voltmeter is

a) Thermistor b) RTD

c) LVDT d) Thermocouple.

x) The spectrum analyzer is used across the frequency spectrum of a given signal to study the

a) Current distribution b) Voltage distribution

c) Energy distribution d) Power distribution.

xi) An a.c. voltmeter is used to measure

a) average value b) rms value

c) peak value d) peak to peak value.

xii) In a $3\frac{1}{2}$ digit voltmeter, the largest number can be read is

a) 0999 b) 1999

c) 4999 d) 9999.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) Explain the terms 'accuracy' and 'precesion' with respect to a measuring system. 2 + 2

   b) Which is the more desirable parameter ? 1

3. a) Define Linear time invariant and Linear time variant systems with example.

   b) Describe the technique used for linearizing a non-linear system for limited range about the operating point. 1 + 1 + 3

4. What is limiting error ?

   A Wattmeter having a range of 500 W has an error of ± 1.5 per cent full scale deflection. If true power is 50 W, what would be the range of readings ? 1 + 4

5. a) State the advantages of the digital voltmeter over analog voltmeter.

   b) What do you mean by 3-1/2 digit display ?

   c) How are DVM classified ? 2 + 2 + 1

6. a) State sampling theorem.

   b) Why is sample and hold circuit required in a DAS ? Construct a suitable sample and hold (S & H) circuit and explain its function. 1 + 1 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What is Histogram ? Explain standard deviation and variance.

   b) By using a micrometer screw the following readings were taken of a certain physical length : 1.34, 1.38, 1.56, 1.47, 1.42, 1.44, 1.53, 1.48, 1.40, 1.59 mm.

   Assuming that only random errors are present calculate the following :

   i) Arithmetic Mean
   ii) Average deviation
   iii) Standard deviation
   iv) Variance. (2 + 2 × 2) + 9

8. a) What is ADC ? Draw the schematic of a Dual ramp ADC circuit.

   b) Explain R/2R ladder network for D to A conversion.

   c) Why is R/2R ladder network technique better than weighted resistor technique ?

9. a) With the help of a functional block diagram, explain the working principle of a swept TRF spectrum analyzer.

   b) What is Standard Hydrogen Electrode (SHE) ? Where is it applied and for what purpose ? Draw a schematic diagram of this instrument. 7 + 2 + 2 + 4

10. a) What are the objectives of Data Acquisition system ?

    b) Draw the block diagram of a generalized DAS and also write the name of the components of signal conditioner used in Data Acquisition System.

    c) What is analog multiplier ? Explain the function of analog multiplier as divider and frequency doubler.

    3 + 5 + 2 + 5

11. Write short notes on any *three* of the following : 3 × 5

    a) 'Q' meter
    b) Log Amplifier
    c) Function Generator
    d) Error in Measurement
    e) Instrumentation Amplifier
    f) Multiplexing.