Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ICE-OLD)/SEM-3/IC-301/2011-12

2011

MEASUREMENT FUNDAMENTALS

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 the following : $10 \times 1 = 10$

i) RTD is an example of ..... transducer.

a) passive b) active

c) analog d) digital.

ii) For an overdamped system the damping coefficient is

a) $t < 1$ b) $t > 1$

c) $t = 1$ d) $t = 0$.

iii) A linear potentiometer is a ..... order instrument.

a) first b) zero

c) second d) third.

iv) Bourdon gauge is useful to measure the

a) flow b) level

c) force d) temperature.

v) Dimension of power is

a) $ML^2 T^{-2}$ b) $ML^2 T^{-3}$

c) MLT^{-2} d) $ML^2 T^{-1}$.

vi) The manufacturer specifies

a) absolute error b) relative absolute error

c) guaranteed error d) all of these.

vii) A 0-10 A ammeter has guaranteed accuracy of 1% of full-scale deflection. The limiting error while reading 2·5 A is

a) 1% b) 2%

c) 4% d) 8%.

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

a) low precision b) high precision

c) low accuracy d) high accuracy.

ix) If the standard deviation of any measurement is $\pm 3\sigma$, the probability of occurrence is

a) 0·6828 b) 0·50

c) 0·9546 d) 0·9974.

x) A thermometer can measure the temperature from – 10°C to 100°C. The scale range and scale span of the instrument are respectively

a) – 10°C to 100°C and 100°C

b) 110°C and 110°C

c) 100°C and 110°C

d) all of these.

GROUP – B

(Short Answer Type Questions)

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

2. Describe the signal conditioning circuit in signal measurement system.

3. Calculate the accuracy of measuring 50 V by

a) a voltmeter (range 0 – 200 V d.c.) whose accuracy is 0·1% F.S. and

b) a voltmeter (range 0 – 100 V d.c.) whose accuracy is 2% of measured value. $2\frac{1}{2} + 2\frac{1}{2}$

4. Define the voltage standard. Compare and contrast between saturated and unsaturated Weston cell. 2 + 3

5. a) What is the difference between sensitivity and dead band of a measurement system ?

b) What is lag of a system response ?

6. What is meant by direct and indirect method of calibration ? Explain with example.

GROUP – C

(Long Answer Type Questions)

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

7. For normal distribution of data, deduce the expression for probable error in terms of average deviation and standard deviation.

   Explain the statement : "A measurement data is specified within ± 3σ limit".

   What are the basic methods of rejecting the data ? 10 + 3 + 2

8. What are different standards available on total quality management system ? Discuss the structures of different standards. 5 + 10

9. Write short notes on any *three* of the following : 3 × 5
   a) Precision and accuracy
   b) Current standard
   c) Least square method
   d) Reliability of measurement.

10. a) What is the difference between dynamic and static characteristics of an instrument ? 3
    b) Why is analysis of dynamic characteristic essential for a system ? 3
    c) Calculate the following for a first order system of step input : 9
       i) Steady state error
       ii) Dynamic error
       iii) Settling time.

11. What are the different types of error in a measurement system ? Discuss the sources of these errors and the techniques of elimination or reduction of these errors.

    5 + 5 + 5