Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ICE)/SEM-5/IC-501/2009-10

2009
INDUSTRIAL INSTRUMENTATION – I

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 : $10 \times 1 = 10$

   i) Bimetallic strips made of two different materials bend during a rise in temperature on account of

      a) differences in coefficient of linear expansion

      b) differences in elastic properties

      c) differences in the thermal conductivities

      d) none of these.

   ii) An LVDT has an output in the form of

      a) linear displacement of core

      b) pulse

      c) rotary movement of core

      d) angular movement of core.

iii) The pH may be defined as negative logarithmic to base 10 of the reciprocal of hydrogen ion concentration.

(State *True* or *False*)

iv) Standard current signal in process industry is

a) 4 - 20 mA b) 0-20 mA

c) 10 - 20 mA d) 5 - 20 mA

v) Smart transmitter allow

a) one-way communication

b) two-way communication

c) both (a) & (b)

d) none of these.

vi) For gray body hemispherical spectral emmittance is equal to

a) zero

b) one, for all wavelength, at a given temperature

c) constant for all wavelength, at a given temperature

d) constant for one wavelength, at different temperature.

vii) Radiation densitometers are suitable for

a) liquids and gases

b) solids and liquids

c) solids and gases

d) solids only.

viii) Viscometer is an instrument which measures consistency of

a) gases

b) Newtonian fluids

c) non-Newtonian fluids

d) gases, Newtonian fluids and non-Newtonian fluids.

ix) A platinum resistance thermometer has a specific resistance of 9×10^{-5} Ω-cm at – 50° C. The value of specified resistance at 50° C would be nearer to

a) $0{\cdot}9 \times 10^{-6}$ Ω-cm b) $0{\cdot}8 \times 10^{-5}$ Ω-cm

c) $1{\cdot}05 \times 10^{-5}$ Ω-cm d) $0{\cdot}9 \times 10^{-4}$ Ω-cm.

x) A thermocouple arrangement is to be used to measure temperatures in the range 700-800° C. Point out the pair that would be most suitable for this application :

a) Copper-Constantan

b) Iron-Constantan

c) Chromel-Alumel

d) Platinum-platinum rhodium.

xi) Lower pressure can be measured by

a) diaphragm b) bellows

c) bourdon tube d) strain gauge.

xii) The gauge pressure indicated at the depth of 35 metre in water tank is

a) 35 kg/cm^2

b) 3·5 kg/cm^2

c) 0·35 kg/cm^2

d) 2·58 kg/cm^2.

GROUP – B
(Short Answer Type Questions)

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

2. a) What are the different types of manometers ?

b) What type of errors arises in manometers ?

c) Which type of manometer is used for better sensitivity ? Describe it. 1 + 2 + 2

3. a) How do you differentiate between thermoelectric & electrothermic effect ?

b) Name four types of thermocouples with their respective compositions & temperature range.

c) What is the function of thermowells in thermocouple ? 2 + 2 + 1

4. What is hydrometer ? What are the advantages and disadvantages of using hydrometers ? 2 + 3

5. What is meant by "differential" in case of pressure switch ? What will be the output of a pressure switch if it is set on 5 kg/cm^2 and differential pressure is 0·4 kg/cm^2 and the pressure is gradually incremented from 2 kg/cm^2 to 7 kg/cm^2 and decremented to initial pressure. 2 + 3

6. a) What are the various types of filled-type thermometer ?

   b) Explain the working principle of any one of them. 1 + 4

GROUP – C
(Long Answer Type Questions)

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

7. a) What do you mean by viscosity ?

   b) How is viscosity measured by Saybolt viscometer ?

   c) What are the different types of non-Newtonian fluids ?

   d) What are Saybolt, Redwood & Engler numbers ?

   e) Describe the working principle of Gowmac densitometer. 1 + 5 + 2 + 2 + 5

8. a) What do you mean by Live zero in case of 4-20 mA current loop ?

   b) Why is a 2-wire transmitter preferred to a 4-wire transmitter ?

   c) How do the I-P & P-I converter work ?

   d) Why are transmitters used in process industry ?

   2 + 5 + 7 + 1

9. a) Explain with block diagram the functioning of a smart and intelligent transmitters. Describe the features of these transmitters.

   b) Explain the force balance transmitter. 4 + 4 + 7

10. Explain with a neat sketch the working of a pneumatic temperature transmitter. A well type manometer has its capillary diameter to well diameter ratio as 1 : 40. If it is required to measure a D/P of 2·0 kg/cm^2, what should be the approximate height of Hg column in the capillary ? 10 + 5

11. Describe the working principle of a total radiation pyrometer with a labelled sketch. How does it different from optical pyrometer ? Show how spectral radiation intensity varies with wavelength for different temperature. 8 + 3 + 4

12. Answer any *three* of the following : 3 × 5

a) Fluidic sensor

b) Ultrasonic thermometer

c) Ionisation gauges

d) Thermistor.