Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/ICE(N)/SEM-5/IC-501/2012-13

2012

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 × 1 = 10

   i) A dead weight tester is used to measure

      a) dead weights

      b) measuring process pressure

      c) producing a high pressure

      d) calibrating a pressure instrument.

   ii) Standard current signal in industries is

      a) 0-20 mA b) 10-20 mA

      c) 4-20mA d) 5-20 mA.

iii) Smart transmitters allow

a) one way communication

b) two way communication

c) both way communication

d) none of these.

iv) Industrial RTDs are available in

a) two-wire b) three-wire

c) four-wire d) all the three types.

v) Absolute pressure is

a) sum of gauge pressure and atmospheric pressure

b) gauge pressure minus atmospheric pressure

c) atmosphere pressure minus gauge pressure

d) none of these.

vi) 1 bar is equal to

a) 1 mm of Hg b) 1 cm of Hg

c) 1 mm of H_2O d) none of these.

vii) In thermostats, the material which has lower temperature coefficient of resistance is

a) Invar

b) Brass

c) Platinum.

viii) The reference function of thermocouple is

a) 0° C b) 100°C

c) room temperature

d) a variable temperature point.

ix) The mostly used Bourdon tube is

a) c-type b) helix type

c) spiral type d) none of these.

x) To calibrate thermocouple we use

a) liquid births

b) heated metal blocks

c) all of these

d) none of these.

xi) Optical pyrometer

a) can measure the temperature at any clear burning gas

b) can measure the temperature down 80° C.

c) can monitor the temperature of moving objects

d) it can measure the light intensity and high temperature.

xii) Coriolis density meter is used for measuring

a) density of fluid

b) flow rate of fluid

c) density and flow rate

d) both (a) and (b).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. In a two wire RTD (*pt* 100) temperature measuring arrangement if α (resistance temperature coefficient) is 0·385 Ω/°C and resistance of each lead wire is 5 Ω what will be the actual reading when the instrument reads out as 100° C ?

What are the advantages and disadvantages of thermistor as a temperature sensor ?

3. Define the following terms :

   a) Gauge pressure

   b) Absolute pressure

   c) Differential pressure

   d) Velocity pressure

   e) Static pressure.

4. In a pitot static velocity measurement, the differential head produced is 10kPa. Calculate the rate of flow when the fluid is water (ρ of water = 1000 kg/m^3).

5. Define absolute and kinematic viscosity. Mention their units in both cgs and MKS units.

6. Describe a method to measure liquid density.

GROUP – C

(Long Answer Type Questions)

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

7. a) Draw and explain the functional block diagram of a smart intelligent transmitter.

   b) Describe the different features of transmitter.

   c) Explain with a neat sketch the principle of operations of force – balance transmitter. 5 + 4 + 6

8. a) Explain the working principle of a capillary viscometer.

b) The absolute viscosity of fluid under test is 100 centipoises. The density of the fluid is $0{\cdot}75\ gm/cm^2$.

Calculate the following :

(i) Fluidity in " *rhe*"

(ii) Kinematic viscosity in 'stokes'

(iii) Relative viscosity in centipoises (let water at 20°C absolute viscosity 1·002 CP)

(iv) Absolute viscosity in 'Pa S'. 7 + 8

9. a) Describe an optical pyrometer for measurement of temperature of a distant object. Discuss the effects of

(i) emissivity of the target source

(ii) absorbing media.

b) A thermocouple at room temperature 30°C is dipped suddenly into a bath having water at 100°C. It takes 30 seconds to reach 96·5°C. Find the time required to reach a temperature of 98°C. 8 + 7

10. a) Describe a flapper-nozzle system. Draw its characteristic curve. What is meant by 'throttling range' ?

    b) A well type manometer has its capillary diameter to well diameter ratio as 1 : 20. It is required to measure a pressure differential of 1 pascal. What should be the approximate height of the mercury column in the capillary ? 8 + 7

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

    a) Ionization gauge

    b) Optical pyrometer

    c) Pneumatic transmitter

    d) Gas density measurement.