



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

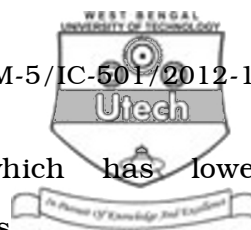
- a) dead weights
- b) measuring process pressure
- c) producing a high pressure
- d) calibrating a pressure instrument.

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 H₂O
 - 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. $3 \times 5 = 15$

2. In a two wire RTD (*pt* 100) temperature measuring arrangement if α (resistance temperature coefficient) is $0.385\ \Omega/^{\circ}\text{C}$ and resistance of each lead wire is $5\ \Omega$ 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. $3 \times 15 = 45$

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 0.75 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.
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