

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 × 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

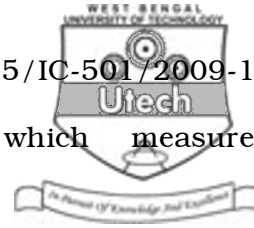
- a) one-way communication
- b) two-way communication
- c) both (a) & (b)
- d) none of these.

- vi) For gray body hemispherical spectral emittance 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  $9 \times 10^{-5} \Omega\text{-cm}$  at  $-50^\circ \text{C}$ . The value of specified resistance at  $50^\circ \text{C}$  would be nearer to

- a)  $0.9 \times 10^{-6} \Omega\text{-cm}$
- b)  $0.8 \times 10^{-5} \Omega\text{-cm}$
- c)  $1.05 \times 10^{-5} \Omega\text{-cm}$
- d)  $0.9 \times 10^{-4} \Omega\text{-cm}$ .

x) A thermocouple arrangement is to be used to measure temperatures in the range  $700\text{-}800^\circ \text{C}$ . 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)  $35 \text{ kg/cm}^2$
- b)  $3.5 \text{ kg/cm}^2$
- c)  $0.35 \text{ kg/cm}^2$
- d)  $2.58 \text{ kg/cm}^2$ .

**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  $5 \text{ kg/cm}^2$  and differential pressure is  $0.4 \text{ kg/cm}^2$  and the pressure is gradually incremented from  $2 \text{ kg/cm}^2$  to  $7 \text{ kg/cm}^2$  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 ?

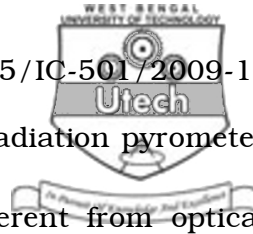
2 + 5 + 7 + 1

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  $2.0 \text{ kg/cm}^2$ , 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 differ 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.

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