Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B. TECH (ICE)/SEM-5/IC-501/2010-11

2010-11
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 answer for any *ten* of the following : $10 \times 1 = 10$

i) The filled system thermometer with Hg is classified as

a) Class II b) Class I

c) Class III d) Class V.

ii) The sensitivity is greater for :

a) K-type b) J-type

c) T-type d) E-type.

iii) The temperature measuring range of Class- A RTD is, :

a) – 200°C to 650°C b) 0 to 700°C

c) – 100°C to 850°C d) – 200°C to 850°C.

iv) Lower pressure can be measured by

a) diaphragm b) bellows

c) bourdon tube d) strain gauge.

v) The pressure indicated in a pressure gauge mounted on an empty tank placed 100 metre above from sea level is

a) 10 kg/cm^2 b) 1 kg/cm^2

c) 0·1 kg/cm^2 d) 0.

vi) In a rotating cylinder viscometer, the viscosity is determining the

a) torque

b) speed

c) both torque and speed

d) velocity.

vii) Well type manometers have

a) poor accuracy

b) good accuracy

c) low sensitivity

d) high sensitivity in compared to U-tube manometer having all dimensions are same.

viii) To average the temperature of a large vessel, the ..... combination of thermocouples are used

a) series b) parallel

c) series-parallel d) fail safe.

ix) Radiation pyrometers are used in the temperature range of

a) 0 – 500°C b) 500°C to 1000°C

c) – 250°C to 500°C d) 1200°C to 2500°C.

x) Standard current signal of the pressure industry is

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

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

xi) Smart Transmitters allow

a) one-way communication

b) two-way communication

c) both way communication

d) none of these.

xii) The pH can be define as

a) Negative $\log_{10}$ (Reciprocal of H+ ions concentration)

b) Negative $\log_{10}$ (Reciprocal of He^+ ions concentration)

c) Negative $\log_{10}$ (Reciprocal of HO_2^+ ions concentration)

d) Negative $\log_{10}$ (Reciprocal of O_2^+ ions concentration).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. Draw a neat sketch and explain for essential parts of Bourdon tube for pressure measurement.

3. Define the following terms : 1 + 1 + 1 + 1 + 1

a) Gauge pressure- a) Gauge pressure b) Absolute pressure c) Differential Pressure d) Velocity pressure e) Static Pressure. 5

4. In a K-type T/C, the *emf* developed by the T/C is 41·15 mv (with cold junction is at ambient temperature). The ambient temperature is 34°C. What is the temperature of hot junction ? [Given $E_{30\text{-}0}$ = 1·203 mv and $E_{40\text{-}0}$ = 1·611 mv, $E_{1030\text{-}0}$ = 42·432 mv. $E_{1040\text{-}0}$ = 42·817mv] 5

5. Discuss the selection criteria of RTD material. What is lead compesation for RTD ? 3 + 2

6. Explain the V-I characteristics of a Thermister. 5

GROUP – C

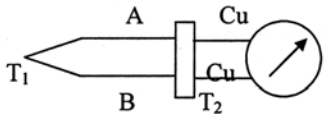
(Long Answer Type Questions)

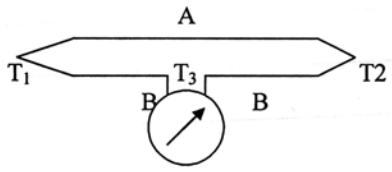
Answer any *three* of the following.

$3 \times 15 = 45$

7. What is meant by cold junction compensation of a Thermocouple ? Describe the microprocessor based temperature compensation technique for a thermocouple. A T/C made of conductors A & B is connected to a milli-

voltmeter (PMMC type) using 'Cu' leads as shown in fig. below. In either case find out the reading of millivoltmeter.





3 + 8 + 4

8. Discuss how the bulb size is determined in filled system thermometer. Discuss different compensation techniques adopted for variation of ambient temperature. 5 + 10

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

10. a) What is thermocouple ?

    b) Describe the various type of thermocouple according to their material used.

    c) Describe the working principal of thermocouple type pyrometer. 2 + 6 + 7

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

a) Ionization Gauge.

b) Pneumatic transmitter.

c) Optical pyrometer.

d) Semiconductor temperature sensors.

e) Motion – balance transmitter.