



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH(EIE)(N) / SEM-5 / EI-501 / 2012-13

2012

INDUSTRIAL INSTRUMENTATION

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) In radiation level detector which radiation is generally used ?
 - a) Beta particles
 - b) Alpha particles
 - c) Gamma rays
 - d) Neutron.
 - ii) Capacitive transducers can be used for measurement of liquid level. The principle of operation used in this case is
 - a) change of capacitance with change of distance between plates
 - b) change of area of plates
 - c) change of dielectric strength
 - d) none of these.



- iii) Reynolds number
- a) decreases with increase in average velocity of liquid
 - b) increases with increase in the absolute viscosity of liquid
 - c) decreases with increase in density of the flowing liquid
 - d) none of these.
- iv) Which of the following temperature sensors has excellent linear characteristics ?
- a) RTD
 - b) Thermocouple
 - c) Silicon-based IC chip.
 - d) Radiation pyrometer.
- v) Positive displacement flowmeter measures the
- a) Volume flow rate
 - b) Mass flow rate
 - c) Velocity of flowing fluid
 - d) All of these.
- vi) To make the rotameter indication to be independent of fluid density
- a) Float density must be twice the fluid density
 - b) Float density must be equal the fluid density
 - c) Float density must be half of the fluid density
 - d) Float density must be thrice the fluid density.



- vii) The cross-sectional area of Bourdon tube is
- a) circular
 - b) rectangular
 - c) elliptical
 - d) none of these.
- viii) One Torr means
- a) one cm of Hg
 - b) one mm Hg
 - c) one atmospheric pressure
 - d) one kilopascal.
- ix) K-type T/C is made of
- a) Chromel-Alumel
 - b) Chromel-Constantan
 - c) Cu-Constantan
 - d) Pt-Pt rhodium.
- x) The gauge pressure is equal to
- a) absolute pressure – atmospheric pressure
 - b) atmospheric pressure – absolute pressure
 - c) absolute pressure
 - d) atmospheric pressure.
- xi) PT-100 RTD means temperature bulb having
- a) $100\ \Omega$ at 0°C
 - b) $100\ \Omega$ at 100°C
 - c) $0\ \Omega$ at 0°C
 - d) $0\ \Omega$ at 100°C .



- xii) The application of a dead weight tester is
- a) to measure process pressure
 - b) to measure very high pressure
 - c) to calibrate pressure instrument
 - d) to test dead weight.

GROUP – B

(Short Answer Type Questions)

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

2. a) What do you mean by Cold Junction Compensation technique ?
- b) Name any two types of thermocouples and mention their individual temperature range. $2 + 1 + 2$
3. a) An Orifice meter ($C_d = 0.61$) measuring the flow rate of air in a pipe is substituted by a venturimeter ($C_d = 0.98$) having throat diameter same as that of the orifice. For the same flow rate find the ratio of pressure drop for the venturimeter to the orifice plate.
- b) What is Reynolds Number ?
- c) What is the reason behind the permanent pressure drop across an orifice meter ? $2 + 1 + 2$
4. Describe with a proper diagram how differential pressure can be measured using Bellows Element. $2 + 3$



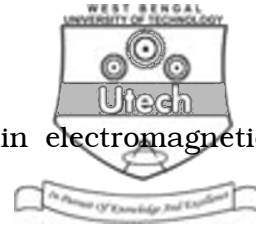
5. a) What are the selection criteria of manometric fluid ?
b) Why is corrugation useful for metallic diaphragm ? 3 + 2
6. a) Explain why three-wire RTD connection is advantageous over two-wire RTD connection.
b) What do you mean by thermowell ? 3 + 2

GROUP – C

(Long Answer Type Questions)

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

7. a) What is the basis of classification of hazardous area ?
Give examples of Class I, II and III classification of hazardous area.
b) What is the difference between IP code for the enclosures and NEMA enclosures ?
c) What is meant by intrinsic safety ? What is the advantage of using intrinsically safe circuit ?
d) What does IP65 signify ? What is its NEMA equivalent ?
- 4 + 3 + 5 + 3
8. a) What are the different types of ultrasonic flowmeters ?
Show that ultrasonic flow measurement system by measuring frequency shift is independent of sonic velocity.



- b) Why *dc* excitation is not permitted in electromagnetic flowmeter ?
- c) Where are coriolis flowmeter used ? Describe its operation. 2 + 6 + 2 + 1 + 4
9. a) What are the main source of error in 2-wire RTD for temperature measurement ? Describe a 4-wire RTD for temperature measurement. 2 + 5
- b) What factor governs the choice of material for an RTD ? What is the self-heating error and how is it corrected in resistance thermometer ? 2 + 2 + 1
- c) Name three RTD materials and draw the graph for resistance *versus* temperature variation for these materials. 1 + 2
10. a) Describe the level measurement technique of high pressure tank using sight glass or gauge glass with suitable diagram. 5
- b) Explain how displacer can be used for level measurement. 5
- c) Describe with a neat sketch the construction and working of a radiation level indicator. 5
11. a) Explain the working principle of a Ring balance type manometer. 5
- b) What are the important characteristics of the elastic members ? 2



- c) What are the errors occurred during the pressure measurement by a C-type Bourdon tube and how can they be removed ? 4
- d) What precautions are to be taken while calibrating with a dead-weight tester ? 4
12. Write short notes on any *three* of the following : 3 × 5
- a) McLeod gauge with schematic diagram
 - b) Optical pyrometer with schematic diagram
 - c) Capacitive type level detector
 - d) Positive displacement flowmeter
 - e) Open Channel flowmeter.

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