INDUSTRIAL INSTRUMENTATION
(AEIE 3103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) For the measurement of flow the cheapest device is
(a) Venturi (b) Dall flow tube
(c) Flow nozzle (d) Pitot static tube.

(ii) Pirani gauge is useful for measurement of pressure
(a) between 10^{-1} to 10^{-3} mm of Hg
(b) between 10^{-1} to 10^{-6} mm of Hg
(c) between 10^{-1} to 10^{-9} mm of Hg
(d) between 10^{-1} to 10^{-12} mm of Hg.

(iii) One Torr is defined as
(a) one mm Hg (b) one inch Hg
(c) one atmosphere (d) one kilo Pascal.

(iv) In 4 – 20 mA signal that corresponds to 0 – 100% scale, what would be the current at 50%?
(a) 4 mA (b) 8 mA (c) 12 mA (d) 16 mA.

(v) A flow with a high Reynolds number indicates that the flow is
(a) laminar (b) erratic (c) turbulent (d) transitional.

(vi) Which of the following represents the lower and upper range of standard industrial pressures?
(a) 0 – 10 psi (b) 0 – 15 psi
(c) 3 – 10 psi (d) 3 – 15 psi.

(vii) Which type of Thermocouple has the maximum sensitivity?
(a) T-type (b) K-Type (c) E-Type (d) J-Type.

(viii) Which of the following types of Bourdon Tube shape has a small tip travel and necessitates amplification?
(a) C-Type (b) Spiral
(c) Helical Shape (d) All of These.

(ix) Vaccum pressure is
(a) equal to gauge pressure
(b) equal to atmospheric pressure
(c) lower than atmospheric pressure
(d) equal to absolute pressure.

(x) A flow meter that measures flow rates which are independent of density is
(a) Rotameter (b) Electromagnetic flow meter
(c) Venturimeter (d) Orifice meter.

Group – B

2. (a) Explain with neat sketches, the construction and working of McLeod gauge, both non-linear and linear types.

(b) How is dead weight tester used for pressure instrument calibration?

6 + 6 = 12

3. (a) Define absolute pressure.

(b) Explain the advantage of inclined manometer with a suitable diagram.

(c) Describe the operating principle of C-type Bourdon Tube with schematic diagram.

(d) What errors may occur during the pressure measurement by a C-type Bourdon Tube?

1 + 2 + 5 + 4 = 12

Group – C

4. (a) How volumetric flow rate (Q) is measured by a Rotameter?

(b) What modification should be done if the liquid is denser than float?

(c) What are the different tapping positions for fluid flow line in orifice flow meters?

(d) What is vena-contracta position?

5 + 2 + 3 + 2 = 12

5. (a) Describe with neat sketch, the working principle of electromagnetic flowmeter. What are its advantages and disadvantages?

(b) Define Reynolds number. State its significance in determining flow characteristics.

(4 + 2) + (3 + 3) = 12

Group – D

6. (a) Explain the principle of level measurement using ultrasonic technology. List three advantages of ultrasonic measurement systems.

(b) Describe boiler drum level measurement using D/P Transmitter.

(3 + 3) + 6 = 12

7. (a) Explain how displacer can be used for level measurement.

(b) Describe with a neat sketch how to measure interface level between two dissimilar liquids.

6 + 6 = 12

Group – E

8. (a) Describe the operating principle of bimetallic thermometer. Why is lead compensation not required in Thermistor for temperature measurement?

(b) What is meant by cold junction compensation of thermocouple? Describe one technique for cold junction compensation.

(5 + 1) + (3 + 3) = 12

9. (a) Which metal is used widely for RTDs? What is the temperature coefficient of RTD? Compare 3-wire and 4-wire RTDs.

(b) Write shot note on (i) Radiation Pyrometer (ii) Optical Pyrometer.

(1 + 2 + 3) + (3 + 3) = 12