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) Type of orifice plate suitable for measurement of clean fluids flow rate is
(a) Conical edge orifice (b) Concentric orifice
(c) Segmental orifice (d) Eccentric Orifice.

(ii) An electronic level transmitter with a 4-20 mA output is calibrated to range of 10 cm to 100 cm. If the transmitter output is 12 mA then the liquid level is
(a) 55 cm (b) 67.5 cm (c) 75cm (d) 45cm.

(iii) The meter which is suitable for flow totalization is
(a) Turbine meter (b) Venturimeter
(c) Ultrasonic flow meters (d) Orifice plate.

(iv) A fluid flowing with Reynolds number greater than 4000 indicates that the flow is
(a) Laminar (b) Erratic (c) Turbulent (d) Transitional.

(v) Which of the following lists the standard range of pressure signal sued in industry?
(a) 0 – 10 psi (b) 0 – 15 psi (c) 3 – 10 psi (d) 3 – 15 psi.

(vi) Which of the following is not a flow measurement element?
(a) Venturi (b) Rotameter (c) Burdon (d) Pitot Tube.

(vii) Working principle of radiation pyrometer is based on the
(a) Wien's law (b) Kirchoffs law
(c) Stafan-Boltzman law (d) Seeback effect.

(viii) The direct method of measurement of liquid level is
(a) Pressure and force operated method (b) Method using float
(c) Head method (d) Transducer method

(ix) A pitot-static tube measures
(a) Static pressure
(b) Dynamic pressure
(c) Total pressure
(d) Difference between total and static pressure.

(x) K-type T/C is made of
(a) Cu, Constantan
(b) Chromel, Constantan
(c) Pt, Pt rhodium
(d) Chromel, Alumel.

Group – B

2. (a) Draw a labelled sketch of a C-type Bourdon pressure gauge and explain its principle of operation.

(b) Describe with a proper diagram how differential pressure can be measured using Bellows Element.

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

3. (a) Explain the working principle of well type manometer with a net schematic diagram.

(b) Why mercury is mostly used as a manometric fluid?

(c) Describe low pressure measurement technique by Pirani gauge.

(3 + 2) + 3 + 4 = 12

Group – C

4. (a) Derive the fluid flow equation from Bernoulli's equation.

(b) Classify the types of orifice plate and draw the diagram for the same.

(c) Define discharge coefficient.

5 + (3 + 3) + 1 = 12

5. (a) Define Newtonian fluids.

(b) Draw the schematic diagram for Pitot tube and describe it's working.

(c) Describe the working of electromagnetic flow-meter with schematic diagram. Find the expression for flow through it.

2 + (2 + 2) + (2 + 2 + 2) = 12

Group – D

6. (a) Explain with schematic diagram, how DP transmitter can be used to measure open tank liquid level.

(b) Describe the method of conductive liquid level measurement using capacitive sensor with schematic diagram. Draw the block diagram for signal conditioning unit for this system.

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

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

(b) Explain the FMCW method of radar type level measurement system.

(3 + 3) + 6 = 12

Group – E

8. (a) State the laws of thermocouples.

(b) With suitable schematic diagram, explain any method of cold junction compensation of thermocouple.

(c) What is thermowell?

5 + (3 + 3) + 1 = 12

9. (a) State two differences between Pt_{100} and Pt_{200}.

(b) Draw the schematic diagram for the optical pyrometer and describe it's working.

(c) What is meant by intrinsic safety?

4 + (3 + 3) + 2 = 12

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