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CS/B.TECH/ICE(NEW)/SEM-6/IC-603/2013

2013

INDUSTRIAL INSTRUMENTATION – II

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 the following : $10 \times 1 = 10$

   i) Which of the flow meter has the lowest pressure drop for a given range of flow ?

   a) Orifice meter b) Venturimeter

   c) Flow nozzle d) Rotameter.

   ii) Air purge system level indicator can be used for measuring the level of

   a) corrosive liquids b) abrasive liquids

   c) both (a) and (b) d) none of these.

iii) Which precaution is taken in capacitive level measurement when the liquid is conductive ?

a) Insulator b) Electric wires

c) Metal tank d) None of these.

iv) A flow transmitter with a 4-20 mA output has a calibrated range of 1·0 – 6·0 m^3/sec. What flow rate is indicated by a current of 12 mA ?

a) 7·0 m^3/sec b) 3·5 m^3/sec

c) 4·5 m^3/sec d) 3·6 m^3/sec.

v) Which transducer is used with orifice flow meter ?

a) Manometer b) Strain gauge

c) Bourdon gauge d) None of these.

vi) Positive displacement flow meter is

a) a variable area flow meter

b) a quantity flow meter

c) differential flow meter

d) none of these.

vii) Float material for weight flow rate measurement in rotameter is

a) stainless steel b) plasmet

c) glass d) phosphor bronze.

viii) In radiation level detector, when the tank is full with liquid, the amount of radiation received at the detector is

a) directly proportional to the amount of liquid between the radiation source & the detector

b) inversely proportional to the amount of liquid between the radiation source & the detector

c) independent of the amount of liquid

d) none of these.

ix) In case of capacitance level measurement, capacitance will ..... with the increase in level.

a) increase

b) decrease

c) remain same

d) no relation between level & capacitance.

x) Which of the following is not a selection parameter for a barrier ?

a) Ignition temperature b) Rated voltage

c) Polarity d) Internal resistance.

GROUP – B

(Short Answer Type Questions)

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

2. Define the terms 'turn down' and 'rangeability' in case of a flow meter. What is mass flow-rate ? Explain the terms 'discharge co-efficient' and 'β-ratio' in case of a flow meter. 2 + 1 + 2

3. What is a disc type encoder used as a digital transducer ? Discuss its resolution capability. 3 + 2

4. With the help of a neat sketch, explain how a torque-tube displacer assembly is used for the measurement of liquid level in a tank.

5. Explain the principle of radiation level detector. Discuss its merits and demerits. 3 + 2

6. What are the different tapping positions for fluid flow line in orifice flowmeter ? What is venacontracta position ? Can a tapping be made at that position with varying flow rate ?

2 + 2 + 1

7. Explain with neat diagrams, the working principle of electromagnetic flowmeter.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) What is Coriolis force ? How is it used in mass flow rate measurement ?

   b) What is the working principle of Pitot tube ? Derive the expression of volumetric flow rate of Pitot tube.

   c) A Pitot tube with coefficient of 0·95 is used to measure the velocity of air in a pipe. The measured differential pressure is 400 mm. What is the velocity of air in a pipe ? 6 + 6 + 3

9. a) Explain the working principle of transit time ultrasonic flowmeter.

   b) What is Doppler effect ? How is it used in flow measurement ?

   c) Given a beat frequency (Δf)of 100 cps for an ultrasonic flowmeter, the angle (θ) between the transmitters and receivers is 45° and the sound path (d) is 120 mm. Calculate the fluid velocity in m/sec. 6 + 6 + 3

10. a) Explain the principle of operation of a Rotameter with diagram.

    b) How the viscosity and fluid density affect the volumetric flow rate measurement through Rotameter ? Explain how to minimize it.

    c) If the Rotameter taper angle is 2°, float volume and density are 20 cc and 5 gm/cc respectively, fluid density is 0·9 gm/cc, intel diameter is 3·57 cm and a flow rate of 60 cc/sec is obtained with an indication of 3 cm in height. Calculate the value of drug coefficient and metering ratio. 6 + 4 + 5

11. a) What is different classification for method of analysis ?

    b) What is the sensitivity of a thermal conductivity gas analyser ?

    c) Describe the Zirconia Oxygen analyser method.

    5 + 5 + 5

12. a) Write short notes on grounding and shielding in EMC.

    b) What is the basis of classification of hazardous area ? Give examples of different types of hazardous area.

    c) What is meant by intrinsically safe barrier ? How does it provide safety ? 6 + 4 + 2 + 3

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

a) Vortex flowmeter

b) Hot-wire anemometer

c) Microwave level switches

d) Optical level detectors

e) EMI/EMC

f) Flow nozzles.

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