Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(ICE-OLD)/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 × 1 = 10

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

a) Orifice meter b) Venturi meter

c) Flow Nozzle d) Rotameter.

ii) The throat section of venturi generally is made of

a) stainless steel b) plastic materials

c) copper d) none of these.

iii) The float position in the Rotameter can be essentially linear with

a) pressure b) flow rate

c) area d) all of these.

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

a) corrosive liquids b) abrasive liquids

c) both of these d) none of these.

v) 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.

vi) Flow material for weight flow rate measurement in rotameter is

a) Stainless steel b) Plasmet

c) Glass d) Phosphor bronze.

vii) 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 .

viii) Which transducer is used with orifice flowmeter ?

a) Manometer b) Strain gauge

c) Bourdon gauge d) None of these.

ix) Positive displacement flow meters are

a) variable area flow meter

b) quantity flow meter

c) differential flow meter

d) none of these.

x) Square root extractor is not required for

a) venturimeter

b) electromagnetic flowmeter

c) rotameter

d) TC.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

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

2 + 1 + 2

3. What is Reynolds number ? How does it come in for flow calculation ? How the viscosity and fluid density affect the volumetric flow rate measurement through rotameter ? Explain to minimize it. 2 + 1 + 1 + 1

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 vena contracta position ? Can a tapping be made at that position with varying flow rate ?

2 + 2 + 1

GROUP – C
(Long Answer Type Questions)

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

7. 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 co-efficient 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

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

   b) What is Doppler Effect ? How is it used in flow measurment ?

c) What is the working principle of an Electromagnetic flowmeter ?

d) 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.

4 + 4 + 4 + 3

9. a) Distinguish between float type and displacer type level gauges.

b) How is the measurement range limited with float type system ?

c) Can the capacitive method of level gauging be used in conducting type liquids as well ? If yes, describe the principle of operation. Show, how this is done for conducting type liquids.

d) How probe can be designed for capacitive type level measurement purpose ? 3 + 2 + 4 + 4 + 2

10. 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

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

a) Vortex flowmeter

b) Hot-wire anemometer

c) Microwave level switches

d) Cross-correlation flowmeter

e) Optical level detectors.