Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ICE)/SEM-6/IC-603/2011

2011

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 any *ten* of the following : $10 \times 1 = 10$

   i) A flowmeter whose output is independent of fluid density is

      a) turbine flowmeter

      b) electromagnetic flowmeter

      c) venturimeter

      d) orifice meter.

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

      a) Orifice meter b) Venturimeter

      c) Flow nozzle d) Rotameter.

iii) Shielding is used to block

a) electrostatic field b) magnetic field

c) EMI d) all of these.

iv) In float type liquid level measurement, the density of the float

a) > liquid

b) < liquid

c) = liquid

d) does not depend on liquid density.

v) The Zener barrier is used in

a) flame proof instrument

b) intrinsically safe instrument

c) electromagnetic instrument

d) none of these.

vi) Hot wire anemometers are used for measurement of

a) gases

b) solids

c) solid containing liquid

d) liquid containing solid.

vii) In area flowmeter

a) restriction area is kept constant

b) differential head is held constant

c) volume is kept constant

d) surface area is kept constant.

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

a) increase

b) decrease

c) remain same

d) no relation between level and capacitance.

ix) To avoid ground loop, we can use

a) single point ground b) ground bus

c) ground plane d) none of these.

x) Laser based level measurement depends on

a) accurate direction of the time it takes for a light pulse to travel to the process material surface and back

b) the velocity of light

c) *X*-ray radiation

d) none of these.

xi) The type excitation to produce magnetic field used in the electromagnetic flowmeter is

a) A.C. b) D.C.

c) pulsating D.C. d) A.C. and D.C.

xii) The basic principle of float type of level sensor is

a) force balance b) motion balance

c) energy balance d) none of these.

GROUP – B
(Short Answer Type Questions)

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

2. Explain the principle of operation of typical vortex flowmeter and show output is linearly related with vortex frequency. Discuss its ranges and features. 3 + 2

3. How many types of flow profiles are in a flowing fluid ? Define each of them with proper diagram. How are they related with Reynolds number ? 1 + 3 + 1

4. a) What do you mean by intrinsic safety ?

b) How Zener barrier is used for intrinsic safety ? 1 + 4

5. Describe with neat sketch the construction and working of optical method of level measurement.

6. What is the basic difference between float type and displacer type level indicators ? Write down the disadvantages of direct level measurement system. 3 + 2

GROUP – C

(Long Answer Type Questions)

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

7. a) What is Coriolis acceleration ? How is it used in mass flow rate measurement ? Discuss its merits and demerits.

   b) With neat diagram, explain the working of turbine flow-meter and point out its limitations. 2 + 5 + 2 + 6

8. a) Describe with a neat sketch, the working principle of float type level measurement method.

   b) What are the different types of thermal level sensor ? Where is it used ? Explain the method of level measurement using one of them.

   c) A two-wire pressure transmitter of range $0 - 4 kg/cm^2$ is used for measuring the level of water in a tank. The space above the level is filled with water vapour of $2\ kg/cm^2$ pressure. Calculate the output current of the transmitter if the water level in the tank is 5 metre when pressure transmitter is installed,

      i) just at the bottom level of the tank

      ii) 5 metre below the bottom of the tank

      iii) 5 metre above the bottom of the tank. 5 + 5 + 5

9. a) Explain with neat diagrams, the working of electromagnetic flowmeter. Write down its advantages.

   b) What are the different direct methods available for liquid level measurement ?

   c) What is NEMA ? 4 + 2 + 6 + 3

10. a) Prove that the scale of rotameter is linearly related with volumetric flow rate.

   b) Explain with neat diagram the working principle of venturi tube.

   c) A transit time based ultrasonic flowmeter is used to measure velocity of a gas flowing in a pipe. In such a case it was found that the zero flow transit time $T_o = 1{\cdot}2$ ms whereas when there was flow the differential transit time was 115 ms. The angle between the flow and the transmitter and receiver unit is 45°. Find the velocity of the gas. sound velocity in that gas if the operating temperature is 500 m/sec. 5 + 5 + 5

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

a) Shielding

b) Ultrasonic level sensor

c) Radiation type mass flowmeter

d) Doppler flowmeter

e) Microwave level switches

f) Flow nozzles.