



Name :

Roll No. :

Invigilator's Signature :

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 ?

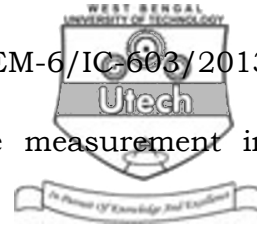
- | | |
|------------------|-----------------|
| a) Orifice meter | b) Venturimeter |
| c) Flow nozzle | d) Rotameter. |

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 m³/sec. What flow rate is indicated by a current of 12 mA ?
- a) 7.0 m³/sec b) 3.5 m³/sec
- c) 4.5 m³/sec d) 3.6 m³/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.

$2 + 1 + 2$

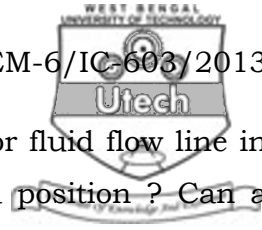
3. What is a disc type encoder used as a digital transducer ?
Discuss its resolution capability.

$3 + 2$

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

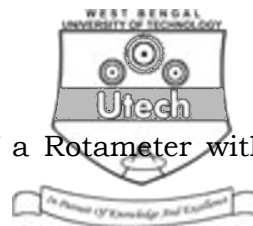
(Long Answer Type Questions)

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 ?
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

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, inlet 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 drag 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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