



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

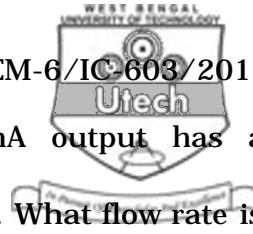
- a) corrosive liquids b) abrasive liquids
- c) both of these d) none of these.

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 $1.0 - 6.0 \text{ m}^3/\text{sec}$. What flow rate is indicated by a current of 12 mA ?

- a) $7.0 \text{ m}^3/\text{sec}$ b) $3.5 \text{ m}^3/\text{sec}$
- c) $4.5 \text{ m}^3/\text{sec}$ d) $3.6 \text{ m}^3/\text{sec}$.

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

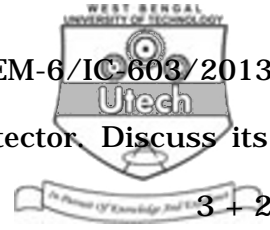
2. Define the terms 'turn down' and 'rangeability' in case of a flowmeter. What is mass flow rate ? Explain the terms 'discharge co-efficient' and ' β -ratio' in case of a flowmeter.

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.
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 ?

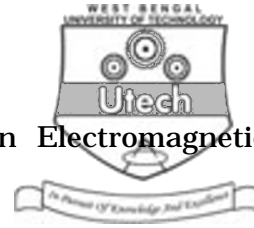
2 + 2 + 1

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 ?
8. a) Explain the working principle of transit time ultrasonic flowmeter.
- b) What is Doppler Effect ? How is it used in flow measurement ?

6 + 6 + 3



- 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.

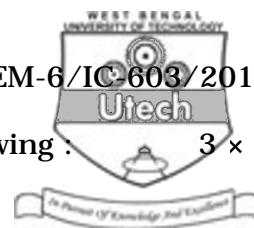
4 + 4 + 4 + 3

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.

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