



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(ICE)/SEM-6/IC-603/2012**

**2012**

**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) Determination of the massflow rate of a gas using an orifice plate is based on the following measurements
  - a) DP across the orifice and Static pressure of the gas
  - b) DP across the orifice and absolute temperature of the gas
  - c) DP across the orifice, Static pressure of the gas and its absolute temperature
  - d) DP across the orifice and viscosity of the gas.



ii) Reynolds number

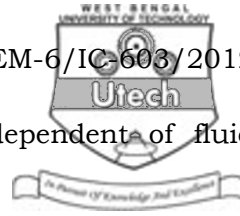
- a) increase with increase in average velocity of liquid
- b) decrease with increase in absolute viscosity of liquid
- c) increase with increase in density of flowing liquid
- d) all of these.

iii) Square root extractor is not required for

- a) Venturimeter
- b) Electromagnetic flowmeter
- c) Rotameter
- d) TC.

iv) Which flowmeter that works on the constant pressure drop principle ?

- a) Venturimeter                      b) Rotameter
- c) Turbine flowmeter              d) Vortex flowmeter.



v) A flow meter whose output is independent of fluid density is

- a) Turbine flowmeter
- b) Electromagnetic flowmeter
- c) Venturimeter
- d) Orifice meter.

vi) In case of Pilot tube

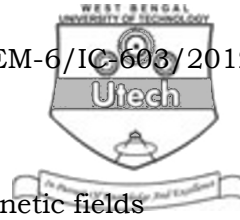
- a) velocity head is converted into pressure head
- b) pressure head is converted into velocity head
- c) pressure head is converted into datum head
- d) none of these.

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

- |                    |                     |
|--------------------|---------------------|
| a) Stainless steel | b) Plasmeter        |
| 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 and the detector
  - b) inversely proportional to the amount of liquid between the radiation source and the detector
  - c) independent of the amount of liquid
  - d) none of these.
- ix) The Zener barrier is used in
- a) flame proof instrument
  - b) intrinsically safe instrument
  - c) electromagnetic instrument
  - d) none of these.
- x) 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 & capacitance



- xi) Shielding is used to block
- a) electrostatic field      b) magnetic fields
  - c) EMI      d) all of these.
- xii) IP and NEMA are used for
- a) specifying the regulated power supply
  - b) defining the protection level of the devices
  - c) designing integrated circuits
  - d) defining the protection level of enclosures.

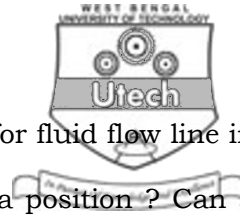
### GROUP – B

#### ( Short Answer Type Questions )

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

2. What is Reynolds number ? How does it come in for flow calculation ? How Laminar and turbulent flows are related to Reynold's number ?
3. a) What is working principle of Pitot Tube ? Derive the expression of volumetric flow rate of Pitot Tube.
- b) A Pitot Tube with coefficient of 0.95 is used to measure the velocity of air in a pipe. The measure differential pressure is 400 mm. What is the velocity of air in a pipe ?

3 + 2



4. What are the difference tapping positions for fluid flow line in orifice flow meter ? What is Venacontracta position ? Can a tapping be made at that position with varying flowrate ?
5. Explain the working principle of radiation level detector.
6. What do you mean by intrinsic safety ? How is zener barrier used for intrinsic safety ?

1 + 4

### GROUP – C

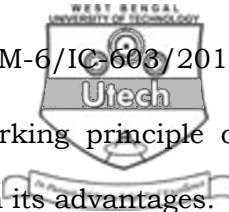
#### ( Long Answer Type Questions )

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

7. a) What is principle of hot-wire anemometer ? Explain the two types of hot-wire anemometer.  
b) Describe with net sketches the working principle of a laser Doppler anemometer (LDA).  $( 3 + 7 ) + 5$
8. a) Explain the working principle of transit time ultrasonic flow meter.  
b) What is Doppler Effect ? How is it used in flow measurement ?

In an ultrasonic flowmeter, the beat frequency is 805 cps, the angle (  $\theta$  ) between the transmitters and receivers is  $45^\circ$ , and the sound path is 120 mm.

Calculate the fluid velocity in m/sec.  $( 6 + 6 ) + 3$



9. a) Explain with neat diagrams, the working principle of electromagnetic flowmeter. Write down its advantages.
- b) What are the different direct methods available for liquid level measurement ?
- c) What is the basic differences between float type and displacer type level indicators ?  $(4 + 2) + 6 + 3$
10. a) What is the difference between IP code for the enclosures & NEMA equivalent ?
- b) What is grounding ? What is ground plane ? Find the relationship between the voltages developed in the ground plane and change in the current in the ground plane. How is this voltage reduced ?  $4 + (2 + 2 + 2 + 2 + 3)$
11. Write short notes on any *three* of the following :  $3 \times 5$ 
  - a) Vortex Flowmeter
  - b) Shielding
  - c) Capacitive Level Detector
  - d) Flow nozzles
  - e) Target Flowmeter.

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