

2 MARKS & QUESTION- ANSWERS
VI semester
EI 336- Industrial Instrumentation -II
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UNIT 1

1) Define Viscosity.

It is a measure of fluidity of the system. Many fluids undergo continuous deformation with the application of shearing stress.

2) Define Newtonian fluids

If the force flow relation is linear then the fluid is Newtonian .

3) Define Non Newtonian fluids

If the force flow relation is non linear then the fluid is Newtonian .

4) Define Kinematic Viscosity.

Ratio of absolute viscosity to the density of the fluid.

$$V = \mu \text{ cm}^2 / \zeta \text{ sec}$$

5) Define Specific Viscosity.

Ratio of absolute viscosity of the fluid to the absolute viscosity of a standard fluid at the same temperature.

$$\mu_s = \mu / \mu_h$$

6) Define Relative Viscosity.

Ratio of absolute viscosity of the fluid at a given temperature to the absolute viscosity of a standard fluid at 20°C.

7) Define Viscosity index

It is an empirical number that indicates the effect of change of temperature on viscosity if a fluid.

8) Define fluidity.

It is the reciprocal of viscosity. Its unit is 1/ poise.

9) Define Humidity.

It is basically moisture content in air or it is the quantity of water vapour retained by gas.

10) Define Absolute Humidity.

Weight of water vapour in unit weight of gas.

$$H = W_r / W_g$$

11) Define Specific Humidity.

It is weight of vapors in unit weight of mixture.

12) Define Relative Humidity.

This is the ratio of moisture content of gas to maximum moisture content of the gas at that temperature.

13) Define dew point.

This is the saturation temperature of the mixture at the corresponding vapour pressure.

14) Define various units of Humidity.

Vppm = parts per million / volume.

G/ kg = weight concentration

Relative humidity = in %

Dew point in °C.

15) Define Hygrometer.

Used to measure the moisture content in air. It also used to measure humidity.

16) What is the basic principle of Hygrometer.

It consist of mechanical device measuring the dimension change of humidity sensitive materials like animal hair, animal membrane , paper etc.

17) Define Moisture.

Defined as the amount of water absorbed by solids or liquids.

18) What are the various methods of measurement of moisture.

Based on the weight of the particle

Based on the resistance, capacitance,

19) How will you find the % moisture present in the substances.

$$\% Mp = (W_{wet} - W_{dry}) / W_{wet} * 100$$

20) What are the different types of viscometer?

Say bolt viscometer

Rotameter type

Consistency meters.

21) What is Psychrometer?

Psychrometer is a device that uses the bulb thermometers to measure humidity. It is also used in air conditioning systems for maintaining humidity.

22) What are the different types of hygrometer?

Hair hygrometers

Wire electrode hygrometers

Electrolysis type hygrometers

Resistive type

Capacitive type

Microwave reflector

23) Explain the principle of saybolt viscometer.

As the viscosity of the fluid varies , the flow rate and hence time taken to drain the fluid through the capillary tube varies. The time indicates the viscosity and is denoted by say bolt number.

24) What is meant by consistency?

General term for viscosity and more often used in connection with Non-Newtonian fluids.

25) Explain the principle of oscillating type consistency meters.

When the inner cylinder is given an axial sinusoidal motion through a mechanical drive rod, the fluid in the annular space gets a shearing force and the motion in the inner cylinder well to transmitted the magnitude of this transmission will depend on the consistency of fluid.

UNIT 2

26) What are the units of velocity?

Feet per second (fsp)

Feet per minute (fpm)

Meters per second (mps)

27) Define Bernoulli equation.

In a given flow system, there is a relationship between pressure, fluid velocity, and elevation at any two points .

28) define Reynolds number.

Combination of density, viscosity of the fluid to a dimension describing length and the average fluid velocity.

29) Define rational expansion factor.

It is the ratio of compressible flow to the incompressible flow

30) What are the different types of orifice?

Concentric orifice

Eccentric

Segmental

Quadrant edge

31) define Concentric orifice?

It has a circular hole in the middle and is installed in the pipe line with the hole concentric to the pipe. Its thickness depends upon pipe line size.

32) define eccentric.

It is installed in with the bore tangential to the upper surface of the pipe, it is used where the liquid contains a relatively high % of dissolved gases.

33) define segmental

its hole diameter is 98% of pipe diameter. It is installed with a curved section of the opening coincident with the lower surface of the pipe.

34) define quadrant

edges is rounded to form a quarter circle. used for the flow of heavy crudes and slurry and viscous flows.

35) What are the advantages of using venturi tube as a restriction element?

More suitable for slurry

Accurate

Calibrated easily

36) define pitot tube.

It is an obstruction type primary element, used for fluid velocity measurement. Differential pressure across these taps is proportional to the velocity of the fluid.

37) What are the disadvantages of pitot tube?

They can become plugged with sediment and that the pressure difference sensed may not be large enough to give the desired accuracy for the flow rate under consideration.

38) What are the advantages of pitot tube?

No pressure loss

Economical

Some types can be easily removed from the pipe.

39) define stagnation point.

Fluid approaching the object starts losing its velocity till directly in front of the body where the velocity is zero. This point is known as stagnation point.

40) define dall tube

It is an obstruction type primary element, used for fluid flow measurement. It produces large differential pressure with low pressure loss.

41) mention the advantages of dall tube.

Slow head loss

Short lying length

Available numerous material of construction

42) mention the disadvantages of dall tube

pressure difference is sensitive to up stream disturbances

more straight pipe is required in the approach pipe line

- 43) what are sealing liquids commonly used?
Chloro naphthalene, dibutyl phthalate, chlorinated oils.
- 44) what are the different tapping of orifice?
Flange tape
Pipe tape
Venacontracta tape
- 45) give the details about flange tape.
Located one inch either side of orifice plate.
Pressure difference is an integral part of the orifice.
- 46) give the details about pipe tape.
Located pipe diameter from the orifice.
Only the permanent pressure difference across the orifice is utilized.
- 47) give the details about vena contracta tape.
Down stream pressure tap is located variable distance from the orifice.
Pressure difference is maximum for the given flow.
- 48) List the advantages of the orifice plate
used in wide range of pipe sizes
used with pressure differential device.
Available in many materials
- 49) List the disadvantages of the orifice plate
high permanent pressure loss
reduces the use in slurry services
accuracy depends on the care during installation.
It has the square root characteristics.

UNIT3

- 50) What are the different types of positive displacement meters?
Reciprocating piston type
Rotating vane type
Nutating disk type
Lobed impeller type
Oscillating piston type
- 51) List the advantages of reciprocating piston type
high accuracy
its construction material is not limited.
- 52) List the disadvantages of reciprocating piston type
high cost
subject to leakage
problems created by dirty particle
high maintenance cost
restricted to moderate flow rates
- 53) What are the major three methods of flow meters?
Area flow meter
Mass flow meter & Quantity meters

- 54) What are the different types of thermal flow meters?
 Heat transfer flow meters
 Hot wire flow meters
- 55) Name the different types of weighing methods
 semiconductor feed belt weighing (Batch weighing)
 continuous conveyor scale
 radio active transmission gauge
 volumetric solid methods
- 56) Write any two points of calibration of flow meter
 (i) wet meter- manometer which is calibrated with mercury
 (ii) dry meter- manometer which is calibrated with mercury
- 57) Explain the principle of turbine flow meter
 when the liquid enter through inlet, due to the inflow, shaft rotates which cuts the magnetic pickup, and produces the voltage which is proportional to inflow of water.
- 58) What are the different types of mass flow meter?
 Angular momentum type
 Liquid bridge
 Calorimeter type
- 59) list the disadvantages of heat transfer flow meter
 heat is directly placed in the fluid stream and easily damaged by corrosion
 large input power is required
- 60) List the advantages of turbine flow meter
 good accuracy
 excellent repeatability
 low pressure drop & easy to maintain
 good pressure & temperature range
 compensation of viscosity variation
- 61) List the disadvantages of turbine flow meter
 high cost
 limited use for slurry application
- 62) List the advantages of rotary vane type
 no pressure loss
 high temperature & pressure rating
 good accuracy
 available numerous construction material
- 63) List the disadvantages of rotary vane type
 high cost
 accuracy decreases in increase of flow
- 64) List the advantages of lobed impellor type
 increase accuracy at higher flow rate
 leakage is decreased
 can be used for corrosive solids
 good capacity range
- 65) List the disadvantages of lobed impellor type
 cost high & require frequent maintenance

- 66) List the disadvantages of glass Rotameter
 subject to breakage
 It must mounted vertically
 It limited to low temperature
 Less accuracy
 If pressure is greater than 35 kg/cm^3 tube get damage
- 67) list the advantage of oscillating piston type
 good accuracy
 can be easily applied to automatic liquid batching system
 good repeatability
 moderate cost
- 68) list the disadvantage of oscillating piston type
 available in small size
 suitable for clean fluids
- 69) what is the principle of densitometer
 float density less than the fluid density, level increases float moves up, resistance connected float varies, so output varies. Voltage output is proportional to the density of the fluid.
- 70) list the advantages of nutating disk type.
 Less cost
 Good accuracy
 High temperature & pressure ratings
- 71) list the disadvantages of nutating disk type
 heavy
 accuracy decreases in increase flow rate
- 72) what is Rotameter?
 It is an example of variable area flow meter. When fluid enters lopped moves from the bottom to top. Distance is proportional to the flow rate.
- 73) Explain the principle of calorimeter flow meter
 consist of two coil type resistance thermometer, difference of temperature between the thermometer is maintained constant.
- 74) List some example of inferential flow meter.
 Turbine flow meters
 Target flow meters
 Ultrasonic flow meters

UNIT 4

- 75) Explain Faraday's law .
 whenever a conductor cuts the magnetic field, an emf induced is equal to the rate at which the magnetic lines of force changes.
- 76) list the advantages of electromagnetic flow meter?
 It can handle slurries & corrosive fluids
 It has low pressure drop
 It can be used as bi-directional meter
 Available in large pipe size & capacities
- 77) list the disadvantages of electromagnetic flow meter?
 Expensive , Heavy and large size and Explosion

78) what are the different types of ultrasonic flow meters

time difference type

Doppler flow meter

79) Explain the principle of vortex flow meter

it is based on vortex shedding which occurs when a gas or liquid flows around a non stream lined objects. When fluid flows pass an obstacle, boundary layers of slow moving fluid are formed along the outer surface of the obstacle and the flow is unable to follow contours of the obstacle of its downstream side.

80) What are the different methods of solid flow measurement?

Direct weighing system

Pneumatic method

Leakage flow technique

81) What are the advantages of solid flow measurement?

It is used for flow measurement upto 100 tonnes/ hr

Accuracy is ± 0.5 to ± 0.75 of full scale deflection

82) What are the disadvantages of solid flow measurement?

For variation in size a correction factor is to be added.

83) list the applications of solid flow measurements

used in chemical & fertilizer industry

used in paper industry

mining & associated industry for sand, rock, cement, lime etc

food processing unit.

84) explain the principle of hot wire anemometer

It is used for unsteady flow of gasses. Because of constant voltage wire gets heated. Heat loss changes due to change in viscosity of fluid.

85) Write any guide lines for the selection of flow meters?

In order to cover reverse flow, pulsating flow, response time and so on

Extreme applications such as corrosive, non conductive liquid with large solid content the list will probably consist of a single meter.

86) explain the principle of leakage flow technique to find the solid flow rate measurement

electrode is used as the capacitance detector. When a material flows this leakage field changes and the capacitance increases. This increased capacitance detected at an interval depends on flow rate.

87) Rotameter is called variable area meter. Why?

The distance between the float and tapered glass varies. So area is also varying. So it named as variable area flow meter.

88) what are the advantages of using X- ray system?

It measures thickness with out contact with the material.

Well suited to measure thickness of sheet in rapid motion like rolling etc.

89) What are the uses of β -rays?

Used for thin metal sheets or foils, paper, rubber & plastics

90) What are the draw backs of using DC excitation in Electromagnetic flow meter?

Used for materials of low conductivity & flowing at slow speed.

DC amplifiers have many inherent problems
Output is quite small.

91) What are the advantages of using AC excitation in Electromagnetic flow meter?
High amplification can be more reliably, cheaply and easily done.
High speed and high conductivity.

92) What is laminar flow?
Fluid particles move in a smooth fashion and tend to stay in layers. This layer like movement is called laminar flow.

93) What is turbulent flow?
Fluid velocity fast, particles also tends to have movement perpendicular to the over all the direction of flow, which is called turbulent flow.

94) define continuity equation.
It is the one of the most basic equation in flow calculations. It states that over all flow rate in the system is not changing with time.

95) What are the disadvantages of pitot tube?
They can become plugged with sediment and that the pressure difference sensed may not be large enough to give the desired accuracy for the flow rate under consideration.

96) What are the causes of pressure loss?
Due to friction, either with in the fluid or between fluid and boundaries.
Fluid imparting (various fittings) on the objects.

UNIT 5

97) List the direct level measuring methods.
Float type level indicator
Displacer type detector
Sight glass type.

98) List the indirect level measuring methods.
Hydrostatic measurement
Air purge system
Boiler drum system.

99) What are the advantages of sight glass level instrument?
Direct reading is possible.
Special designs are available.
Glass less devices are available in numerous material for corrosion resistance.

100) What are the advantages of displacer level instrument?
High accuracy
Reliable to clean liquids
Mounted internally or externally
Adaptable to liquid interface measurement.

Unit 1

1) Explain the construction and principle of operation of dry bulb Psychrometer with neat sketch

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 250**

2) Explain briefly about moisture measurement of various substances

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 255**

3) Explain the construction and principle of operation of Say bolt Viscometer with neat sketch

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 269**

4) Explain any two types of hygrometers used for Humidity measurement, with neat sketch.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 251**

5) Explain briefly about consistency meter.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 274**

Unit 11

1) Explain the operation of Orifice and venturi tube with neat diagram.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 183**

2) Discuss the installation of head flow meter and piping arrangement for different fluids.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 188**

3) Describe with neat sketch the construction and working of variable head type of flow meter. Also discuss about its adv and disadv.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 176**

4) Write short notes on
flow nozzle
pitot tube.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 190**

5) Discuss the installation and tapping in orifice flow meter.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 188**

Unit 111

1) Explain the principle of operation of any four types of positive displacement type flow meter with neat sketches.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 203**

2) discuss in detail the flow measurement using mass flow meter.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 198**

3)) Describe with neat sketch the construction and working of Turbine flow meter. Also discuss about its adv and disadv.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 205**

4)) Describe with neat sketch the construction and working of Rotameter. Also discuss about its adv and disadv.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; **Patranabis; page- 193**

5) Explain about the calibration of different flow meters.

Ans:PROCESS MEASUREMENT & ANALYSIS; Liptak; page- 127&171

Unit V1

1) Describe with neat sketch the construction and working of Vortex flow meter.

Ans:PROCESS MEASUREMENT & ANALYSIS; Liptak; page- 252

2) Describe with neat sketch the construction and working of different types of Ultrasonic flow meters.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 212

3) Describe with neat sketch the construction and working of Electromagnetic flow meter. Also discuss about its adv and disadv.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 207

4) Describe with neat sketch the construction and working of Target flow meter.

Ans:INDUSTRIAL INSTRUMENTATION & CONTROL; S.K.Singh; page- 170

5) Explain about solid flow measurements.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 225

Unit V

1) discuss electrical methods of level measurement.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 240

2) Discuss ultrasonic methods level measurement

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 246

3) explain how boiler drum level is measured using hydra step system.

Ans:PROCESS MEASUREMENT & ANALYSIS; Liptak; page- 340

4) how liquid level is measured using float and displacer sensor?

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 228

5) Discuss the principle of operation of various schemes of hydrostatic type level measuring system.

Ans:PRINCIPLES OF INDUSTRIAL INSTRUMENTATION; Patranabis; page- 234