Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
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Dr. MAHALINGAM
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Question Bank

Industrial Instrumentation –2

DEPARTMENT OF
ELECTRONICS AND INSTRUMENTATION ENGINEERING

Unit-1

ONE MARK:

1. Gauge glass techniques is a _____ type of method
   (a) Direct
   (b) Indirect
   (c) Electrical
2. Floats are _____ balancing devices
3. Float and tape method is suitable for _____ type of tank
4. Float and shaft method is suitable for _____type of tank
5. The Dip tube used in the magnetic float type level measurement is to withstand the pressure of _____
6. The amount of immersion of displacer in a liquid is same as that of float [True/False]
7. The weight of the displacer should be _____ than that of liquid
8. Displacer type level measurement is highly reliable and have accuracy [True/ False]
9. The force in a liquid at rest is known as _____ pressure
10. Boiler drum level measurement can be done by
    (a) Differential pressure method
    (b) Hydrastep method
    (c) feed forward control method
    (d)All the above
11. Imagine one end of a DPT is connected to a one tank and other end is exposed to atmosphere. The differential pressure is proportional to _____ pressure
12. The electrical methods of level measurements are
    (a) Contact point type
    (b) Conductivity type
    (c) Resistive type
    (d) All the above.
13. For non-conductive liquids,the electrode and the tank wall forms the plate of a parallel plate capacitor with the liquid acting as dielectric [True/ False]
14. Radiation method uses _____ rays
15. Ultrasonic type level measurement works on the principle of _____
16. In the radiation level detector, when the liquid level in the tank raises, the amount of radiation received is
    a)Increases b)Unchanged
    c)Decreased d)None of these
17. 4.Which type of rays are commonly used in radiation level detector?
    a)Gamma rays b)Beta rays
    c)Nuclear radiation d)Alpha rays
18. Which of the following is not an advantage of radiation level detector?
    a)No moving parts b)No physical contact
    c)Suitable for abrasive liquids d)Radiation source holders may be heavy
19. The length of displacer is upto
    a)3 m b) 5 m
    c)8 m d)10 m
20. Float level switches may be designed for

a)Internal mounting b)External mounting
c)Both internal and external mounting d)none of these

21. Which of the following is a direct level measurement method?
    a)Air trap method b)Float level gauge
    c)Diaphragm box method d)Ultrasonic method
22. Boiler drum level measurement is based on
    a)Density b)Differential pressure
    c)Viscosity d)Flowrate
23. The operation of hydra step depends on the difeerence in
    a)Electrical resistivities b)Capacitance
    c)Inductance d)None of these
24. 11.Which of the following is formed between electrode and the vessel in hydra step boiler drum level gauge?
    a)Capacitive cell b)Conductivity cell
    c)Resistivity cell d)All the above
25. In hydra step system, the voltage appearing at the electrode is restricted to
    a)2Vrms b)4 Vrms
    c)8Vrms d)10 Vrms

Answers:

1. (a) direct 2. Motion 3. Open 4. Closed 5. Tank 6. False 7. Heavier 8.True 9. Hydrostatic 10. (d) hydrastep method 11. Water pressure 12. (d) all the above 13. True 14. Gamma 15. SONAR 16. c)Decreased 17. a)Gamma rays18. d)Radiation source holders may be heavy 19. a)3 m 20. c)Both internal and external mounting 21. b)Float level gauge 22. b)Differential pressure 23. a)Electrical resistivities 24 c)Resistivity cell.25. d)10 Vrms

TWO MARKS:

1. Give the principle of direct method and indirect method of liquid level measurement.
   - Direct method which use varying level of liquid as means of obtaining the measurement.
   - Indirect method which use variable that changes with the liquid level to actuate the measuring mechanism.

2. Give the advantages of differential pressure method of level measurement.
   - Any differential pressure indicating device can be used.
   - Most suitable for measuring level in pressurised vessel such as boiler drum, high pressure heater, etc. . . .

3. How is the measurement range limited in float type system?

   As the depth to which the float sinks will depends upon the density of liquid, it is necessary to take account of this designing the system. Inaddition, the area of the float must be sufficiently large due to reduce the error produced by change in depth.

4. What is the limitation in float type system?
   - They are normally limited to moderate pressure.
   - They are tailored to tank geometry.

- Many of the float operated designs have moving parts exposed to the process and cannot be used in dirty or plugging services.

5. What is the similarity between displacer type and float type measurement?
   Switching arrangements and installation consideration are the same for displacer and float switches.

6. What is the major difference of float level switch and displacer level switch measurement?
   The major difference between a float level switch and a displacer level switch is that a float moves with the same surface whereas displacer is partially immersed.
7. What do you mean by level switches?
   - Float switches utilize a float that follow liquid levels and at same point with in its range.
   - Most of the float switches are designed for relatively short travel.

8. What are the limitations of level switches?
   - Internal mounted switches are cheap but the tank has to be shut down for the removal of maintenance.
   - External mount switches are costly.

9. What are the advantages of level measurement using displacer and torque tube?
   - The instrument is rugged and simple in construction and reliable in operation.
   - With the selection of suitable material for float, flat cage and torque tube it is possible to use this instrument over a wide range of pressures.
   -
10. What are the types of electrical method?
    The types of electrical methods are
    - Resistive method
    - Inductive method
    - Capacitive method

11. What is the application of resistive method?
    Measurement of level is done for high conductivity liquids such as city supply water, sewage or sea water.
12. What are the advantages of resistive method?
    - It can be used if the resistivity of liquid is very high.
    - When there is the need of level measurement of large conductive liquid, more and more contact rods can be added with separate signal output for each rod.

13. What are the disadvantages of resistive method?
    - The contact rods are corroding by corrosive liquids.
    - Difficulty when there is saturated vapour above the liquid phase.
    - Any change in conductivity of liquid causes errors.

14. What is the principle of nuclear radiation method?
    It is based on the principle that γ ray or β rays are absorbed differently by varying thickness of an intermediate medium.

15. What are the advantages of nuclear radiation method?
    - There is no physical contact with liquids.
    - They have no moving parts.
    - They have good accuracy and responses.
    - They are useful at very high temperature / pressure.

16. What are the disadvantages of nuclear radiation method?
    - The reading is affected by density change of liquid.
    - Radiation source holders may be heavy.
    - Their cost is relatively high.

17. What is the principle of ultrasonic sensors?

    Ultrasonic level detectors used the principle of reflection of an acoustic wave form a liquid to vapour plane or vice versa.

18. What are the advantages of ultrasonic sensors?
    - Easy to use
    - Inexpensive
    - As it is a digital method, this method is more accurate.

19. What is the application of ultrasonic sensor?

    Liquid phase type is used in storage tanks of oil and chemicals and for aircraft or marine equipment tanks.

20. What are the methods used in liquid level measurement in boiler drum?
    - Differential pressure method
    - Hydra step method

21. What are the disadvantages of differential pressure method?

    As the differential pressure head (h_f and h_v) is a function of density, any temperature and pressure variation in two limbs will cause error.

22. What are the advantages of Hydra step gauge?
    - Reliability is much higher
    - When an electrode fails, it is easy and quick to replace
    - Maintenance costs are significantly reduced
    - More accurate

23. What is the principle of hydra step boiler drum?

    The operation of hydra step depends on these being a difference in the electrical resistive of high purity water and steam at boiler pressures.

Unit-2

One mark:

1. _____ is the ratio of the density of a fluid to the density of the reference fluid.
(a)Density (b)Absolute viscosity **(c)Specific gravity** (d)Relative density
2. What is the range for turbulent flow?
(a)0-2000 (b)2000-4000 **(c)4000-10000** (d)10000 and above
3. Which of the following is related to Gay-Lussac's law?
(a)$P_2T_1=P_1T_2$ (b)$P_2V_2=P_1V_1$ (c)$V_2T_1=T_2V_1$ (d)none of the above
4. Match the following:

i.	Flow nozzle	- (a)Direct indicating type
ii.	Rotameter	- (b)Usable for all types of flow with good accuracy
iii.	Nutating disc	- (c)Cheaper than venturi,more accurate than orifice
iv.	Reciprocating piston	- (d)Common with liquid,less accurate

Ans: 1(c),2(a),3(d),4(b)

5. The two different designs of venturitubes are **short recovery cone type** and **long recovery cone type.**
6. Materials for orifice plates are_____
(a)steel (b)stainless steel (c)Phosphor-bronze **(d)All of the above**
7. The venturi is more accurate than orifice because **less pressure losses.**
8. Units of volumetric flow rates_____
(a)m^3/hr (b)litre/sec (c)gallons/hr **(d)All of the above**
9. Pitot tube is used mainly for _____measurement.
(a)Level (b)Viscosity **(c)Fluid velocity** (d)none
10._____can be used to measure the mass flow rates of foams ,slurries ,mixtures.
(a) Coriolis flowmeters (b)Inertial torque
(c)Gyroscopic effect (d)Bernoulli's principle

11.The flowmeter which is used in LPG,gasoline and other petroleum products industries are_____
(a)Nutating disc (b)Oscillating piston
(c)Lobed impeller **(d)Oval-shaped gear**
12.The accuracy of Nutating disc type flowmeter is_____
(a)±0.2 **(b)±1** (c)±0.5 (d) ±1.5
13._____can be used for gas flow measurement.
(a)Nutating disc **(b)Lobed impeller**
(c)Oval-shaped gear (d)Oscillating piston
14. In tappings, generally the side of the pipe,at an angle between **30^0 and 90^0**
15. In the following equation $Q=W.C_P(T_2-T_1)$ which does C_P represents **specific heat coefficient.**

16. Which of the following is a type of inferential flow meter?
(a)Thermal mass flowmeter **(b)Turbine flow meter**
(c)Area flow meter (d)All the above

17. The very commonly used terms used in connection with flow-meters are **turn-down and rangeability.**
18. The value of orifice is usually between_____
(a)0.1-0.5 (b)0.5-0.8 **(c)0.9-1.0** (d)1.0-2.0

19. In venturitube, the range of operation is_____

(a)Low (b)Very low (c)High **(d)Very high**

20. An impact opening of Pitot tube is about_____diameter.

(a)1-2mm (b)0.6-0.8mm **(c)3-6mm** (d)none

21. Which of the following is relate to Boyle's law?

(a)$P_2V_2=P_1V_1$ (b)$V_2T_1=T_2V_1$ (c)$P_2P_1=T_2T_1$ (d)all the above

22._____defined as vertical distance through which a liquid would fall to attain a given velocity.

(a)Velocity head (b)Pressure head (c)Variable head (d)none

23.Convert:25000 LPH into **6.94×10^{-3}** m^3/sec

24.Convert:1m^3/sec=**3.6×10^6** LPH.

25.Unit of absolute viscosity **Centipoise.**

TWO MARK QUESTIONS:

1.LIST OUT SOME OF THE VARIABLE HEAD TYPE FLOWMETERS?

- Orifice,
- Venturi,
- Flownozzle,
- Pitot tube,
- Dall tube.

2.DEFINE REYNOLDS NUMBER

Reynolds number of fluid is the ratio between the inertial forces moving a fluid to viscous forces resisting the moment.

Re=inertial forces moving a fluid/viscous force resisting the moment

Re=pvd/μ

3.DEFINE COMPRESSIBLE FLUIDS

It is a fluid where the volume and density change when subjected to a change in pressure.Eg:gases and vapours.

4.DEFINE NON COMPRESSIBLE FLUIDS

It is a fluid where there is a very little change in volume when subjected to change in pressure.Eg:liquids.

5.WHAT ARE THE DIFFERENT TYPES OF GAS LAWS?

- Boyles law,
- Charles law,
- Gay lussac law.

6.DEFINE BOYLES LAW

I t is a gas law that states that the absolute pressure of a given quantity of gas varies inversely with its volume provided temperature remains constant.

(ie)P2v2=p1v1.

7.DEFINE CHARLES LAW

It is a gas law that states that the volume of a given quantity of gas varies directly with its absolute temperature provided pressure remains constant.(ie)V2T1=V1T2.

8.DEFINE GAY LUSSAC LAW

It is a gas law that states that the absolute pressure of a given quantity of a gas varies directly with its absolute temperature provided pressure remains constant.(ie)P2T1=P1T2.

9.DEFINE BERNOULLI'S THEOREM:-

It states that in a flowing stream,the sum of velocity head,pressure head and elevation head at one point is equal to their sum at another point in the direction of flow and the loss due to friction between two points.

10.DEFINE VELOCITY HEAD?

It is defined as the vertical distance through which the liquid would fall to attain a given velocity.

11.WHAT ARE THE ASSUMPTIONS MADE IN FIXED RESTRICTION VARIABLE HEAD TYPE FLOW METERS?

- The elevation head is very small or negligible,
- The fluid is incompressible,
- Frictionless,
- Adopting flow.

12.DEFINE β RATIO:-

It is the ratio between the diameter of the restriction and inside diameter of the pipeline.

13.DEFINE CO EFFICIENT OF DISCHARGE:-

It is the ratio between actual flow rate and the theoretical flow rate.

14.DEFINE VENA CONTRACTA POINT:-

The minimum area of the flow channel occurs not at the restriction but at some point slightly down stream known as the vena contracta point.

15. DEFINE STAGNATION POINT:-

When a solid body is held centrally and stationary in a pipeline with a fluid streaming down,due to the presence of the body,the fluid while approaching the object starts losing its velocity is zero.This point is known as stagnation point.At stagnation point kinetic head is converted into stagnation head.

16.WHAT ARE THE ADVANTAGES OF ORIFICE PLATE?

- It is used than the others as it is cheap and it is easily reproducible
- Maintanence is very easy.

17.WHAT ARE THE DISADVANTAGES OF ORIFICE PLATE?

- Permanent pressure loss is high
- It is suitable for low range of flow measurements.

18.WHAT ARE THE ADVANTAGES OF VENTURI FLOW METERS?

- Permanent pressure loss is minimum.
- Good accuracy .
- The range of operation is very high.

19.WHAT ARE THE DISADVANTAGES OF VENTURI FLOW METERS?

- High cost and maintanence is difficult.
- It has high differential pressure**.**

20.WHAT ARE THE ADVANTAGES OF FLOW NOZZLE?

- Low permanent pressure loss
- Shorter length
- Lower weight.

21.WHAT ARE THE ADVANTAGES OF PITOT TUBES?

- It is a simple design and device can be installed easily

- It is suitable for both open and closed loop channels.

22.LIST OUT THE DIFFERENT TYPES OF TECHNIQUES AVAILABLE FOR MEASURING THE FLUID FLOW RATE

- Head type
- Area type
- Mass flow meters
- Positive displacement types
- Electrical types
- Open channel type
- Solid material flowing meter.

23.DEFINE DENSITY

Density is defined as mass per unit volume of a substance.Its unit is kg/m3.

24.WHAT IS THE REYNOLDS NUMBER FOR LAMINAR FLOW AND TURBULENT FLOW?

- Turbulent flow-0 to 2000
- Laminar flow->4000.

25.DEFINE GAUGE PRESSURE

It is the difference between absolute and the local atmospheric pressure.

Unit-3

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One markQUESTIONS

1. Positive displacement flowmeters are
   a) Variable area flowmeters b) quantity flow meters
   c) Steady flow of gases d) variable head type flowmeters
2. Which of the following is not a displacement type flowmeters?
   a) Reciprocating piston type b) turbine
   c) Nutating disc type d) oval gear type
3. Positive displacement type flowmeters have an accuracy of
   a) 0.01% b) 0.1% c) 1% d) 5%
4. Which is used to determine the volume of flow by counting number of strokes?
   a) Nutating type b) reciprocating type
   c) Oval gear type d) helical type
5. In a helical type flowmeters, which is used to generate a pulse proportional to rotational speed?
   a) Magnetic sensors b) optical sensors
   c) Both a and b d) none of these
6. Which is based on the principle of rate of flow and the speed of rotor?
   a) Thermal mass flowmeter b) turbine meter
   c) rotameter d) lobed meter
7. How many rotors does a lobed impeller meter have?
   a) 4 b) 2 c) 3 d) 1

8. Which of the following is not an inferential flowmeter?
   a) Multi jet fan b) turbine
   c) Horizontal propeller d) reciprocating piston
9. Turbine flowmeters are not widely used in
   a) Military application b) petroleum c) textile d) aerospace

10. Rotameter is a
    a) Variable head type flowmeter b) variable area type flowmeter
    c) Positive displacement type flowmeter d) none of these
11. Rotameter is generally used for measurement of
    a) Multi flow b) single flow c) double flow d) all of these
12. Which material is generally preferred in Rotameters?
    a) Silicon b) wood c) copper d) glass
13. Rotameters are applicable for
    a) Tar b) chemical liquors c) high viscous fluid d) low viscous fluid
14. The flow rate of nutating disc type flowmeter ranges from
    a) 1-10gm b) 15-500gpm c) 1000-1500gpm d) none of these
15. Mass flowmeters is based on the principle of
    a) Electromagnetic induction b) piezoelectric effect
    c) Angular momentum d) none of these
16. Mass flowmeter is used for the measurement of
    a) Steady flow of liquids b) steady flow of gases
    c) Unsteady flow of liquids d) unsteady flow of gases
17. Which flowmeter measures the rise in temperature of fluid after the heat is added to it?
    a) Hot wire flowmeter b) heat transfer flowmeter
    c) Both a and b d) none of these
18. Thermal mass flowmeter includes the application of
    a) Combustion in large boiler b) air sampling
    c) Separation of gases d) all of these
19. Coriolis mass flowmeters is used for the measurement of
    a) Mass flowmeters b) process temperature
    c) Density of material d) all of these
20. Positive displacement flowmeters are generally preferred for
    a) Abrasive fluids b) clean fluids
    c) Household water meter d) all of these
21. When there is no flow through rotameter, the float rests at
    a) Top of meter tube b) bottom of meter tube
    c) Middle of meter tube d) any one position
22. In a volume flowmeter, the change in excitation voltage is applied to
    a) bellows b) spring c) elastic filament d) none of these
23. Volumetric flowmeters are generally connected with
    a) Vibrometer b) densitometer c) galvanometer d) none of these
24. Quantity flowmeters are also called as
    a) Cubic meter b) volumetric meter
    c) Acceleration meter d) area meter
25. If the flow rate is calculated by time and volumetric flow measurement then it is called as
    a) Secondary calibration b) primary calibration
    c) Standard calibration d) none of these
26. In a dynamic weighing method, the temperature range is within
    a) 2DEG FH b) 1DEG FH c) 5DEG FH d) 10DEG FH
27. The start of preliminary fill is also called as
    a) Delay time b) peak time c) tare time d) none of these

28. In a weighing cycle operation, the shape of the detector at the inlet of the tank is
    a) Round b) oval c) conical d) helical
29. The total calibrating time in dynamic weighing method is
    a) 50% b) 80% c) 10% d) 15%
30. The need for flowmeter calibration is to avoid
    a) Deposits in meter b) damage c) ageing d) all of these

ANSWERS:

1) B) quantity flowmeters
2) B) turbine
3) B) 0.1%
4) B) reciprocating piston type
5) C) both a and b
6) B) turbine meter
7) C) 2
8) D) reciprocating piston
9) C) textile
10) B) variable area type flowmeters
11) B) single flow
12) D) glass
13) D) low viscous fluids
14) B) 15-500 gpm
15) C) angular momentum
16) D) unsteady flow of gases
17) B) heat transfer flowmeter
18) D) all of these
19) D) all of these
20) A) abrasive fluids
21) B) bottom of metering tube
22) A) bellows
23) B) densitometer
24) B) volumetric meter
25) B) primary calibration
26) B) 1 DEG FH 27) C) tare time
28) C) conical 29) A) 50%
30) D) all of thes

TWO MARKS

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1. **Define flow meter?**

   A flowmeter is a device that meters movement of fluid in a conduit or an open space. These fluids could be water, chemicals, air, stream or solids.

2. **Why positive displacement meters are not recommended for measuring slurries?**

   Positive displacement meters do not require a power supply for their operation and do not require straight upstream and downstream pipe runs for

their installation. The process fluid must be clean. Particles greater than 100 microns in size must be removed by filtering. Positive displacement meters operate with small clearances between their precision-machined parts; wear rapidly destroys their accuracy. For this reason, positive displacement meters are generally not recommended for measuring slurries or abrasive fluids.

3. What is the use of positive displacement meter?

Positive displacement meters are essentially flow quantity meters. They widely used for the applications where the highest degree of accuracy and good repeatability are required.

4. What are the different types of positive displacement meters?

- Reciprocating piston type
- Rotating vane type
- Nutating disk type
- Lobed impeller type
- Oscillating pistontype

5. Write some applications of mutating disc meters?

Nutating disc meter is used extensively for residential water service measurement, but can be used in many industrial applications.

6. List some applications of reciprocating pump meters?

Reciprocating pump meters are available in many forms such as multi piston meters, double acting meters, rotary valves and horizontal slide valves.

7. What is meant by inferential meters?

In these meters, the moving element is a rotor which is generally designed to rotate at a speed proportional to the velocity of flow through the meter . The rotor rotates under the influence of the driving torque which is resisted by the torques due to damping, fluid friction and mechanical friction.

8. What are the different types of thermal flow meters?

- Heat transfer flow meters
- Hot wire flow meters.

9. 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.

10. How the mass flow rate is determined?

The mass flow rate of a fluid is usually determined by simultaneous measurement Of the volume flow rate and the fluid density, although a recently available alternative is the coriolis meter.

11. What is the formula used to find K factor in turbine flow meter?

The 'K' factor (i.e., the number of pulses generated per gallon of flow) is given as

$$K=\frac{T_k f}{Q}$$

Where, K = Pulses per volume unit. T_k = Time constant in min.

Q = Volumetric flow rate in gpm F = Frequency in HZ

The turbine flow meters provide very accurate flow measurement over wide flow range.

12. List some main applications of cylinder and piston type meter.

The cylinder and piston type variable area flow meter often used for

measuringflow of fuel oils, tar, chemical liquors and other such high viscosity fluids. Its operating principle is similar to rotameter.

13. Wirte any two general approaches for measurement of mass flow rate?

1. One involves the use of some type of volume flow meter, some means of density measurement and some type of simple computer to compute mass flow rate.
2. The other, more basic approach is to find flow metering concepts that are inherently sensitive to mass flow rate.

14. What is the use of tuning fork configuration in Coriolis mass flow meter?

The mechanical "tuning fork" configuration minimizes the vibratory force into the frame.

15. What are the applications of thermal mass flow meter?

Thermal flow meters are very popular for the measurement of unsteady flow of gases, and can be used to measure flow rate in terms of mass, which is very desirable feature, especially on gas service.

16. What are the characteristics of area flow meter?

- It has linear scale as the volume of flow through an area meter is essentiallyproportional to the area.
- These are accurate to within ± 2% of the maximum reading.
- It can be easily installed.
- Very small size area meters are obtained.

17. What are the applications of rotameter?

- It can be used to measure flow rates of corrosive fluids.
- Particularly useful to measure low flow rates.

18. What is the difference between constant-current and constant-temperature anemometers?

Constant-current anemometers do not have a feedback system. Temperature is simply proportional to flow rate. They are less popular because their zero-flow reading is not stable, temperature and velocity response is slow and temperature compensation is limited.

Constant-temperature anemometers are popular because of their high- frequency response, low electronic noise level, immunity from sensor burnout when airflow suddenly, compatibility with hot-film sensors, and their applicability to liquid or gas flows.

19. Why does a flowmeter need calibration?

The reasons for a flowmeter falling out of calibration are many and varied but not limited to:

Deposits in the flowmeter

Minerals, oils, solvents and other foreign matter can have a dramatic impact on yourmeters performance.

Aging

Internal parts of any mechanical object will eventually fail or break; many times the bearings are the cause.

Damage

A flow meter that has received a substantial impact or has been dropped can change the performance output of a flowmeter.

Improper

Installation:

Many times, a flowmeter is put out of calibration simply because it was installed improperly. By not following the manufacturer's specifications, you can break the meter instantly.

20. The reamed holes in the walls of the cylinder equally spaced in cylinder and piston type area meter why?

- The holes are spaced helically around the cylinder in rows. so that the variationin area for various heights of the piston is continuous.
- By properly spacing the holes, the calibration of the instrument for flow rate is made linear.

Unit-4

One mark

1.Electromagnetic flow meter is based on the principle of _____

2.In electromagnetic flow meters _____ acts as the conductor.

3.Find the odd one out of the following

a)DC excitation b)50 Hz dc excitation c)Pulsed dc excitation d)50 Hz ac excitation

4. How many types of ultrasonic flow meters are there?

a)2 b)3 c)4 d)5

5. A vortex flowmeter is typically made of _____ stainless steel.

6. In electromagnetic flowmeters,the amount of voltage is proportional to the __

7.Short circuiting in magmeter can be avoided by protecting the flow tube bore by a)neoprene b)line of glass c)both a and b d)none of the above

8. Swirlmeters are digital device which has moving parts. Say true or false ?

9.Classify the types of vortex flow meters ?

10 . _____ is a device used to measure flow in open channels.

11. Write the faraday's formula.

12. In magnetic flowmeters.the velocity should not be allowed to fall below _____.

13. In electromagnetic flow meter, the flow-dependent voltage is in phase with changing in _____.

a) magnetic field b) electric field c) both d) none of the above

14. In pulsed DC type excitation , AC supply is applied to bridge rectifier through _____.

a) DIAC b) TRIAC c) MOSFET d) None of the above

15. Delay between the two received signals is a measure of the _____ velocity.

16. The source used in the nuclear method of solid flowrate measurement is ___

a) alpha rays b) gamma rays c) UV rays d) IR rays

17. Hydro Ranger Series from milltronics is a good example for _____.

ANSWERS:

1.Faraday’s law of electromagnetic induction
2.Liquid
3.b). 50 Hz dc excitation
4.b).3
5.316
6.Flow rate
7.c)both a and b
8.false
9.swirlmeter , vortex shedding meter , fluidic meter
10.flo-dar
11.E is proportional to VBD
12.4 ft/sec
13.a). magnetic field
14.b). TRIAC
15.fluid
16.b). gamma rays
17.non contact ultra sonic sensors

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TWO MARKS:

1. what are the limitation of Ultrasonic flow meter?

The liquid being measured must be relatively free of entrained gas or solids to minimize signal scattering and absorption.

2.what is the principle of doppler type ultrasonic flow meter?

Doppler effect is used to measure the flow rate in a pipe . One transduser transmits an ultrasonic wave into the flow steam.liquid flowing through the pipe must contain sonically reflective matrials such as solid particles or entrained air bubbles.The movement of these materials alters the frequency shift is measured and used to calculate flow rate.

3.What is the principle of laser doppler anemometer system?

The principle is based on the doppler phenomena in which the frequency of the scattered light from a moving object differs from that of the incident beam by a value proportional to the velocity of the body . The velocity of the particles in the fluid with the incident beam causes a Doppler shift of the scattered light's frequency and produces a photo detector signal directly related to velocity.

4. **What are the advantage of laser doppler anemometer system**?

- Used over a wide range of flow measurement.
- Good precision and high resolution in time
- No pressure loss or flow disturbance.
- measurement of velcity is direct.
- As there is no need of physical object inserted into the flow,the flow is undisturbed by measurement.
- Sensing volume can be very small.
- very high frequency response is possible.

5. What are the disadvantage of laser doppler anemometer system?

- Transparent flow channel is required .
- Need for traces particles in the fluid.
- Cost is high due to complexity of the apparatus.

6 .What are the advantage of vortex shedding flow meter?

Linearity is of the order+-0.5%.
Excellent repeatability of the order +- 0.1%.
Good dynamic response.
Has no moving psrts.
Does not depend on fluid gravity ,viscosity or temperature.
very low pressure loss.

7. what are the applications of nuclear method of solid flowrate measurement?

This method can be used in

- Chemical and fertilizer industries.
- Paper industries for coal, copper, and iron ores.
- concentration associated industries for coal, copper ,etc.
- Building material for sand, rock, cement, lime, etc..

8.selection of flow meter:

- accuracy
- safety
- installation
- cost

9.What is the formula used to find the vortex frequency?

Vortex frequencyf=NsV/W

where,

Ns=strouhal number (constant)
V=fluid velcity
W=width of the shedder facing the flow.

10.How to avoid short circuiting in magmeter?

The flow tube bore is protected by an insulating lining of glass or neoprene which also serves to prevent the short circuiting of emf through the electrodes.It consists of two metal detecting electrodes that are supplied as a separate unit with flanged ends which can be bolted into the main pipe.

UNIT -5

Multiple choice questions and answers:

1._____is the term connected with the amount of water vapour present in air or gas.

a. Moisture b. humidity c. viscosity. d. density

2.The classical method is dry and wet bulb system also known as.

a. psychrometer b. hygrometer c. viscometer d. manometer

3.Another name for hot wire electrode type hygrometer.

a. electrolysis type hygrometer

b. electrical type humidity transducer
c. dew cell
d. electrolytic hygrometer

4. _____are more suitable for continuous recording and control of humidity.
a. electrical type humidity transducer
b. electrolysis type hygrometer
c. thermal drying method
d. none of the above

5_____material absorbs moisture and starts dissociating in electrical type humidity transducer
a. lithium chloride b. calcium chloride c. hygroscopic d. zinc chloride

6. _____meter which measure the temperature of a polished surface when traces of condensation appear on its surface.
a. electrolysis type hygrometer b. commercial dew point
c. capacitance hygrometer d. infrared absorption hygrometer

7. _____is the term used to indicate the amount of water vapour absorbed in Liquid or absorbed by a solid.
a. humidity b. viscosity c. moisture d. none of the above

8. _____law states that at constant temperature the mass of water vapour dissolved in a given volume of liquids is in direct proportion to the partial pressure of water vapour in the sample.
a. Charles'slaw
b. Henrys' law
c. Newton's thirdlaw
d. Pascal'slaw

9. The internal property of a fluid offers resistance flow is known as _____
10. What is the unit of viscosity in SI units?
11.What is the unit of absolute viscosity?
12. $1Ns/m^2$= ___ poise
13.Coefficient of viscosity=
14.Dynamic velocity is defined as the ratio of shear stress to the velocity gradient [True/False]
15. _____ is the reciprocal of fluidity
16._____ = absolute viscosity/density of fluid
17.Non-Newtonian fluids obey the newton's law of viscosity [True/False]
18._____ is the empirical number that indicates the effect of changes of temperature on viscosity of fluid
19.Large viscosity index means _____ sensitivity to temperature [higher/lower]
20.Saybolt viscometer works on the principle of _____
21.To measure viscosity of liquids having viscosities as high as 10000poise, we use _____
22.The presence of water vapour in air or gas is known as_____
24.Humidity measuring instrument is known as _____
25.Psychrometer is also known as _____
26._____ determine atmospheric the humidity by the reading of two thermometers
27.The temperature at which the water vapour starts condensing is called as _____

28.The amount of water absorbed by a solid or a liquid_____

Answers:

1.b.)humidity
2.a.)psychrometer
3. b.)electrical type humidity transducer.
4. a.)electrical type humidity transducer
5.c.)hygroscopic
6. b.)commercial dew point .
7.c.)moisture
8.b.)Henrys' law
9.Viscosity
10.Pascal sec
11.Ns/m^2
12.10
13.ηAV/d
14.True
15.Viscosity
16.Kinematic viscosity
17.False
18.Viscosity index
19.Lower
20.Capillarity
21.Rotameter type viscometer
22.Humidity
23.Hygrometer
24.Hygrometer
25.Dry and Wet bulb Psychrometer
26.Dew point temperature
27.Moisture

TWO MARKS QUESTIONS ANSWERS

1. Define Newtonian fluids
If the force flow relation is linear then the fluid is Newtonian .
It obeys Newton's law of viscosity
T =μ du/dy

2. Define Non Newtonian fluids
If the force flow relation is non linear then the fluid is Newtonian .
Does not obey Newtons law of viscosity
3.Define viscosity
Viscosity can be defined as the internal friction of the fluid and it measurement of the fluidity. Viscosity is inversely proportional to the temperature. Unit of viscosity is poise and pascal.
4. Define Kinematic Viscosity.
Ratio of absolute viscosity to the density of the fluid.
V= μ/r in cm2/ sec
5. Define Specific Viscosity.

Ratio of absolute viscosity of the fluid to the absolute viscosity of a standard fluid at
the same temperature.
μs = μ / μ std

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 and fluidity.

- It is an empirical number that indicates the effect of change of temperature on viscosity if a fluid.
- It is the reciprocal of viscosity. It is unit is 1/ poise.

8. What are the different types of viscometer?

- Say bolt viscometer
- Rotameter type
- Consistency meters.

9. 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.

10.Define coefficient of viscosity ?

It is a force required per unit area to maintain unit difference of velocity between two parallel plates in the fluid.

$$F = AV/d$$

Where

F = force in dynes

= of viscosity of fluid

A = area of plate, V =velocity, d = distance from fixed plate.

11. List out the advantages of rotameter type viscometer ?

This method is used to measure continuously the viscosity of liquids having viscosities as high as 10,000 poise.

The instrument can be installed in the main process stream or in a bypass so that viscosities can be measured under the prevailing temperature and pressure conditions.

12. Define Humidity.

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

13. Define Absolute Humidity.

Weight of water vapour in unit wait of gas.

1. H=Wr / Wg

14.Define Specific Humidity.

It is weight of vapors in unit weight of mixture

SH=mw/md

15. Define Relative Humidity.

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

16. Define various units of Humidity.

Vppm = parts per million / volume.

G/ kg = weight concentration
Relative humidity = in %
Dew point in °C.

17. What is the need for humidty measurement ?

Humidity affects human comforts and many industrial processes as in the case of chemical industries, garment industries, leather industries, pharmatical industries precision equipment manufacturing etc.so humidity measurement is important.

18 List some process industries in which humidity measurement is used ?

- Textile and paper industries
- Electrical industries

19. Define Hygrometer.

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

20. 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.

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

% Mp = (Wwet - Wdry) / Wwet * 100

24. What is dew cell ?

It is an absolute humidity transducer based on a thermal system.The accuracy of this instrument is quite good and the response time is within 3 to 5 min.

25 What are the features of dew cell ?

- The temperature measured can directly give the dew point.
- The balancing of vapour pressure makes the device suitable for vapour pressure measurement.
- The device measures humidity from 15 to 100% and dew point from 30 to 70
- It requires reconditioning with fresh lithium chloride every three to four months.

UNIT-1

1. Explain the principle and operation of electrode type and lithium chloride hygrometers used for humidity measurement with neat sketch.
2. Explain the principle and operation of any two types of hygrometers used for moisture measurement with neat sketch.
3. Explain with neat sketch the operation of wet bulb and dry bulb psychrometer.
4. Write short notes on:
   (i) wood and wood products for moisture measurement.
   (ii) Web type materials for moisture measurement.
5. Explain the principle of operation of Dew point hygrometers
6. Explain the principle of operation of Electrolytic hygrometers for moisture measurement.

UNIT-2

1. Describe with neat sketches, the construction and working principle of the pitot tube.
2. With a neat sketch diagram explain venturi tube.
3. Discuss the installation & tapping in orifice flow meter.
4. Write short notes on:
   (i) Flow nozzle
   (ii) Dall tube
5. Derive an expression for the volumetric flow rate of liquid passing through a restriction.
6. What are the factors to be considered in piping arrangements?
7. Discuss the installation of head flow meter & piping arrangement for different fluids.

UNIT-3

1. Explain the principle of operation of different types of positive displacement type flow meter with neat sketches.
2. Explain the principle of operation of a Rotameter with necessary sketches and equations.
3. Explain the principle of operation of Turbine flow meter
4. Explain the principle of operation of Angular momentum mass flow meter
5. Explain the principle of operation of Coriolis mass flow meters
6. Explain the principle of operation of Thermal mass flow meters
7. Explain the principle of operation of Calibration of flow meters

UNIT-4

1. Explain the theory of operation and construction details of electromagnetic flow meter. Why is it not recommended for gas flow measurement?
2. Illustrate the principle of operation of ultrasonic Doppler flow meter.
3. Explain briefly about vortex shedding flow meter.
4. Explain the principle of operation of Laser doppler anemometer systems
5. Explain the principle of operation of Target flow meter.
6. Explain the principle of operation of Solid flow rate measurement.
7. Explain the principle of operation of calibration of flow meter.

UNIT-5

1. Discuss the electrical methods of level measurement.
2. Discuss the ultrasonic methods of level measurement.
3. Describe with neat sketches, the construction and working principle of the level measurement using displacer and torque tube.
4. Describe the air purge/ bubbler level gauging system and explain with neat sketch.
5. Explain the methods of hydrostatic type of liquid level measurement system.
6. Explain the principle of operation of different types of float type liquid measurement system with neat sketches.
7. Explain the principle of operation of Differential pressure method.
8. Explain the principle of operation of Hydra step systems.