Department of Mechanical Engineering
S_3 Mechanical Engineering
ME1202 - FLUID MECHANICS & MACHINERIES
TWO MARK QUESTIONS

Module –I (Introduction)

1. Define fluid?

A fluid is a substance having a property to flow easily.

Example: liquid, vapour, gas.

2. Define fluid mechanics?

Fluid mechanics is a branch of science which deals with property and behaviour of fluids at rest and in motion.

3.Define fluid statics?

The study of fluids at rest is called fluid statics .

4.Define fluid kinematics?

The study of fluids in motion where pressure forces are not considered is called fluid kinematics.

5.What is the SI unit of density ?

The SI unit of density is kg/m^3.

Example: Density of water is 1000 kg/m^3.

6.Define specific volume?

It is the ratio of volume to the mass of a fluid. It is denoted by υ.Its unit is m^3/kg.

$$\upsilon = \frac{\text{volume of fluid}}{\text{Mass of fluid}}$$

$\upsilon = V/m$ m^3/kg

7. Define specific gravity with respect to density?

It is the ratio of density of a fluid to density of a standard fluid. It is denoted by s.

i.e, $$s = \frac{\text{density of liquid}}{\text{density of water}}$$

$$s = \frac{\text{density of gas}}{\text{density of air}}$$

8.Define viscosity?

It is defined as the resisting property of liquid to its flow corresponding to its adjacent layers.

9. Which one of the following has high viscosity, (i) water or (ii) lubricating oil?

Lubricating oil has high viscosity.

10. Define poise ?

Poise is the other name of unit of viscosity in CGS system which equals dyne-sec/cm^2.

11.Give the classification of fluids?

Classification of fluids are,

(i) Ideal fluid
(ii) Real fluid
(iii) Newtonian fluid
(iv) Non Newtonian fluid
(v) Ideal plastic fluid.

12. What is real fluid?

A fluid which has viscosity is a real fluid. All fluid in practice are real fluids.

13.What is non Newtonian fluid?

A real fluid in which shear stress is not proportional to rate of shear strain.

$\tau \neq \mu . \frac{du}{dy}$

τ = Shear stress μ = viscosity of the fluid

du = change in velocity dy = change in perpendicular distance.

14.What is compressibility?

Compressibility is the property of fluid which undergoes change in volume under various pressure conditions.

15. Define compressible fluid?

A liquid is considered to a compressible fluid only when there is a change in volume of liquid that occurs under large pressure variation .

16. Define compressibility?

It is also defined of reciprocal of bulk modulus of elasticity (k).

i.e, compressibility = 1/k .

k= compressive stress / volumetric strain

17.Define capillarity?

It is the phenomenon of rise or fall of liquid surface relative to out side liquid surface

18.Give the types of gas laws?

The types of gas laws are,

(i) Boyles law

(ii) Charles law

19. Give the equation for capillarity fall in an glass tube.

The equation for the capillarity fall is

$$h = \frac{4\sigma\cos\theta}{\rho g d} \text{ metre.}$$

20. Give some properties of fluid?

Some properties of fluids are density, specific weight, viscosity, surface tension and capillarity

21. Define fluid dynamics?

The study of fluid in motion where pressure forces are considered is called as fluid dynamics.

22. Define density or mass density?

Density is the ratio mass of a fluid to its volume it is denoted by ρ.

ρ = m\v kg/m^3

23. Define specific weight or weight density ?

Specific weight is defined as the ratio of weight of fluid to its volume .

Its unit is N/m^3.

i.e, $w = W/V \quad N/m^3$

24.Define specific gravity with respect to weight density?

It is the ratio of specific weight of fluid to specific weight of a standard fluid .

i.e, $s = \frac{\text{specific weight of liquid}}{\text{specific weight of water}}$ (for liquids)

i.e, $s = \frac{\text{specific weight of gas}}{\text{specific weight of air}}$ (for gasses)

25.Define dynamic viscosity?

The shear stress required to move one layer with unit velocity over another layer at unit distance .It is known as dynamic viscosity .It is denoted as μ

26.Give the other names of dynamic viscosity ?

The other name of dynamic viscosity are

(i) absolute viscosity and

(ii) co efficient of viscosity .

Its unit is Ns/m^2.

27.Give the units of viscosity in (i) MKS (ii) CGS and (iii) SI systems?

The units of viscosity in

(i) MKS system is $kgf\text{-}sec/m^2$.

(ii) CGS system is $dyne\text{-}sec/cm^2$.

(iii) SI system is Ns/m^2.

28. Give equivalent values for poise in SI units and CGS unit system?

Equivalent value in

SI unit, one poise $=1/10\ Ns/m^2$

CGS system, one poise = dyne – sec. / cm^2.

29.What is cause for viscosity?

The causes for the viscosity are

(i) inter molecular force of cohesion and

(ii) moment of molecules being exchanged .

30.Define ideal fluid?

A fluid which is incompressible and has no viscosity is called as an ideal fluid . It is an imaginary fluid .

31. Define Newtonian fluid?

A real fluid in which shear stress is directly proportional to the rate of shear strain.

$\tau = \mu . \frac{du}{dy}$

32. Define ideal plastic fluid ?

A fluid whose shear is more than yield value and its shear stress is directly proportional to shear strain is called as ideal plastic fluid.

33.What is an incompressible fluid?

A liquid is considered to be incompressible only when there is a change in volume of a liquid that occurs under smaller pressure variation.

34.Give some example of surface tension ?

Some examples of surface tension are ,

(i) coins when placed over liquid gently floats and gives a spherical shape
(ii) molten lead particles while descending spherical shape
(iii) falling droplet of rain water gives spherical shape

35. Give some examples of capillarity?

Some examples of capillarity are

1) Rise of shape in tree.
2) Rise of kerosene through wick.

36. Give the equation for capillarity in a glass tube?

The equation for capillarity is $h=4\sigma\cos\theta / wd$

37. Define vapour pressure?

When evaporation takes place within enclosed surface the partial pressure created on the liquid surface by the vapour molecules is called as vapour pressure

38. Define Boyles law?

Boyles law for a given quantity of gas constant temperature pressure is inversely proportional to its volume.

It is denoted as

P 1/v at constant t :pv= a constant
V 1/p at constant t

39.Define Avogadro's law?

Avogadro's law states that equal volume of gases at the same temperature and pressure contains equal number of molecules. It is given by pv=nRT

Where r gas constant
N Avogadro number

40.Define surface tension.

It is defined as the tangential force per unit length acting at right angles on either side of the surface. It is denoted by σ. Its unit is N/m.

41.Give the equation for the effect of surface tension on a liquid droplet.

The equation is given by $P = \frac{4\sigma}{d}$

where P = pressure intensity inside the droplet.
σ = surface tension of liquid.
d = diameter of droplet.

42.Give the equation for effect of surface tension on a hollow bubble.

The equation is $P = 8\sigma/d$

where P = pressure intensity inside the droplet.
σ = surface tension of liquid.
d = diameter of droplet.

43. Give the equation for effect of surface tension on a liquid jet.

The equation is $P = 2\sigma/d$

where P = pressure intensity inside the droplet.
σ = surface tension of liquid. d = diameter of droplet.

44.Define capillarity.

It is defined as the phenomenon of rise or fall of liquid surface relative to outside liquid surface.

45.Define Charles law.

Charles law for a given quantity of gas at constant pressure, the volume varies directly with absolute temperature. $v \alpha T$ at constant P.

46.Give the values for angle of contact for (1) mercury and glass tube (2) water and glass tube.

The values for the angle of contact θ for,
(1)mercury and glass tubes $\theta = 128^{o}$
(2) water and glass tubes $\theta = 0^{o}$

47.What are the causes for viscosity?

The causes for viscosity are,
1.inter molecular force of cohesion and
2. moment of molecules being exchanged.

48.What is an incompressible fluid?

A liquid is considered to be incompressible only when there is a change in volume of a liquid that occurs under smaller pressure variation.

49. Give the equation for capillarity fall in an glass tube.

The equation for the capillarity fall is

$$h = \frac{4\sigma\cos\theta}{\rho g d} \text{ metre.}$$

Module – VI (Positive Displacement Machines)
Reciprocating pump.

1) Define pump?

It is defined as the hydraulic machine in which converts the mechanical energy into hydraulic energy, which is mainly in the form of pressure energy.

2) What is the main parts of reciprocating pump?

1.A cylinder with a piston, Piston rod, connecting rod and a crank.
2.Suction pipe, Delivery pipe.
3.Suction valve and
4.Delivery valve.

3) **What is the slip in reciprocating pump?**

Slip is the difference between the theoretical discharge and actual discharge of the pump.

Slip= Qth-Qact.

4) Why negative slip occures in reciprocating pump?

If actual discharge is more than the theoretical discharge the slip of the pump will be negative. Negative slip occurs only when delivery pipe is short, Suction pipe is long and pump is running at high speed.

5) How will you classify the reciprocating pump?

The reciprocating pump may be classified as,
1.According to the water in contact with one side or both sides of the piston.
2.According to the number of cylinders provided.

Classification according to the contact of water is (1) Single acting (2)Double acting.
According to the number of cylinders provided they are classified as,
1.Single Cylinder pump.
2.Double cylinder pump.
3.Triple cylinder pump.

6) What is single acting pump and double acting pump?

If the water is in contact with one side of the piston the pump is known as single acting pump, On the other hand if the water is in contact with both sides of the piston the pump is called double acting pump.

7) Define indicator diagram?

The indicator diagram for a reciprocating pump is defined as the graph drawn between the pressure head in the cylinder and the distance traveled by the piston from inner dead center for one complete revolution of the crank.

8) Define ideal indicator diagram?

It is defined as the graph between pressure head in the cylinder and stroke length of the crank under ideal condition is known as ideal indicator diagram.

9) What is an air vessel?

An air vessel is a closed chamber containing compressed air in the top portion and liquid at the bottom of the chamber. At the base of the chamber there is an opening through which the liquid may flow into the vessel or out of the vessel.

10) What is the purpose of an air vessel fitted in the pump?

1.To obtain a continuous supply of liquid at a uniform rate.

2.To save a considerable amount of work in overcoming the frictional resistance in the suction and delivery pipes, and

3.To run the pump at a high speed with out separation.

11) What is the work saved by fitting a air vessel in a single acting ,double acting pump?

Work saved by fitting air vessels in a single acting pump is 84.87%,

In a double acting pump the work saved is 39.2%.

12) Define coefficient of discharge of reciprocating pump?

It is defined as the ratio of actual discharge to theoretical discharge of reciprocating pump.

cd=Qa/Qth.

13) Define centrifugal pump?

It is defined as a device, which converts mechanical energy in the hydraulic energy by means of centrifugal force acting in the cylinder.

14) What is priming?

Priming is a process of filling up water in the casing and suction pipe of the centrifugal pump for the removal of air before starting it.

15). What is Discharge through a Reciprocating Pump in Per sec ?

For Single acting

Discharge (Q)=ALN/60

Where

A=Area of the Cyclinder in m^2

L=Length of Stroke in m.

N=Speed of Crank in RPM

For Double acting

Q=2ALN/60

16). What is the Workdone by Reciprocating Pump Per sec.?

Workdone = $\rho gALN(h_s+h_d)/60$ (for single acting)

For Double acting:

Work done= $2\rho gALN(h_s+h_d)/60$

Where

ρ=Density of Water in kg/m^3

A=Area of the Cyclinder in m^2

L=Length of Stroke in m

N=Speed in rpm

h_s,h_d=Suction and Delivery head in m

17). What is the Pressure head due to acceleration in the Suction & Delivery Pipe ?

$h_f=4fl(A/a*\omega r\sin\theta)^2/2gd$

Where

f=Co-efficient of friction. A = Area of piston in m^2. a = Area of pipe in m^2.

ω = Angular speed r = Radius of crank

19). What is the relation between Work done of a Pump and Area of Indicator Diagram ?

Work done by the pump is Proportional to the area of the Indicator diagram.

20). What is the Work done by the Pump per sec due to acceleration and friction in the suction and delivery Pipes ?

For single acting

$$W= \rho gALN(hs+hd+0.67hfs+0.67hfd)/60$$

For Double acting

$$W=2\rho gALN(hs+hd+0.67hfs+0.67hfd)/60$$

Where

hfs, hfd =loss of head due to acceleration in the suction and delivery Pipe.

21). What is the Mean Velocity of Single acting reciprocating pump ?

$$v=A\omega r/3.14a$$

Where

ω =Angular velocity in rad/sec

r =Radius of the crank in m

A and a =Area of cylinder and Pipe in m^2

Module-III (Flow Through Circular Conduits)
VISCOUS FLOW, TURBULENT FLOW& FLOW THROUGH PIPES

1) What do you meant by viscous flow ?

A flow is said to be viscous if the Renold's number is less than 2000 (or) the flows in layers ie. $R_e < 2000$.

2) **What is Hagen poiseuille's formula ?**

$P_1-P_2 / \rho g = h_f = 32 \mu \bar{U} L / \rho g D^2$

The expression is known as Hagen poiseuille formula .

Where

$P_1-P_2 / \rho g$ = Loss of pressure head
$\bar{U}$ = Average velocity
μ = Coefficient of viscosity
D = Diameter of pipe
L = Length of pipe

3) Derive the relation between Umax and $\bar{U}$?

$$Umax / \bar{U} = \tfrac{1}{4} \mu \left(-\frac{\partial p}{\partial x}\right) R^2 / \tfrac{1}{8} \mu \left(-\frac{\partial p}{\partial x}\right) R^2$$

$$Umax / \bar{U} = 2$$

4) Define kinetic energy correction factor?

Kinetic energy factor is defined as the ratio of the kinetic energy of the flow per sec based on actual velocity across a section to the kinetic energy of the flow per sec based on average velocity across the same section. It is denoted by (α).

K. E factor (α) = K.E per sec based on actual velocity / K.E per sec based on Average velocity .

5) Define momentum correction factor : -

It is defined as the ratio of momentum of the flow per sec based on actual velocity to the momentum of the flow per sec based on average velocity across the section . It is denoted by

(β) = Momentum per sec based on actual velocity
Momentum Per sec based on average velocity

6) Give the expression for the loss of head due to friction in viscous flow ?

Loss of head due to friction In viscous flow $f = 16/Re$

Where

f = Coefficient of friction between pipe and fluid
Re = Renolds number

7) Differentiate Laminar & Turbulent Flow : -

Laminar Flow	Turbulent Flow
1) A flow is said to be laminar if Renolds	1) A flow is said to be turbulent if

number is less than 2000 is known as Laminar flow.	Renolds number is greater than 4000 is known as Turbulent flow .
2) Laminar flow is possible only at low velocities and high viscous fluids .	2) Is the flow is possible at both velocities and low viscous fluid .
3) In such type of flow fluid particle moves in laminas or layers gliding smoothly over the adjacent layer .	3) In that type of flow fluid particle move in a zig – zag manner .

8) What is the expression for head loss due to friction in Darcy formula ?

$$h_f = 4fLV^2 / 2gD$$

Where

f = Coefficient of friction in pipe
L = Length of the pipe
D = Diameter of pipe
V = velocity of the fluid

9) **What are the factors influencing the frictional loss in pipe flow ?**

Frictional resistance for the turbulent flow is

i. Proportional to v^n where v varies from 1.5 to 2.0 .
ii. Proportional to the density of fluid .
iii. Proportional to the area of surface in contact .
iv. Independent of pressure .
v. Depend on the nature of the surface in contact .

1**0) What are the factors to the determined when viscous fluid flows through the circular pipe ?**

The factors to the determined as

i. Velocity distribution across the section .
ii. Ratio of maximum velocity to the average velocity .
iii. Shear stress distribution .
iv. Drop of pressure for a given length .

11) Give the equation for average velocity : -

The equation for average velocity is given as

$$\bar{U} = \frac{1}{8} \mu \left(-\frac{\partial p}{\partial x}\right) R^2$$

Where R = Radius of the pipe

12) Give the formula for velocity distribution: -

The formula for velocity distribution is given as

$$U = \frac{1}{4} \mu \left(-\frac{\partial p}{\partial x}\right) \left(R^2 - r^2\right)$$

Where R = Radius of the pipe
r = Radius of the fluid element

13) What do you understand by the terms a) major energy losses , b) minor energy losses

Major energy losses : -

This loss due to friction and it is calculated by Darcy weis bach formula and chezy's formula .

Minor energy losses :-

This is due to

i. Sudden expansion in pipe .
ii. Sudden contraction in pipe .
iii. Bend in pipe .
iv. Due to obstruction in pipe .

14) How will you determine the loss of head due to friction in pipes?

Darcy weis-bach

$$h_f = 4fLV^2 / 2gD$$

Where

h_f = Loss of head due to friction .
f = Coefficient of friction in pipe .
D = Diameter of pipe .
L = Length of the pipe
V = Mean velocity of flow .

Chezy's formula

$$V = C\sqrt{mi}$$

Where

$$i = h_f / l$$

15) Give an expression for loss of head due to sudden enlargement of the pipe :-

$$he = (V_1-V_2)^2 / 2g$$

Where

h_e = Loss of head due to sudden enlargement of pipe .
V_1 = Velocity of flow at section 1-1
V_2 = Velocity of flow at section 2-2

16) Give an expression for loss of head due to sudden contraction : -

$$h_c = 0.5\ V^2/2g$$

Where

h_c = Loss of head due to sudden contraction .
V = Velocity at outlet of pipe.

17) Give an expression for loss of head at the entrance of the pipe : -

$$h_i = 0.5V^2/2g$$

where

h_i = Loss of head at entrance of pipe .
V = Velocity of liquid at inlet and outlet of the pipe .

18) Derive the expression for drop of pressure for a given length of a pipe :-

$$P_1-P_2 = 32\ \mu\bar{U}L / \rho gD^2$$

Where

P_1-P_2 is drop of pressure .

19) Give expression for co efficient of friction in terms of shear stress :-

$$f = 2ï_0 / \rho v^2$$

Where

$ï_0$ = Shear stress
v = volume of pipes
f = coefficient of friction

20) Give an expression for loss of head due to an obstruction in pipe

Loss of head due to an obstruction

$$= V^2 / 2g \left(A / C_c (A-a) - 1 \right)^2$$

Where

A = area of pipe
a = Max area of obstruction
V = Velocity of liquid in pipe
A-a = Area of flow of liquid at section 1-1

21) Define the terms a) Hydraulic gradient line [HGL]
b) Total Energy line [TEL]

a) Hydraulic gradient line :-

Hydraulic gradient line is defined as the line which gives the sum of pressure head and datum head of a flowing fluid in apipe with respect the reference line .

b) Total energy line :-

Total energy line is defined as the line which gives the sum of pressure head , datum head and kinetic head of a flowing fluid in a pipe with respect to some reference line .

22) What is sypon ? where it is used :_

Sypon is along bend pipe which is used to transfer liquid from a reservoir at a higher elevation to another reservoir at a lower level .

Uses of sypon : -

1. To carry water from one reservoir to another reservoir separated by ahill ridge .
2. To empty a channel not provided with any outlet sluice .

23) What is the intensity of pressure rise due to water hammer ?

Water hammer in pipe is given by

$P = \rho LV / t$ = When the valve is closed gradually
$= V \sqrt{KP}$ = when the valve is closed suddenly and pipe is assumed rigid .
$= V \times \sqrt{\rho / 1/K + D/Et}$ = when valve is closed suddenly and pipe is elastic .

24) What is meant by hydraulic mean depth ? or hydraulic radius :-

It is the ratio between area of flow to the wetted perimeter of pipe .

Hydraulic mean depth $m = A / P = \pi / 4\, d_2 / \pi d = d/4$

$m = d/4$

25) What does the pressure rise due to water hammer in pipes depends on?

It depends on

Velocity of flow of water in pipe .
The length of the pipe .
Time taken to close the valve .
Elastic properties of the material of the pipe .

26) What is the condition for maximum power transmitted through a nozzle ?

$hf = H / 3$

It states that power transmitted through nozzle is maximum when loss of head due to friction in pipe is one third of the total head supplied at the inlet of pipe .

27) What are the basic educations to solve the problems in flow through branched pipes?

i. Continuity equation .
ii. Bernoulli's formula .
iii. Darcy weisbach equation .

28) What is Dupuit's equation ?

$$L_1/d_1^5 + L_2/d_2^5 + L_3/d_3^5 = L / d^5$$

Where

L_1, d_1 = Length and diameter of the pipe 1
L_2, d_2 = Length and diameter of the pipe 2
L_3, d_3 = Length and diameter of the pipe 3

Module-II (Fluid Flow Concepts and Basic Equations)

1) Define forced vertex flow? Give example?

It is defined as that type of vertex flow in which some external torque is required to rotate the fluid mass.

Example.

1.A vertical cylinder containing liquid which is rotated about its central axis with a constant angular velocity.

2.Flow of liquid inside the impeller of a centrifugal pump.

2) Define free vertex flow? Give examples?

When no external torque is required to rotate the fluid mass,that type of flow is called free vertex flow.

Example.

1.Flow of liquid through a hole provided at the bottom of a container.

2.A whirlpool in a river.

3) Write the equation of motion for vertex flow?

$dp=\rho(v^2/r)dr-\rho gdz$

This the equation of variation of pressure of a rotating fluid in any plane.

Where

r-Radius of element.

p-Pressure variation.

ρ-density of liquid.

g-Acceleration due to gravity.

4) Write the equation of forced vortex flow?

$Z=(\omega^2r^2)/2g$

Where

Ω-Angular velocity.

r-Radius of parabola.

z-Height of parabola.

g-Acceleration due to gravity.

5) Write the equation of closed cylindrical vessels?

$Z=(\omega^2r^2)/2g$

Volume of air before rotation=Volume of closed vessel-Volume of liquid in vessel.

Volume of air after rotation=Volume of paraboloid formed.

6) What are the forces present in a fluid flow?

Fg-Gravity force

Fp-Pressure force

Fv-Force due to viscosity

Ft-force due to turbulence.

Fc-Force due to compressibility.

7) Give the Euler's equation of motion?

$(dp/\rho)+gdz+vdv=0$

8) What are the assumptions made in deriving Bernouillie's equation?

1.The fluid is ideal
2.The flow is steady.
3.The flow is incompressible.
4.The flow is irrotational.

9) What is bernouillie's equation for real fluid?

$(p_1/\rho g)+(v_1^2/2g)+z_1=(p_2/\rho g)+(v_2^2/2g)+z_2+h_l$
where hl is the loss of energy
(p/ρg)-Pressure energy.
(v2/2g)=Kinetic energy.
z-Datum energy.

10) State the application of Bernouillie's equation ?

It has the application on the following measuring devices.

1.Orifice meter.
2.Venturimeter.
3.Pitot tube.

11) Define venturimeter?

A venturimeter is a device used for measuring the rate of flow of a fluid flowing through a pipe.It consists of three parts,They are short converging part ,and throat a diverging part.

12) Write the expression for rate of flow through venturimeter?

Discharge through venturimeter is given by

$$Q_{actual}=c_d a_1 a_2 (2gh)^{1/2}/(a_1^2-a_2^2)^{1/2}$$

Where
cd-Co-efficient of venturimeter
a1-area of inlet
a2-area of throat.
h-difference in pressure heads at the inlet and at the throat.
g-acceleration due to gravity.

13) What purpose orifice meter is used? Define it?

It is a device used for measuring the rate of flow of a fluid through a pipe.Orificemeter consist of a flat circular plate which has a circular sharp edged hole called orifice meter.

14) State momentum equation and Impulse momentum equation?

The momentum equation states that net force acting on a fluid mass in equal to the change in momentum per second in direction.This is given as

$$F=d(mv)/dt$$

The impulse momentum equation is given by $F.dt=d(mv)$

15) State moment of momentukm equation?

The moment of momentum equation states that the resultant torque acting on a rotating fluid is equal to rate of change of moment of the momentum. Mathematically it is given as.

$T=pq(v_2r_2-v_1r_1)$

16) Define pitot tube and give its working principle?

The pitot tube consist of a glass tube bent at right angles.It is based on the principle that if the velocity of flow at a point becomes zero the pressure there is increased due to conversion of kinetic energy into pressure energy.

17) Derive an equation for the resultant force exerted by a flowing fluid on a pipe bend?

$F_x=PQ(v_1-v_2\cos\leftarrow\lrcorner)+P_1A_2-P_2A_2\cos\leftarrow\lrcorner.$

$F_y=PQ(-v_2\sin\leftarrow\lrcorner)-P_2A_2\sin\leftarrow\lrcorner.$

Resultant force=$(F_x^2+F_y^2)\text{^}^{1/2}$

And the angle made by the resultant force with horizontal direction is given by

18) State Bernouillie's theorem?

It states that in a steady ideal flow of an incompressible fluid the total energy at any point of the fluid is constant. The total energy consists of pressure energy, Kinetic energy and potential energy.

19) Give the expression for actual velocity in pitot tube?

$(v_1)=c_v(2gh)\text{^}^{1/2}$

c_v-Co-efficient of pitot tube.

(v_1)act-Actual velocity.

$(2gh)\text{^}^{1/2}$ -Theoritical velocity.

20) What arrangements should be adopted to find the velocity at any point in a pipe by a pitot tube?

The arrangements to be adopted are (1)Pitot tube along with vertical piezometer tube.(2)Pitot tube connected with piezometer.(3)Pitot tube and vertical piezometer connected with a differential U-tube manometer.

21) What are the types of fluid flows?

The fluid flow is classified as,

(1)Steady and unsteady flow.
(2)Uniform and non-uniform flow.
(3)Laminar and turbulent flow.
(4)Compressible and incompressible flow.
(5)Rotational and irrotational flow.
(6)One,two and three dimention flow.

22) Differentiate steady and unsteady flow?

Steady flow	Unsteady flow.
1.Steady flow is defined as that type of flow in which the fluid characteristics like velocity,pressure etc at a point do not change with time	Unsteady flow is that type of flow in which the velocity.pressure at a point changes with time.
2. $(dv/dt_{)(0,0,0)}=0$	$(dv/dt_{)(0,0,0)}=/0$

23) Differentiate uniform and non-uniform flow?

Uniform flow	Non-uniform flow.
1.It is defined as that type of flow in which the velocity at any given time does not change with respect to space.	It is defined as that type of flow in which the velocity at any given time changes with respect to time.
2.$(dv/dt_{)t=constant}=0$	$(dv/dt)_{t=constant}=/0$

24) Differentiate laminar and turbulent flow?

Laminar flow.	Turbulant flow.
1.Laminar flow is defined as that type of flow in which the fluid particle move along well defined path or streamline and all the streamline are straight and parallel.	It is defined as that type of flow in which the fluid particle moves ina zig-zag way
2.Reynolds number<2000	Reynolds number>4000.

25) Define cmpressible flow?

Compressible flow is that type of flow in which the density of the fluid changes from point to point.(eg)Flow of gasses through orifice nozzle and gas turbine.

26) Define incompressible flow?

Incompressible flow is that type of flow in which the density is constant for the fluid flow.(eg)Subsonic aerodynamics.

27) Define rotational flow?

Rotational flow is that type of flow in which in which the fluid particle flowing along streamlines, also rotate about their own axis.

28) Define irrotational flow?

It is that type of flow in which the fluid particle while flowing along streamlines,do not rotate about their own axis.

29) Define one dimensional flow?

One dimentional flow is that type of flow in which the flow parameter such aas velocity is a function of time and one space co-ordinate only,say X. U=F(x),V=0,w=0.

30) Define two dimensional flow?

It is that type of flow in which the velocity is a function of time and two rectangular space say X and Y.

$u=F_1(X,Y), V=F_2(X,Y)$ and $w=0$.

31) What is three dimentional flow?

A three dimentional flow is that type of flow in which the velocity is a function of time and three mutually perpendicular directions.

$U=F_1(X,Y,X), v=F_2(X,Y,Z), w=F_3(X,Y,Z)$.

U,v,w are velocity components inX,Y,Z direction respectly.

32) What is total acceleration of three dimensional fluid flow?

If a_x, a_y,a_z are the total acceleration in x,y,z directions.

Then $a_x=du/dt=u.(\partial u/\partial x)+v.(\partial u/\partial y)+w.(\partial u/\partial z)+\partial u/\partial t$.

$a_y=dv/dt=u.(\partial v/\partial x)+v.(\partial v/\partial y)+w.(\partial v/\partial z)+\partial v/\partial t$.

$a_z=dw/dt=u.(\partial w/\partial x)+v.(\partial w/\partial y)+w.(\partial w/\partial z)+\partial w/\partial t$

33) Define local acceleration?

It is defined as the rate of increace of velocity with respect to time at a given point in a flow field.

34) Define convective acceleration?

It is defined as the rate of change of velocity due to the change of position of fluid particle in a fluid flow.

35) Define velocity poyential function?

It is defined as a scalar function of space and time such that its negative derivative with respect to any direction gives the fluid velocity in that direction.It is denoted by Φ.

$U= -\partial\Phi/\partial x, v=-\partial\Phi/\partial y, w=-\partial\Phi/\partial z$.

U,v,w are the velocity in x,y,z direction.

36) Mention the properties of potential function?

1.If velocity potential exists,The flow should be irrotational.

2.If velocity potential satisfies the laplace equation,It represents the possible steady incompressible irrotational flow.

37) Define stream function

It is defined as the scalar function of space and time, such that its partial derivative with respect to any direction gives the velocity component at right angles to that direction.It is denoted by

38) Mention the properties of stream function?

1.If stream function exists,itn is a possible case of fluid flow which may be rotational.

2.If stream function satisfies laplace equation, It is a possible case of an irrotational flow.

39) What is equipotential line?

A line along which the velocity potential Φ is constant is called equipotential line.

40) Give the relation between stream function and velocity potential function?

$u=-\partial\Phi/\partial x$ and $v=-\partial\Phi/\partial y$

$u=-\partial\Psi/\partial y$ and $v=-\partial\Psi/\partial x$

$u=-\partial\Phi/\partial x=-\partial\Psi/\partial y$ and $v=-\partial\Phi/\partial y=-\partial\Psi/\partial x$

Hence $\partial\Phi/\partial x=\partial\Psi/\partial y$

$\partial\Phi/\partial y=-\partial\Psi/\partial x$

1.What is flow net?

A grid obtained by drawing a series of equipment lines and steam lines is called a flow net. The flow net is an important tool is analysis two dimensional. irrotational flow problems.

2.What are the types of motion of fluid particle?

i. **Linear translation or pure translation.**
ii. **Linear Deformation.**
iii. **Angular Deformation**
iv. **Rotation.**

3.What are linear translation?

It is defined as the movement of a fluid element in such a way that it moves bodily from one position to represents in new position by a'b'&c'd' are parallel.

4.What is linear deformation?

It is defined as the deformation of a fluid element in linear direction when the element moves the axes of the element in the deformation position and undeformation position are parallel but their lengths changes.

5.Define angular deformation?

It is defined as the average change in the angle contained by two adjacent sides. Let s & s is the change in angle between two adjacent sides of a fluid element . The angular deformation=1/2*($S\theta_1$ +$S\theta_2$).

6.Define rotation of fluid element?

It is defined as the movement of a fluid element in such a way that both of rotate in same direction. It is equal to1/2(∂ v/∂x-∂u/∂y) for a two_dimensional element x, y plane.

$\omega_z=1/2(\partial u/\partial x-\partial u/\partial y)$

$\omega_x=1/2(\partial w/\partial y-\partial v/\partial z)$

$\omega_y=1/2(\partial u/\partial z-\partial w/\partial x)$

7.Define vortex flow mention its types?

Vortex flow is defined as the flow of a fluid along a curved path or the flow Of a rotating mass of fluid is known as votex flow.

i. **Forced vortex flow.**
ii. **Free vortex flow.**

8.Define free vortex flow?

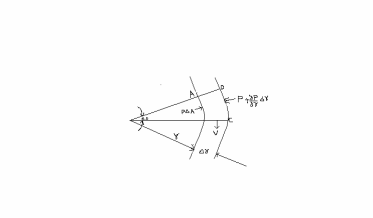
When no external torque is required to rotate the fluid mass that type of flow Is called free vortex flow.

9.Define forced vortex flow?

Forced vortex flow is defined as that type of vortex flow in which some externa Torque is required to rotate the fluid mass.The fluid mass in the type of flow rotates at constant Angular velocity 'w'.The tangential velocity of any fluid particle is given by v=cosr.

10.Give the equation of motion for vortex flow?

Pressure acting PSA on the face AB.
Pressure force(P+ ∂p/∂rΔr)SA on the face cd.
centrifugal force mv^2/r acting in the direction away.



From center O
Now the mass of the element= mass density*volume
$=\rho*\Delta A*\Delta r$
Centrifugal force=$\rho*\Delta A*\Delta r*v^2/r$
Equal the forces in the radial direction we get

$$(P+\partial p/\partial r\Delta r)\Delta A-p\Delta A=p\Delta A\Delta r v^2/r$$

$$\partial p/\partial r\Delta r\Delta A=p\Delta A\Delta r v^2/r$$

Cancelling ΔA,Δr on both sides we get

$$\partial p/\partial r=pv^2/r$$

11.What are the forces present in the fluid flow?

a) **Gravity force (F_g)**
b) **Pressure force (F_p)**
c) **Force due to viscosity(F_v)**
d) **Force due to turbulence(F_t)**
e) **Force due to compressibility(F_o)**

12.What are the assumptions made in the deviation of Bernoulli's eqn?

i **The fluid is ideal**
ie,viscosity is zero
ii **The flow is steady.**
iii **The flow is incompressible.**
iv **The flow is irrotational.**

13.State Bernoulli's theorem?
It states that in a steady,ideal flow of an incompressible fluid,the total energy at any point of the fluid is constant.
It is written as,

$$P/w+v^2/2g+z=\text{constant.}$$

14.What is Venturimeter?Mention its parts?
Venturimeter is a device used for measuring the rate of flow of a fluid flowing through a pipe.
Parts:

i **A short convergant part.**
ii **Throat.**
iii **Divergant part.**

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15.What is Orifice meter?

Orifice meter is a device used for measuring the rate of flow of fluid through a Pipe.It is a cheaper device as compared to Venturimeter.It works on the same principle of Venturimeter.

16.What is pitot tube?

Pitot tube is a device used for measuring the velocity of flow at any point in a pipe Or a channel.

17.What is momentum equation

It is based on the law of conservation of momentum or on the momentum principle

It states that,the net force acting on a fluid mass is equal to the change in momentum of flow per unit time in that direction.

Expression:

The force acting on the fluid mass 'm' is given by

$$F=m*a$$

Where

F=force

m=mass of fluid

a =acc

18.What is impulse momentum equation?

$$F=m*a$$

But $a=dv/dt$

$$\therefore F=m*dv/dt$$

$$=d/dt(mv)$$

$$F=d(mv)/dt$$

$$\therefore F.dt=d(mv)$$

This is implse momentum equation.

Statement:

It states that the impulse of a force F acting ona fluid mass 'm' in a fhort interval of time dt is equal to the change of momentum d(mv) in the direction of force.

19.State momentum of momentum equation?

It states that the resulting torque acting on a rotating fluid is equal to the rate of change of moment of momentum.

20.Give the expression for Bernoulli's equation of real fluid?

$$P_1/\rho g+V_1^2/2g+Z_1=P_2/\rho g+V_2^2/2g+Z_2+h_2$$

Where

$P_1/\rho g$**=Pressure head at section 1**

$V_1^2/2g$**=Velocity head at section 1**

re head at section 2

$V_2^2/2g$**=Velocity head at section 2**

Z_2**=datum head at section 2**

h_L**=loss of energy between sections 1&2**