

MARIA COLLEGE OF ENGINEERING & TECHNOLOGY
ATTOOR
DEPARTMENT OF CIVIL ENGINEERING
MECHANICS OF FLUIDS- (CE 35)
TWO MARK QUESTIONS

UNIT-1

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/m³.

Example: Density of water is 1000 kg/m³.

6. Define specific volume?

It is the ratio of volume to the mass of a fluid. It is denoted by v . Its unit is m³/kg.

Specific volume = volume of fluid / Mass of fluid (m³/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, $s = \text{density of liquid} / \text{density of water}$

8. Define viscosity?

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

9. Define poise ?

Poise is the other name of unit of viscosity in CGS system which equals dyne-sec/cm².

10. 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.

11. What is real fluid?

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

12. What is non Newtonian fluid?

A real fluid in which shear stress is not proportional to rate of shear strain.
 $\mu \cdot (du/dy)$

μ = viscosity of the fluid
du = change in velocity
dy = change in perpendicular distance.

13. What is compressibility?

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

14. 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 .

15. Define compressibility?

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

i.e, compressibility = $1/k$.

k = compressive stress / volumetric strain

16. Define capillarity?

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

17. Give the types of gas laws?

The types of gas laws are,

(i) Boyles law

(ii) Charles law

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

The equation for the capillarity fall is

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

19. Give some properties of fluid?

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

20. Define fluid dynamics?

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

UNIT-II

1. Define density or mass density?

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

$\rho = \frac{m}{V}$ kg/m³

2. Define specific weight or weight density ?

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

Its unit is N/m³.

i.e, $w = \frac{W}{V}$ N/m³

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

4. 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

5. Give the other names of dynamic viscosity ?

The other name of dynamic viscosity are

- (i) absolute viscosity and
- (ii) coefficient of viscosity .

Its unit is Ns/m^2 .

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

The units of viscosity in

- (i) MKS system is kgf-sec/m^2 .
- (ii) CGS system is dyne-sec/cm^2 .
- (iii) SI system is Ns/m^2 .

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

Equivalent value in

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

CGS system, one poise = $\text{dyne - sec. / cm}^2$.

8. What is cause for viscosity?

The causes for the viscosity are

- (i) inter molecular force of cohesion and
- (ii) moment of molecules being exchanged .

9. Define ideal fluid?

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

10. Define Newtonian fluid?

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

$$= \mu \cdot du/dy$$

11. 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.

12. 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.

13. 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

14. Give some examples of capillarity?

Some examples of capillarity are

- 1) Rise of sap in tree.
- 2) Rise of kerosene through wick.

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

The equation for capillarity is $h = \frac{4\sigma \cos \theta}{\rho r}$

16. 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

17. Define Boyles law?

Boyles law for a given quantity of gas constant temperature pressure is inversely

proportional to its volume.

It is denoted as

$P \propto 1/v$ at constant t : $pv = \text{a constant}$

$V \propto 1/p$ at constant

18. 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

19. 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 γ . Its unit is N/m.

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

The equation is $P = \frac{2\gamma}{d}$

where P = pressure intensity inside the droplet.

d = diameter of droplet.

UNIT-1II

1. Define capillarity.

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

2. Define Charles law.

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

3. 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 for,

(1) mercury and glass tubes $\theta = 128^\circ$

(2) water and glass tubes $\theta = 0^\circ$

4. What are the causes for viscosity?

The causes for viscosity are,

1. inter molecular force of cohesion and

2. moment of molecules being exchanged.

5. 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.

7. What do you mean by viscous flow ?

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

8. What is Hagen poiseuille's formula ?

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

The expression is known as Hagen poiseuille formula .

Where $P_1 - P_2 / \rho g =$ Loss of pressure head

$U =$ Average velocity

μ = Coefficient of viscosity
D = Diameter of pipe
L = Length of pipe

9. Derive the relation between U_{max} and U ?

$$U_{max} / U = \frac{1}{4} \mu (-\partial p / \partial x) R^2 / \mu (-\partial p / \partial x) R^2$$
$$U_{max} / U = 2$$

10. 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 $(\alpha) = \text{K.E per sec based on actual velocity} / \text{K.E per sec based on Average velocity}$.

11. 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 average velocity

12. Differentiate Laminar & Turbulent Flow : -

Laminar Flow Turbulent Flow

1) A flow is said to be laminar if Reynolds number is less than 2000 is known as Laminar flow.

1) A flow is said to be turbulent if Reynolds 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 .

13. 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

14. What are the factors influencing the frictional loss in pipe flow ?

Frictional resistance for the turbulent flow is

i. Proportional to vn 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 .

15. What are the factors to be determined when viscous fluid flows through the circular pipe ?

The factors to be 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 .

16. Give the equation for average velocity : -

The equation for average velocity is given as

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

Where R = Radius of the pipe

17. Give the formula for velocity distribution: -

The formula for velocity distribution is given as

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

Where R = Radius of the pipe

r = Radius of the fluid element

18. 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 .

19. How will you determine the loss of head due to friction in pipes?

Darcy weis-bach

$$h_f = \frac{4fLV^2}{2gD}$$

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

$$i = \frac{h_f}{L}$$

20. Give an expression for loss of head due to sudden enlargement of the pipe :-

$$h_e = \frac{(V_1 - V_2)^2}{2g}$$

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

UNIT-IV

1. 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 a pipe with respect to 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 .

2. What is syphon ? where it is used :_

Syphon 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 syphon : -

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

3. What is the intensity of pressure rise due to water hammer ?

Water hammer in pipe is given by

$P = \rho L V / t$ = When the valve is closed gradually

$V K P$ = when the valve is closed suddenly and pipe is assumed rigid .

4. 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 $m = A / P = \pi / 4 d^2 / \pi d = d / 4$

$m = d / 4$

5. 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 .

6. What is the condition for maximum power transmitted through a nozzle ?

$h_f = H / 3$

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 .

7. What are the basic equations to solve the problems in flow through branched pipes?

i. Continuity equation .

ii. Bernoulli's formula .

iii. Darcy Weisbach equation .

8. Define forced vortex flow? Give example?

It is defined as that type of vortex 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.

9. Define free vortex flow? Give examples?

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

Example.

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

2. A whirlpool in a river.

10. Write the equation of motion for vortex flow?

$$dp = -\frac{v^2}{r}dr - g dz$$

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

Where

r-Radius of element.

p-Pressure variation.

g-Acceleration due to gravity.

11. Write the equation of forced vortex flow?

$$Z = \frac{\omega^2 r^2}{2g}$$

r-Radius of parabola.

z-Height of parabola.

g-Acceleration due to gravity.

12. Write the equation of closed cylindrical vessels?

$$Z = \frac{\omega^2 r^2}{2g}$$

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

Volume of air after rotation = Volume of paraboloid formed.

13. 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.

14. Give the Euler's equation of motion?

$$\frac{dp}{\rho} + g dz + v dv = 0$$

15. What are the assumptions made in deriving Bernoulli's equation?

1. The fluid is ideal

2. The flow is steady.

3. The flow is incompressible.

4. The flow is irrotational.

15. State the application of Bernoulli's equation ?

It has the application on the following measuring devices.

1. Orifice meter.

2. Venturimeter.

3. Pitot tube.

16. 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.

17. 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.

18. State momentum equation and Impulse momentum equation?

The momentum equation states that net force acting on a fluid mass is 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 $F \cdot dt = d(mv)$

19. State moment of momentum 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.

$$T = \rho Q (v_2 r_2 - v_1 r_1)$$

20. 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.

UNIT-V

1. State Bernoullie'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.

2. Give the expression for actual velocity in pitot tube?

$$(v_1) = C_v (2gh)^{1/2}$$

C_v = Co-efficient of pitot tube.

$(v_1)_{act}$ - Actual velocity.

$(2gh)^{1/2}$ - Theoretical velocity.

3. 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.

4. 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 dimension flow.

5. Differentiate steady and unsteady flow?

Steady flow Unsteady flow.

1. Steady flow is defined as that type of Unsteady flow is that type of flow in flow in which the fluid characteristics which the velocity, pressure at a point like velocity, pressure etc at a point do changes with time.

not change with time

2. $(dv/dt)(0,0,0)=0$ $(dv/dt)(0,0,0) \neq 0$

6. 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 changes with respect to time. It is defined as that type of flow in which the velocity at any given time changes with respect to space.

7. 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.

8. What is impulse momentum equation?

$$F = m \cdot a$$

This is impulse momentum equation.

Statement:

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

9. 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.

10. 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.

11. Define free vortex flow?

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

12. Define forced vortex flow?

Forced vortex flow is defined as that type of vortex flow in which some external torque is required to rotate the fluid mass. The fluid mass in the type of flow rotates at constant

angular velocity ' ω '. The tangential velocity of any fluid particle is given by $v = \omega r$.

13. 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.

14. Define one dimensional flow?

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

15. 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 .

$$u = F_1(X, Y), V = F_2(X, Y) \text{ and } w = 0.$$

16. What is three dimensional flow?

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

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

U,v,w are velocity components in X,Y,Z direction respectively.

17. 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.

18. 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.

19. 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

20.What is flow net?

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