Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib

Civil Department

Subject - BTCE- 303-18 Fluid Mechanics

Question Bank

UNIT –I DEFINITIONS AND FLUID PROPERTIES

1. Defined the following
   Weight density, specific volume and specific gravity of a fluid?
2. One liter of crude oil weighs 9.6 N. Calculate its Specific weight, density and specific weight.
3. Differentiate between (i) liquid and gases (ii) real and ideal fluid
4. Difference between kinematic and dynamic viscosity? State their units of measurement?
5. Define Newtonian and non -Newtonian fluids?
6. What are the different type's fluids? Explain each type? How are fluids classified? The dynamic viscosity of a liquid is 0.18 centipoises while its kinematic viscosity is 12 centistokes. Find the density of the liquid and the specific gravity of the liquid.
7. Define Surface tension and Capillarity.
8. What do you mean by vacuum pressure?
9. Define Relative or Specific viscosity.
10. Define Compressibility. It is the property by virtue of which fluids undergoes a change in volume under the action of external pressure.
11. What is cohesion and adhesion in fluids?
12. . Calculate the capillary rise in glass tube of 3mm diameter when immersed in mercury, take the surface tension and angle of contact of mercury as 0.52 N/m and 1300 respectively. Also determine the minimum size of the glass tube, if it is immersed in water, given that the surface tension of water is 0.0725 N/m and Capillary rise in tube is not exceed 0.5mm
13. Calculate the capillary effect in glass tube 5mm diameter, when immersed in (1) water and (2) mercury. The surface tension of water and mercury in contact with air are 0.0725 N/m and 0.51 N/m respectively. The angle of contact of mercury of mercury is 130°
14. Define compressibility. Derive an expression for the bulk modulus of elasticity for a perfect I gas, undergoing the isothermal process.
15. Calculate the capillary rise in glass tube of 3mm dia when immersed in mercury take the surface tension and angle of contact of mercury as 0.52N/m and 130° respectively .Also determine the minimum size of the glass tube, if it is immersed in water, given that the surface
    tension of water is 0.0725N/m and the capillary rise in the tube is not to exceed 0.5mm.
16. A 1 .9mm dia tube is inserted in to an unknown liquid whose density is 960 kg/m^3 and it is
    observed that the liquid is rises 5mm in the tube, making a contact angle of 15°. Determine
    the surface tension of the liquid.
17. An oil film of thickness 10mm is used for lubrication between the two square parallel plates of

size 0.9m ×0.9m each, in which the upper plate moves at 2m/s required a force of 100N to maintain this speed. Determine,
1. Dynamic viscosity of oil 2. Kinematic viscosity of oil If the specific gravity of the oil is 0.95

18. f the velocity distribution of over a plate is given by u = (2/3)Y – Y2 in which 'U' is the velocity
in meter per second at a distance 'Y' meter above the plate , determine the shear stress at Y=0 and Y=0.15m the dynamic viscosity of fluid is 8.63 poises.

UNIT-II FLUID STATICS

1. Explain total pressure & center of pressure.
2. State and prove hydrostatic law?
3. A circular plate of 1.20m diameter is place vertically in water so that the center of the plate is 2m below the free surface. Determine the total pressure and depth of center of pressure.
4. State and prove Pascal's law?
5. Define the terms 'buoyancy' and' centre of buoyancy'?
6. What are the conditions of equilibrium of a floating body and a submerged body?
7. Define the terms: Meta centre, centre of buoyancy, meta-centric height, gauge pressure and absolute pressure.
8. Prove total pressure and center of pressure exerted by a statics liquid on plane, inclined and curved surface?
9. Explain the conditions of equilibrium for floating and sub-merged bodies?
10. Show that the centre of pressure lies below the centre of gravity of the vertical surface submerged in a liquid
11. Differentiate between stable, unstable and neutral equilibrium of a floating body.
12. A wooden block of size 6m x 5m x 3m height floats in freshwater. Find the depth of immersion and determine the metacentric height. Specify gravity of wood is 0.70. Find the volume of concrete block placed on the wooden block, so as to completely submerge the wooden block in water. Take specific gravity of concrete as 3.0
13. Explain experimental procedure to determine the metacentric height of a floating vessel.
14.

UNIT -3 FLUID KINEMATICS

1. What is three dimensional flows?
2. Explain the terms

a) Path line b)streak line c) stream line d) stream tube

3. Differentiate steady and unsteady flow?
4. Differentiate uniform and non-uniform flow?
5. Differentiate laminar and turbulent flow?
6. Define compressible flow?
7. Define incompressible flow?
8. Define rotational flow?
9. Define irrotational flow?

10. Define one dimensional flow?
11. Define two dimensional flow?
12. What is total acceleration of three dimensional fluid flows?
13. Define local acceleration and convective acceleration?
14. Define velocity potential functions? Mention the properties of potential function?
15. Define stream function? Mention the properties of stream function?
16. What is equi -potential line?
17. Give the relation between stream function and velocity potential function?
18. Derive the continuity equation for a three dimensional flow, in Cartesian co-ordinates
19. A stream function represents 2-D fluid flow, y : 2xy.Find the velocity at a point P(3,4)

UNIT-IV FLUID DYNAMICS

1. Define forced vertex flow? Give example?
2. Write the equation of forced vortex flow?
3. Give the Euler's equation of motion?
4. What are the assumptions made in deriving Bernoulli's equation?
5. What is Bernoulli's equation for real fluid?
6. State the application of Bernoulli's equation ?
7. Derive continuity equation of differential form. Discuss whether the equation is valid for a steady or unsteady flow, viscous or in viscid flow, compressible or incompressible flow.
8. State the Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation
9. State momentum equation and Impulse momentum equation?
10. 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
11. A Venturimeter with 200mm inlet dia and 100mm throat is laid with axis horizontal andisused for measuring the flow of oil of specific gravity 0.8 the difference of level inU-tubemanometer reads 180mm of mercury, Whist 11520kg of oil is collected through meter is 4min.Calculate the discharge and Co-efficient of meter
12. A 30cm x 15cm Venturimeter is provided in a provided in a vertical pipe line carryingoilofspecific gravity 0.9, the flow being upward. The difference in elevation ofthethroatsectionand entrance section of Venturimeter is 30cm. The pressure differenceinmanometeris25cmof Hg. Take Cd= 0.98. Calculate discharge of oil and pressuredifferencebetweenentranceand throat.
13. An orifice meter consisting of 10cm orifice in a 25cm dia of pipe has a co-efficient 0.65.Thepipe delivers oil of Specific gravity 0.8. The pressure difference between two sidesoftheorifice meter is 80cm of mercury column. Calculate flow rate in lit/sec.

UNIT – V DIMENSIONAL ANALYSIS

1. The frictional torque T of a disc diameter D rotating at a speed N in a fluid of

Viscosity μand density ρin a turbulent flow is given by T=D 5N2ρΦ(μ/D2 Nρ). Prove this Buckingham ’s Π theorem.

2. Explain the different types of similarities.
3. Explain the dimensional analysis with suitable example.
4. The frictional torque T of a disc diameter D rotating at a speed N in a fluid of

Viscosity μ and density ρ in a turbulent flow is given by T=D 5N2 ρΦ(μ/D2Nρ). Prove this Rayleigh’s Π theorem

5. Explain all dimensional number.
6. Explain the term 'dimensionally homogenous equation
7. Define the following dimensionless numbers and mention their significance in fluid flow problems: i) Reynolds no. ; ii) Froude’s no. ; iii) Mach no
8. Prove that the discharge over a spillway is given by the relation using Buckingham’s II - theorem.a=VDf[@D)Hlv
   hereV:velocityofflow,D:Depthatthethroat,H:Fleadofwater,g=Acceleration due to gravlty.
9. What is meant by geometric, kinematic and dynamic similarities?
10. . Define Euler’s equation of motion. Deduce Bemoullis equation from the same

UNIT – I V FLOW PAST IMMERSED BODIES

1. Explain the following : i) Lift ii) Drag
2. Distinguish between skin friction drag and form drag ?
3. What do you understand by co-efficient of drag and co-efficient of lift?
4. A flat plate 1.5m x 1.5m moves at 50 km/hr in stationary air of density 1.15 kg/m3.If the co- efficient of drag and lift are 0.15 and 0.75 respectively, determine : i) The lift force ii) The drag force iii) The resultant force iv) The power required to keep the plate in motion.
5. What is Magnus effect? Why is it known as Magnus effect?
6. What is the expression for drag and lift?

UNIT -7 FLOW MEASUREMENTS

1. A tube of manometer is used to measure pressure of oil specific gravity 0.85 flowing in a pipe line. Its left limb is connected to pipe and right limb is open to atmosphere. The center of the pipe is 100mm below level of mercury in the right limb. If the difference of mercury level in two limbs is 160mm. Find the absolute pressure in KPa.
2. Explain Differential u-tube manometer with neat sketch. Explain all three Simple manometers with neat sketch.
3. Explain Differential manometer With Neat sketch.
4. A U-tube differential manometer is connected two pressure pipes A and B. Pipe A contains Carbon tetrachloride having a specific gravity 1.594 under a pressure of 11.772 N/ Cm2 and pipe B contain oil of specific gravity 0.8 under pressure 11.72 N/ Cm2 . The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as a fluid filling U-tube
5. Define an orifice-meter
6. Define the terms: nappe and crest.
7. What is the difference between orifice and a mouthpiece?
8. What is a venturimeter?Write the expression for rate of flow through venturimeter?
9. What purpose orifice meter is used? Define it?
10. Define pitot tube and give its working principle?

11. Give the expression for actual velocity in pitot tube?
12. What arrangements should be adopted to find the velocity at any point in a pipe by a pitot tube?
13. Compare between venturimeter & orificemeter.

14. A pipe through which water is flowing is having diameter 40cm & 20cm at section 1 and section 2 respectively. The velocity of water at section 1 is given 5m/sec. Find the velocity head at section 1 and section 2 with rate of discharge.
15. Draw a neat sketch of venturimeter. State why the length of divergent cone is made longer. Water flows through horizontal tapering pipe with a diameter of 30cm at one end and20cm at the discharge at the smaller end. A horizontal venturimeter 160x80mm used to measure flow of an oil specific gravity 0.3.
16. Determine the deflection of oil mercury gauge if discharge of oil is 50 l/s. Take Co-efficient of discharge 1.
17. Differentiate between gauge pressure and absolute pressure.
18. With a neat sketch, explain the working of an inverted u - tube manometer.
19. A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to pressure measure the flow of water. The pressure at the inlet is 17.658N/cm2 and the vacuum Take at the throat is 30cm of mercury. Find the discharge of water through the venturimeter- (06 Marks) Ca = 0.98.6 a. What are the energy losses that occur in pipes? Derive an expression for loss of head due to friction in pipes.