**QUESTION BANK**

**ME6451-FLUID MECHANICS AND MACHINERY**

**UNIT –I FLUID PROPERTIES AND FLUID CHARACTERISTICS**

**PART-A**

1. Define Newton’s Law of viscosity.
2. Distinguish between mass density and specific weight.
3. What is the difference between absolute pressure and gauge pressure?
4. Define viscosity of a fluid.
5. What is the variation of viscosity with temperature for fluids?
6. Define surface tension and express its unit.
7. Write the equation of surface tension for liquid droplet and soap bubble.
8. Define capillarity.
9. Write the continuity equation.
10. State Bernoulli’s theorem.
11. What are the major assumptions made in the derivation of the Bernoulli’s equation.
12. What are the limitations of Bernoulli’s equation.
13. Mention any three applications of Bernoulli’s theorem.
14. What is cavitation? what are the effects of cavitation?
15. Write down the expression for discharge through a venturimeter ?
16. What do you understand by momentum equation?
17. Define compressibility.
18. What are the types of fluid?
19. List the types of fluid flow.
20. A soap bubble is formed when the inside pressure is 5N/m2 above the atmospheric pressure. If surface tension in the soap bubble is 0.0125N/m, find the diameter of the bubble formed.

**PART B**

1. 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 and (2) kinematic viscosity of oil , if the specific gravity of the oil is 0.95
2. A 0.5 m diameter shaft rotates in a sleeve under lubrication with viscosity 5 poise at 200rpm. Calculate the power lost for a length of 100mm if the thickness of the oil is 1mm.
3. If the velocity profile of a fluid over a plate is a parabolic with a vertex 20cm from the plate, Where the velocity is 120cm/sec. Calculate the velocity gradiants and shear stress at a distance of 0, 10 and 20 cm from the plate, if the viscosity of fluid is 8.5 Poise.
4. Derive the Euler’s equation of motion and deduce the expression to Bernoulli’s equation.
5. A drainage pipe is tapered in a section running with full of water. The pipe diameters at the inlet and exit are 1000mm and 500mm respectively. The water surface is 2m above the centre of the inlet and exit is 3m above the free surface of the water. The pressure at the exit is 250mm of Hg vaccum. The friction loss between the inlet and exit of the pipe is 1/10 of the velocity head at the exit. Determine the discharge through the pipe.
6. A pipeline 60cm diameter bifurcates at a Y-junction into two branches 40cm and 30cm in diameter. If the rate of flow in the main pipe is 1.5m3/s, and the mean velocity of flow in the 30cm pipe is 7.5m/s, determine the rate of flow in the 40cm pipe.
7. Derive the energy equation and state the assumptions made while deriving the equation.
8. A vertical venturimeter 40 cm x 20 cm is provided in a vertical pipe to measure a flow of oil of relative density 0.8. The difference in elevations of the throat section and the entrance sections in 1 m, the direction of flow of oil being vertically upwards. The oil-mercury differential gauge shows deflection of mercury equal to 40 cm. Determine the quantity of oil flowing the pipe. Neglect losses.
9. A 45o reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm2 and rate of flow of water is 600 liters/s.
10. An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp.gr 0.9 and Cd = 0.6.

**UNIT II**

**PART-A**

1. Differentiate between laminar and turbulent flow.
2. What is meant by critical Reynolds number
3. Derive an expression for the velocity distribution for viscous flow through a circular pipe.
4. Derive Hagen-poiseuille equation state the assumption made.
5. Differentiate between hydraulic gradient line and energy gradient line.
6. What is siphon and list out some of its application?
7. What are the losses experienced by a fluid when it is passing through a pipe?
8. State the characteristics of laminar flow.
9. Mention the types of minor losses.
10. What is the use of moody’s diagram?
11. What are the minor losses? Under what circumstances will they be negligible?
12. What do you mean by flow through parallel pipes?
13. Give the dimensions of the following physical quantities: surface tension and dynamic viscosity.
14. How does surface roughness affect the pressure drop in a pipe if the flow is turbulent?
15. A piping system involves two pipes of different diameters (but of identical length, material and roughness) connected in parallel. How would you compare the flow rates and pressure drop in these two pipes?
16. What are eddies and vena contracta in pipe minor losses?
17. What is equivalent pipe?
18. Define the terms: Drag and lift.
19. What is meant by boundary layer separation?
20. Define displacement thickness.

**PART-B**

1. (i) Define the term ‘boundary layer’.

(ii) Define ‘minor losses’. How they are different from major losses?

(iii) The discharge of water through a horizontal pipe is 0.25m3/s. The diameter of above pipe which is 200 mm suddenly enlarges to 400 mm at a point. If the pressure of water in the smaller diameter of pipe is 120 kN/m2, determine : loss of head due to sudden enlargement; pressure of water in the larger pipe and the power lost due to sudden enlargement.

1. (i) What is meant by critical Reynolds number

(ii) Obtain a relationship between shear stress and pressure gradient.

1. Derive Hagen-poiseuille equation state the assumptions made.
2. Derive an expression for head loss through pipes due to friction/
3. Explain the losses of energy in flow through pipes.
4. Determine the equivalent pipe corresponding to 3 pipes in series with lengths and diameters L1,L2,L3,d1,d2,d3 respectively.
5. For a flow of viscous fluid flowing through a circular pipe under laminar flow conditions show that the velocity distribution is a parabola. And also show that the average velocity is half of the maximum velocity.
6. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take *f* = 0.01 for both sections of the pipe.
7. (i) Obtain expression for Darcy-Weishbach friction factor f for flow in a pipe.

(ii) A smooth pipe carries 0.30 m3/s of water discharge with a head loss of 3.0 m per 100m length of pipe. If the water temperature is 20˚C, determine the diameter of the pipe.

1. A 150 mm diameter pipe reduces in diameter abruptly to 100 mm diameter. If the pipe carries water at 30 liters per second. Calculate the pressure loss across the contraction. Take coefficient of contraction as 0.6.