CBCS SCHEME

USN | | | | | | | | | | 18CV33

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the following fluid, properties and mention their SI units :
i) Specific weight
ii) Kinematic viscosity
iii) Surface extension. **(06 Marks)**

b. Explain the phenomenon of capillarity. Derive an expression for capillary rise of a liquid. **(06 Marks)**

c. A differential manometer is connected at two points A and B as shown in Fig.Q1(c). At B, air, pressure is 9.81 N/cm^2. Find the pressure at A. **(08 Marks)**

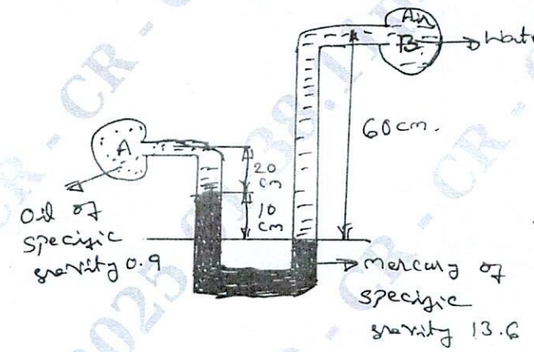

Fig.Q1(c)

OR

2 a. State and prove Pascal's law. **(06 Marks)**

b. Cleary distinguish between :
i) Absolute pressure
ii) Gauge pressure
iii) Vacuum pressure
iv) Atmospheric pressure.
Indicate their relative positions on a chart. **(06 Marks)**

c. The dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and it rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm. **(08 Marks)**

Module-2

3 a. Define :
i) Total pressure
ii) Center of pressure. **(04 Marks)**

b. Derive an expression for total pressure and centre of pressure for a vertical plane surface submerged in a liquid. **(08 Marks)**

c. A 30 cm diameter pipe conveying water branches into two pipes of diameter 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe. If the average velocity in 20 cm diameter pipe is 2 m/s. **(08 Marks)**

OR

4 a. Define the following types of flow :
i) Steady and unsteady flow
ii) Laminar and turbulent flow
iii) Compressible and incompressible flow. **(06 Marks)**

b. Derive the continuity equation for a three dimensional steady, incompressible flow in Cartesian coordinates. **(08 Marks)**

c. Determine the total pressure and centre of pressure of an isosceles triangular plate of base 4 m, altitude 4 m when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. **(06 Marks)**

Module-3

5 a. Derive Euler's equation of motion along a stream line. Obtain Bernoulli's equation from Euler's equation. Mention the assumptions made. **(08 Marks)**

b. Explain the working principle of Pitot tube with a sketch. **(04 Marks)**

c. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. the pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of Hg. Find the discharge of water. take C_d= 0.98. **(08 Marks)**

OR

6 a. State and explain the principle of momentum equation. **(04 Marks)**

b. Derive an expression for discharge through a venturimeter. **(08 Marks)**

c. A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200 mm at position A to 500 mm at a position B which is 4 m at higher level. If the pressure at A and B are 10 N/cm^2 and 6 N/cm^2 respectively and discharge is 200 liters/s, determine the loss of head and indicate the direction of flow. **(08 Marks)**

Module-4

7 a. Derive an expression for discharge over a triangular notch. **(08 Marks)**

b. Write a note on classification of mouthpieces. **(04 Marks)**

c. Determine the height of a rectangular weir of length 6 m to be built across a rectangular channel if the maximum depth of water on the upstream side of weir is 1.8 m and discharge is 2000 litres/s. Take C_d = 0.6 and neglect end contractions. **(08 Marks)**

OR

8 a. Define the hydraulic coefficients C, C_d and C_v of on orifice and obtain the relation between them. **(08 Marks)**

b. Explain ventilation of weirs. **(04 Marks)**

c. The head of water over a an orifice of diameter 100 mm is 10 m. The water coming out from the orifice is collected in a circular tank of diameter 1.5m. The rise of water level in the tank is 1 m in 25 seconds. The coordinates of a point of the jet measured from vena contracta are 4.3 m horizontal and 0.5 m vertical. Find the coefficients C_d, C_c and C_v. **(08 Marks)**

Module-5

9 a. Derive Darcy – Weishbach equation for head loss due to friction n a pipe. **(08 Marks)**

b. Mention major and minor losses in a pipe flow. **(04 Marks)**

c. Water is required to be supplied to a colony of 4000 residents at a rate of 180 liters per person from a source 3 km away. If half the daily requirement needs to be pumped in 8 hours against a frictional head of 18 m, find the size the main pipe supplying water. Assume coefficient of friction as 0.007. **(08 Marks)**

OR

10 a. Explain the reasons for water hammering in pipes. **(06 Marks)**

b. Obtain an expression for the rise of pressure when the flowing water in a pipe is brought to rest by sudden closure of valve and the pipe is elastic. **(08 Marks)**

c. Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 liters/s. **(06 Marks)**

* * * * *