Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: CIPC2003

3rd Semester Regular Examination: 2024-25
SUBJECT: Fluid Mechanics
BRANCH(S): CIVIL, C&EE, CE
Time: 3 Hours
Max Marks: 100
Q.Code: R494

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) How does the viscosity vary for liquid? State the reasons.
b) Determine the pressure in bar at a depth of 10 m oil of specific gravity 0.750.
c) Define pascal's law.
d) What is center of buoyancy?
e) Differentiate rotational and irrotational flow of fluids.
f) Different between Venturi meter and orifice meter.
g) State Darcy-Weisbach equation.
h) Define hydraulic gradient line.
i) What are the characteristics of laminar flow?
j) What do you understand by turbulent flow?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) What do you mean Vacuum pressure? Explain by means of a neat labelled diagram.
b) A clean tube of diameter 2.5 mm is immersed in a liquid with a coefficient of surface tension = 0.4 N/m. The angle of the liquid with the glass can be assumed to be 135^0. The density of the liquid = 13600 kg/m^3. What would be the level of the liquid in the tube relative to the free surface of the liquid inside the tube?
c) A rectangular plate 3 m long and 1 m wide is immersed vertically in water in such a way that its 3 m side is parallel to the water surfaces and is 1 m below it.
Find (I) Total pressure on the plate and (II) Position of center of pressure
d) A wooden block of size 1 m x 0.5 m x 0.4 m is floating in water with 0.4 m side perpendicular to free surface. The specific gravity of wood is 0.75. Determine its meta centric height.
e) What are the conditions of equilibrium of a sub-merged body? Explain them.
f) Explain about velocity potential function and steam function.
g) Define the equation of continuity. Obtain an expression for continuity equation of a three –dimensional flow.

h) Determine the expression for rate of flow through the venturi meter

i) A pipe line 60 cm diameter bifurcates at a Y-junction into two branches 40 cm and 30 cm in diameter. If the rate of flow in the main pipe is 1.5 m^3/s and mean velocity of flow is 30 cm diameter pipe is 7.5 m/s, determine the rate of flow in the 40 cm diameter pipe.

j) What is meant by equivalent pipe? Determine the equivalent pipe corresponding to 3 pipes in series with lengths and diameters L1, L2, L3, D1, D2, and D3 respectively.

k) 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 litres/sec.

l) Obtain an expression for Velocity distribution in turbulent flow for smooth pipe.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two large plate surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of 0.5 m^2 area between two large plate surfaces at a speed of 0.6 m/s if, **(16)**

(i) When the thin plate is in the middle of the two plate surfaces,

(ii) When the thin plate is at a distance of 0.8 cm from one plate surface.

(iii) When the thin plate is at a distance of 0.6 cm from one plate surface.

(iv) When the thin plate is at a distance of 0.4 cm from one plate surface.

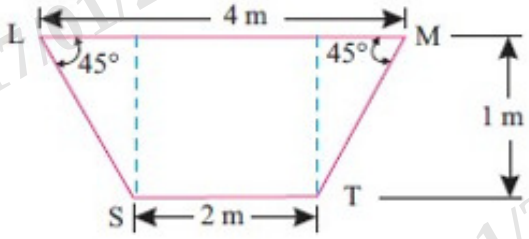
Take dynamic viscosity of glycerin as 8.1×10^{-1} N s $/m^2$

Q4 A trapezoidal 2 m wide at the bottom and 1 m deep has side slopes 1:1. (Ref. to Fig.) **(16)**

Determine

(i) Total pressure

(ii) Centre of pressure on the vertical gate closing the channel when it is full of water.



Q5 Derive the Bernoulli's equation from Euler's equation with a suitable neat diagram. State the assumptions made during the derivation. **(16)**

Q6 Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of the water in the tank is 4 m above the center of the pipe. Consider all minor losses and take f = 0.009. Also draw the hydraulic gradient line and total energy line of the same. **(16)**