B.Tech. Degree III Semester Regular/Supplementary Examination in Marine Engineering November 2022

### 19-208-0305 FLUID MECHANICS
(2019 *Scheme*)

Time: 3 Hours

Maximum Marks: 60

Course Outcome
On successful completion of the course, the students will be able to:

CO1: Understand the basics of fluid properties, manometry, forces on submerged bodies, bouncy and Metacentre.
CO2: Understand the basics of fluid dynamics, and continuity equations, Bernoulli's equation and its applications.
CO3: Solve the problems in one dimensional flow through pipe.
CO4: Understand the basics of laminar viscous flow.
CO5: Gain the concepts of vortex flow and flow over submerged bodies and calculate drag and lift force.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create
PO – Programme Outcome

			(5 × 15 = 75)	Marks	BL	CO	PO
I.	(a)	Explain the method to find out the force acting on a curved surface submerged in liquid.		5	L2	1	1
	(b)	An 80 mm diameter composite solid cylinder consists of an 80 mm diameter, 20 mm thick metallic plate having specific gravity 4.0 attached at the lower end of 80 mm diameter wooden cylinder of specific gravity 0.8. Find the limits of the length of the wooden portion so that the composite cylinder can float in stable equilibrium in water (specific gravity 1.0) with its axis vertical.		10	L4	1	2

OR

II.	(a)	Calculate pressure difference between the points A and B in the following figure. Take specific weight of water as 10 kN/m^3, specific weight of mercury as 136 kN/m^3 and specific weight of oil as 8.5 kN/m^3 for oil.		5	L2	1	1
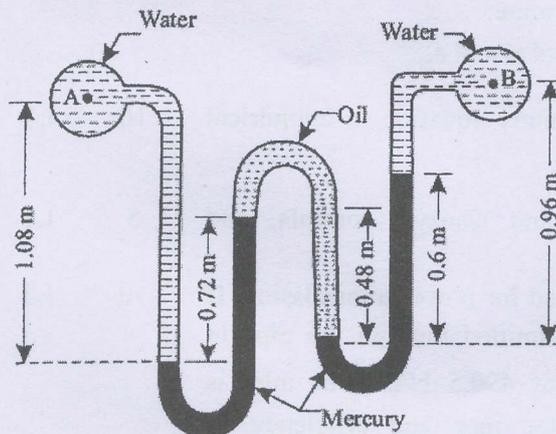
	(b)	A pipe line which is 4 m in diameter contains a gate valve. The pressure at the centre of the pipe is 20 N/cm^2. If the pipe is filled with oil of specific gravity 0.87, find the force exerted by the oil upon the gate and position of centre of pressure.		10	L4	1	2

|			Marks	BL	CO	PO

III. (a) Differentiate between following types of flow — 5, L2, 2, 1
   (i) Steady and unsteady flows
   (ii) Uniform and non- uniform flows

(b) The following data relate to an inclined venturimeter in the following figure. — 10, L3, 2, 2

Diameter of the pipeline = 400 mm
Inclination of the pipeline with the horizontal = 30°
Throat diameter = 200 mm
The distance between the mouth and throat of the meter = 600 mm
Sp. gravity of oil flowing through the pipeline. = 0.7
Sp. gravity of mercury (U-tube) = 13.6
Reading of the differential manometer = 50 mm
The coefficient of the meter = 0.98
Determine the rate of flow in the pipeline.

Oil (sp. gr. = 0.7) — Mercury (sp. gr. = 13.6)
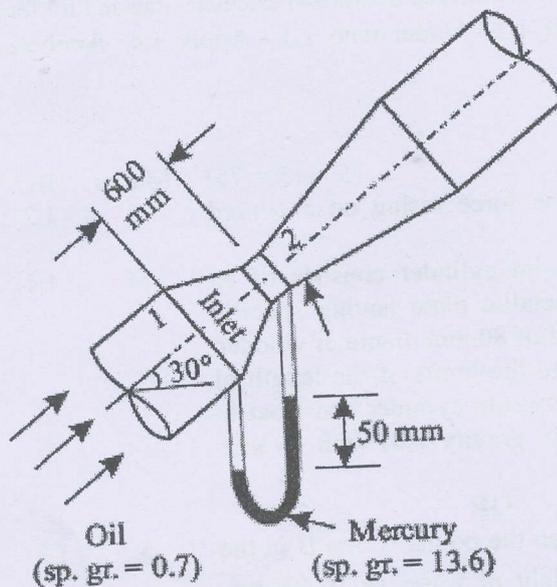
OR

IV. (a) For a two-dimensional flow, the velocity components are $u = x/(x+y), v = y/(x+y)$. Determine: — 5, L2, 2, 2
   (i) The acceleration components a_x and a_y,
   (ii) The rotation component w_z
(b) Derive the differential form continuity equation in cylindrical polar coordinates. — 10, L3, 2, 1

V. (a) Write Darcy-Weisbach formula and Chezy's formula, and elaborate the terms. — 5, L1, 3, 1
(b) A pipe line of length 2000 m is used for power transmission. If 110.3625 kW power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 98.1 N/cm^2. Take f = 0.0065. — 10, L3, 3, 2

OR

(Continued)

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			Marks	BL	CO	PO
VI.	(a)	Explain the flow through pipes connected in series and parallel.	5	L1	3	1
	(b)	A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if f = 0.01. The head at inlet is 300 mm.	10	L3	3	2
VII.		Explain viscous flow through circular pipe and derive an equation to get	15	L2	4	1
	(i)	Shear stress distribution				
	(ii)	Velocity distribution				
	(iii)	Pressure drop for a given length				

<div align="center">OR</div>

			Marks	BL	CO	PO
VIII.		Explain viscous flow between two parallel plate and derive an equation to get	15	L2	4	1
	(i)	Shear stress distribution				
	(ii)	Velocity distribution				
	(iii)	Pressure drop for a given length				
IX.	(a)	Derive an equation to represent variation of pressure of a rotating fluid in a free vortex flow.	5	L2	5	1
	(b)	Prove that in case of forced vortex, the rise of liquid level at the ends is equal to fall of liquid level at the axis of rotation.	10	L2	5	1

<div align="center">OR</div>

			Marks	BL	CO	PO
X.	(a)	Explain the way to calculate drag on a sphere.	5	L2	5	1
	(b)	Derive Kutta- Joukowsi equation.	10	L2	5	1

Bloom's Taxonomy Levels
L1 - 6.67%, L2- 46.67%, L3 - 33.33%, L4 – 13.33%,

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