B

B. Tech. Degree III Semester Regular/Supplementary Examination in Marine Engineering November 2024

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, manometer, forces on submerged bodies, bouncy and metacenter.
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
PI – Programme Indicators

(Answer *ALL* questions)   (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Differentiate atmospheric pressure, absolute pressure and gauge pressure. Indicate their relative positions on chart.	4	L3	1	1
	(b)	A tank contains water in the lower 0.8 m depth. An immiscible liquid of relative density 0.85 is filled on the top of water up to a height of 1.5 m. If the tank is 2 m wide calculate, (i) the pressure force on one side of the tank. (ii) position of the center of pressure.	11	L4	1	2
		OR				
II.	(a)	Find the specific weight of a metallic body which floats at the interface of mercury and water such that 45% of its volume is submerged in mercury and remaining in water.	4	L3	1	1
	(b)	A wooden block in the form of a rectangular prism floats with its shortest axis vertical. The block is 42 cm long, 24 cm wide and 15 cm deep with a depth of immersion of 14 cm. Determine the metacentric height and analyze the stability of the block.	11	L4	1	2
III.	(a)	Differentiate between Notch and Weirs and derive the actual discharge for triangular notch.	7	L1	2	1
	(b)	A venturimeter 40 cm × 20 cm is provided in a vertical pipeline to measure the flow of oil of relative density 0.8. The difference in elevations of the throat section and entrance section is 50 cm, the direction of flow of oil being vertically upwards. The oil-mercury differential U-tube manometer shows a gauge deflection of 10 cm. Calculate the discharge of oil and the pressure difference between the entrance section and throat section. Take the coefficient of discharge as 0.98 and specific gravity of mercury as 13.6.	8	L3	2	2

OR

(P.T.O.)

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			Marks	BL	CO	PI
IV.	(a)	Derive the continuity equation for a three dimensional flow in Cartesian coordinates.	7	L1	2	1
	(b)	A fluid flow field is given by, $$V = x^2 y\, i + y^2\, j - \left(2xyz + y^2 z\right) k$$ Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2, 3, 4).	8	L3	2	2
V.	(a)	Obtain the condition for maximum power transmission through pipes.	5	L1	3	1
	(b)	A horizontal pipe with 8 cm diameter suddenly enlarges to 9 cm diameter at a section. The pressure just upstream of the expansion is 35 kN/m^2. Calculate the pressure just after expansion if the discharge of water in the pipe is 0.0075 m^3/s.	10	L2	3	2

OR

			Marks	BL	CO	PI
VI.	(a)	Obtain the equation for head loss due to sudden enlargement.	7	L1	3	1
	(b)	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 water in the tank is 4 m above the center of the pipe. Consider all minor losses take f = 0.009.	8	L2	3	2
VII.	(a)	Derive the condition for maximum velocity for a viscous flow through pipe and a relation with mean velocity.	7	L2	4	1
	(b)	A laminar flow is taking place in a pipe of diameter 300 mm the maximum velocity is 2.5 m/s. Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 4 cm from the wall of the pipe.	8	L2	4	1

OR

			Marks	BL	CO	PI
VIII.	(a)	Explain the movement of piston in dash pot with neat sketch.	7	L2	4	1
	(b)	A shaft having a diameter of 60 mm rotates centrally in a journal bearing having a diameter of 50.15 mm and length 200 mm. The angular space between the shaft and the bearing is filled with oil having viscosity of 0.8 poise. Determine the power absorbed in the bearing when the speed of rotation is 80 rpm.	8	L2	4	1
IX.	(a)	Define vortex flow and obtain the equation for vortex flow.	7	L2	5	1
	(b)	A vessel, cylindrical in shape and closed at the top and bottom, contains water up to a height of 80 cm. The diameter of the vessel is 20 cm and the length of the vessel is 120 cm. The vessel is rotated at a speed of 400 rpm about its vertical axis. Find the height of paraboloid formed.	8	L3	5	1

OR

			Marks	BL	CO	PI
X.	(a)	Explain about Magnus effect.	4	L2	5	1
	(b)	A spherical steel ball of diameter 20 mm and the density 7500 kg / m^3 is dropped in large mass of water. The coefficient of drag of the ball in water is given as 0.45. Find the terminal velocity of the ball in water. If the ball is dropped in air, find the increase in terminal velocity of ball. Take the density of air = 1.25 kg /m^3 and C$_D$ = 0.1.	11	L3	5	1

Blooms's Taxonomy Level
L1 – 17.33%, L2 – 39.33%, L3 – 28.67%, L4 – 14.67%.

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