BT MRE-III(R/S)-11-23-3010 Reg. No. | | | | | | | | |

C

B.Tech. Degree III Semester Regular/Supplementary Examination in Marine Engineering November 2023

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
PI – Programme Indicators

Answer *ALL* questions (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Explain with the help of a neat sketch the working of bourdon tube pressure gauge.	5	L2	1	1.3.1
	(b)	A pressure gauge consists of two cylindrical bulbs B and C each of 10 sq. cm cross- sectional area, which are connected by a U-tube with vertical limbs each of 0.25 sq.cm cross-sectional area. A red liquid of specific gravity 0.9 is filled into C and clear water is filled into B, the surface of separation being in the limb attached to C. Find the displacement of the surface of separation when the pressure on the surface in C is greater than that in B by an amount equal to 1 cm head of water.	10	L4	1	2.2.1
		OR				
II.	(a)	Differentiate between vacuum pressure, atmospheric pressure and gauge pressure.	5	L2	1	1.3.1
	(b)	The end gates ABC of a lock are 9 m high and when closed include an angle of 120°. The width of the lock is 10 m. Each gate is supported by two hinges located at 1 m and 6 m above the bottom of the lock. The depths of water on the two sides are 8 m and 4 m respectively. Find: (i) Reaction between the gates AB and BC. (ii) Force on each hinge, considering the reaction of the gate acting in the same horizontal plane as resultant water pressure.	10	L4	1	2.2.1
III.	(a)	Write Bernoulli's equation and explain its limitations.	5	L2	2	1.3.1
	(b)	Define velocity potential function and stream function. Also derive the properties of velocity potential function and stream function.	10	L3	2	2.2.1
		OR				

(P.T.O.)

			Marks	BL	CO	PI
IV.	(a)	Explain the relevance of venacontracta.	5	L2	2	1.3.1
	(b)	Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of sp. gr. 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe.	10	L3	2	1.3.1
V.	(a)	Explain and derive Dupuit's equation.	5	L2	3	1.3.1
	(b)	Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200 m, and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16 m. If co-efficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then including them.	10	L4	3	1.3.1
		OR				
VI.	(a)	Explain the physics behind the minor losses due to sudden contraction and sudden expansion of pipe	5	L2	3	1.3.1
	(b)	Two pipes have a length L each. One of them has a diameter D, and the other a diameter d. If the pipes are arranged in parallel, the loss of head, when a total quantity of water Q flows through them is h, but, if the pipes are arranged in series and the same quantity Q flows through them, the loss of head is H. If $d=D/2$, find the ratio of H to h, neglecting secondary losses and assuming the pipe co-efficient f has a constant value.	10	L4	3	2.2.1
VII.	(a)	Derive the equation for power absorbing in overcoming viscous resistance of journal bearing.	5	L2	4	1.3.1
	(b)	Water at 15°C flows between two large parallel plates at a distance of 1.6 mm apart. The viscosity of water at 15°C is given as 0.01 poise. Determine: (i) the maximum velocity (ii) the pressure drop per unit length (iii) the shear stress at the walls of the plates if the average velocity is 0.2 m/s.	10	L3	4	2.2.1
		OR				
VIII.	(a)	Derive the equation for power absorbing in overcoming viscous resistance of foot step bearing.	5	L2	4	1.3.1
	(b)	An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 litres/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall.	10	L3	4	2.2.1

(Continued)

			Marks	BL	CO	PI
IX.	(a)	Differentiate between forced and free vortex.	5	L1	5	1.3.1
	(b)	A closed cylindrical vessel of diameter 30 cm and height 100 cm contains water upto a depth of 80 cm. The air above the water surface is at a pressure of 5.886 N/cm². The vessel is rotated at a speed of 250 rpm. about its vertical axis. Find the pressure head at the bottom of the vessel: (i) at the centre (ii) at the edge.	10	L3	5	2.2.1
		OR				
X.	(a)	Differentiate between streamline body and bluff body.	5	L1	5	1.3.1
	(b)	The air having a velocity of 40 m/s is flowing over a cylinder of diameter 1.5 m and length 10 m, when the axis of the cylinder is perpendicular to the air stream. The cylinder is rotated about its axis and a lift of 6867 N per metre length of the cylinder is developed. Find the speed of rotation and location of the stagnation points. The density of air is given as 1.25 kg/m^3.	10	L3	5	2.2.1

Bloom's Taxonomy Levels
L1 = 6.66%, L2 = 26.67%, L3 = 40.00%, L4 = 26.67%.

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