BT SH-III(R/S)-11-24-283 Reg. No. | | | | | | | | |

C

B.Tech. Degree III Semester Regular/Supplementary Examination in Naval Architecture and Ship Building November 2024

20-215-0302 FLUID MECHANICS I

(*2020 Scheme*)

Time: 3 Hours Maximum Marks: 100

Course Outcome

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

CO1: Recall the basic terms associated with the fundamentals of fluid mechanics.
CO2: Learn the basic static, kinematic and dynamic properties of fluids.
CO3: Apply the fluid properties and laws to study the behaviour of a fluid under different conditions and the basic working principles of different categories of pumps and turbines.
CO4: Analyse the influence of different flow parameters and the nature of velocity and pressure distributions for various types of fluid motion.
CO5: Evaluate the flow characteristics and evolving expressions to study the random and unpredictable nature of fluid motion in real life.

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

PO – Programme Outcome

PART A

(Answer *ALL* questions)

			(5 × 4 = 20)	Marks	BL	CO	PO
I.	(a)	What is the advantage of providing a large reservoir in one of the limbs of a vertical single column manometer? Explain with figure.		4	L3	1	3
	(b)	A set of large numbers of heavy weighing containers need to be placed in a container vessel. Concerning the stability, why it is not recommended to place all the containers in the ship deck, keeping the container holds empty? Explain with neat sketches.		4	L3	2	4
	(c)	You are analyzing the case of a flow of an incompressible fluid through a pipe. The Reynold's number for the flow is 1400. Which equation of motion is best recommended for this case and why?		4	L3	4	4
	(d)	Compare the velocity distribution profile with corresponding expressions in a pipe flow with		4	L3	5	2
		(i)	Reynold's number of 1900.				
		(ii)	Reynold's number of 3000.				
	(e)	Draw a schematic view showing the generation of power through a hydro-electric power plant. Why a draft tube is used in a hydro-electric power plant?		4	L2	3	2

PART B

(5 × 16 = 80)

II.	(a)	State and prove Pascal's law.		8	L2	2	2
	(b)	You are given two round glasses A and B containing identical fluids. Glass A has a diameter of 10 cm and Glass B has a diameter of 5 cm. Both are filled with water up to 10 cm depth. What is the ratio of the fluid pressure exerted at bottom of these 2 glasses? Also state and prove the law applied here.		8	L3	2	3

OR

			Marks	BL	CO	PO
III.	(a)	Prove that the surface tension force on a jet of water is four times as the case of a liquid droplet.	8	L2	1	2
	(b)	Why do submarines need to be designed with strong, pressure-resistant materials than a floating vessel? Explain the context.	8	L3	2	3
IV.	(a)	How does the total pressure force affect the design of the vertical walls of a ship's bulkhead? Why doubling the depth of water in the tank would affect the total pressure force acting on the bulkhead?	4	L4	2	4
	(b)	Derive the expressions for the components of total pressure force acting on (i) bilge plate of a ship. (ii) vertical side plating of a vessel.	12	L4	3	3
		OR				
V.		Derive the general expression for the slope of sea water subjected to a constant horizontal or vertical acceleration in a ballast tank? Let the water in a ballast tank is subjected to constant horizontal acceleration. What will be the slope of the ballast water surface when the vessel moves in the fore and aft directions?	16	L4	3	3
VI.	(a)	State the different properties of velocity potential function and stream function.	4	L3	4	2
	(b)	Derive the generalized continuity equation in three dimensions.	12	L3	4	3
		OR				
VII.	(a)	What is the importance of vena-contracta in orifice meter? And why we are not usually considering the area at vena contracta in the discharge formula?	4	L3	4	2
	(b)	Derive Bernoulli's equation of motion. What are the assumptions made in Bernoulli's equation of motion?	12	L3	5	4
VIII.	(a)	Which type of flow can be analyzed using Prandtl's mixing length theory and why? Which principle of motion is necessary to define a mixing length for a turbulent flow?	4	L3	4	2
	(b)	Prove that the head loss is inversely proportional to square of the pipe diameter for a laminar flow. What will be corresponding relationship for a turbulent flow?	12	L3	5	7
		OR				
IX.	(a)	Why a moving system of co-ordinates is defined in the Karman Similarity Hypothesis? Also write the expression for turbulent shear stress using this hypothesis.	4	L3	5	7
	(b)	Derive an expression for velocity defect in a turbulent pipe flow.	12	L3	5	4
X.	(a)	What is the advantage of connecting pumps in series and parallel?	4	L3	3	7
	(b)	Compare the working principles and suitability of different types of turbines.	12	L2	3	3
		OR				
XI.	(a)	Explain the phenomenon of cavitation in turbines.	4	L3	3	5
	(b)	Describe the working principle of (i) reciprocating pump. (ii) centrifugal pump.	12	L2	3	7

Bloom's Taxonomy Levels

L2 – 24%, L3 – 60%, L4 – 16%.

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