BT SH-III(R/S)-11-22-2046 Reg. No. | | | | | | | | |

C

B.Tech. Degree III Semester Regular/Supplementary Examination in Naval Architecture and Ship Building November 2022

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)		A liquid has a viscosity of 0.005 kg/m.s and a density of 850 kg/m^3. Calculate the kinematic viscosity. Also, explain the terms: (i) Dynamic viscosity (ii) Kinematic viscosity.	4	L1	1	1
	(b)		Explain the terms: (i) meta-centre (ii) meta-centric height	4	L1	2	1
	(c)		What is a pitot tube? How will you determine the velocity at any point with the help of a pitot tube?	4	L1	4	2
	(d)		Explain Reynold's turbulent shear stress and Prandtl's Mixing Length theory for Turbulent Shear Stress.	4	L1	5	4
	(e)		Differentiate between:	4	L1	3	1
		(i)	Turbines and pumps				
		(ii)	Impulse and reaction turbines.				

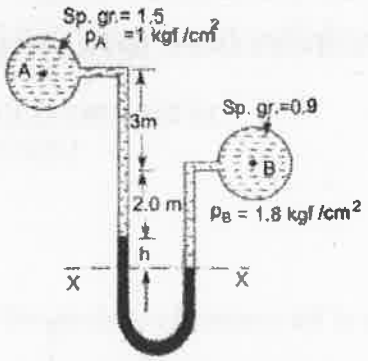
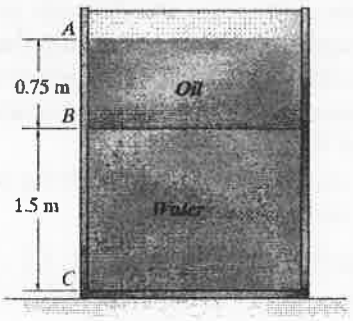
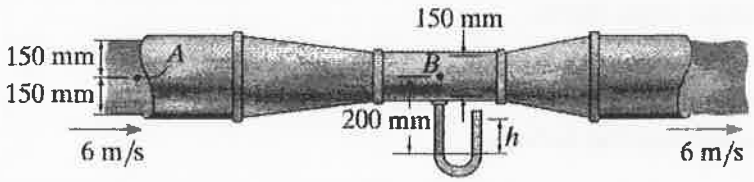
PART B

(5 × 16 = 80)

II.			Two large plane 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 surface area 0.5 m^2 between the two large plane surfaces at a speed of 0.6 m/s, if: (i) the thin plate is in the middle of the two plane surfaces (ii) the thin plate is at a distance of 0.8 cm from one of the plane surfaces? (Dynamic viscosity of glycerine = 8.1 × 10^{-1} Ns/m^2).	16	L2	1	1

OR

(P.T.O.)

		Marks	BL	CO	PO
III.	A differential manometer is connected at the two points A and B of two pipes as shown in figure. The pipe A contains a liquid of sp. gr. = 1.5 while pipe B contains a liquid of sp. gr. = 0.9 The pressures at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. 	16	L2	1	1
IV.	A storage tank contains oil and water acting at the depths shown in figure. Determine the resultant force that both of these liquids exert on the side ABC of the tank if the side has a width of b = 1.25 m. Also, determine the location of this resultant, measured from the top of the tank. Take density of oil as 900 kg/m^3. 	16	L3	2	1
	OR				
V.	An above-ground swimming pool of dimensions 4 × 4 × 1.5 m^3 is filled with water to the rim. Determine: (i) The hydrostatic force on each wall and the distance of line of action of this force from the ground. (ii) Hydrostatic force, when the height of the walls of the pool is doubled and the pool is fully filled.	16	L3	2	1
VI.	Water flows through the pipe at *A* with a velocity of 6 m/s and at a pressure of 280 kPa. Determine the velocity of water at *B* and the difference in elevation *h* of the mercury in the manometer shown in the following figure. 	16	L3	4	2
	OR				
VII.	A pipe carrying water has a tapering section where the diameter changes from 10 cm at section A to 8 cm at section B. The flow is from A to B and the pressure and elevation at these sections are as follows: Section: A: Elevation (m) 102.000 m; Above datum gauge pressure (kPa) 25.00 kPa — B: Elevation (m) 102.500 m; Above datum gauge pressure (kPa) 18.00 kPa Assuming zero loss of energy between these two sections, estimate the discharge in the pipe.	16	L3	4	2

(Continued)

		Marks	BL	CO	PO
VIII.	A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find: (i) pressure gradient (ii) average velocity (iii) Reynold's number of the flow.	16	L3	5	4
	OR				
IX.	Derive the expression for velocity distribution, average velocity and drop of pressure head for the flow of viscous fluid between two parallel plates.	16	L3	5	4
X.	Describe the principle and working of a reciprocating pump with a neat sketch. Also find the slip, coefficient of discharge and theoretical power (in kW) required to drive a single acting reciprocating pump operating at 60 rpm to lift 310 litres/min of water to a height of 15 m. The pump has a 15 cm piston with a crank of radius 15 cm. The delivery pipe is 10 cm diameter.	16	L2	3	1
	OR				
Xi.	Describe briefly the functions of the main components of Pelton turbine with neat sketches. A Pelton wheel is working under a head of 45 m and the discharge is 0.8 m^3/s. The mean bucket speed is 14 m/s. Find the power produced if the jet is deflected by the blades through an angle of 165°. (Assume coefficient of velocity as 0.985).	16	L2	3	1

Bloom's Taxonomy Levels

L1 = 20%, L2 = 32%, L3 = 48%.

***