Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2024

Subject Code:3141906 Date:21-11-2024

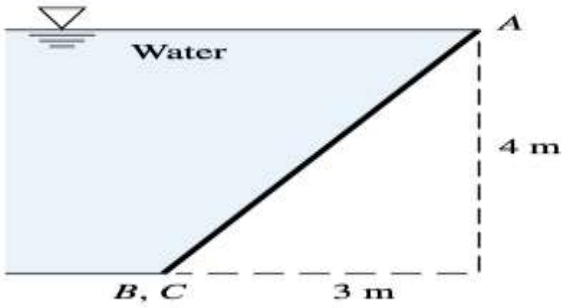
Subject Name: Fluid Mechanics and Hydraulics Machines

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define: (i) Specific gravity (ii) Cavitation (iii) Bulk modulus	**03**
	(b)	Explain the capillary rise/fall phenomenon based on contact angle and wettability criteria.	**04**
	(c)	Determine the change in pressure in a static fluid, if: (i) We move across the fluid horizontally (ii) We move in downward direction by a depth h (iii) the point of pressure application remains same and only directions change.	**07**
Q.2	**(a)**	Explain: (i) Centre of Buoyancy (ii) Metacenter (iii) Metacentric height.	**03**
	(b)	Justify why Cruise ships are provided with lower metacentric height as compared to Naval ships?	**04**
	(c)	Panel ABC in the slanted side of a water tank is an isosceles triangle with vertex at A and base BC = 2 m as shown in figure. Find the water force on the panel and its line of action.	**07**



OR

	(c)	A tank of water has a gate of 5 m height and 3 m width in its vertical wall. The top edge of the gate is 2 m below the water surface. Calculate hydrostatic force on the gate and location of center of pressure?	**07**
Q.3	**(a)**	Differentiate between: (i) Uniform and Non-Uniform flow (ii) Compressible and incompressible flow (iii) Rotational and Irrotational flow.	**03**
	(b)	Derive continuity equation for two-dimensional flow.	**04**
	(c)	Given the steady, two-dimensional velocity distribution u= Kx, v=Ky and w=0, where K is a positive constant. Compute and plot the streamlines of the flow, including the directions.	**07**

OR

Q.3	**(a)**	Define stream function and velocity potential. Establish the relation between them.	**03**
	(b)	Explain the working of Venturimeter based on Bernoulli's theorem.	**04**

	(c)	A velocity field is given by $V=(3y^2-3x^2)\mathbf{.i} + Cxy\mathbf{j}+0\mathbf{k}$. Find out the value of C for which the flow is to be: (i) incompressible (ii) irrotational.	**07**
Q.4	**(a)**	List major and minor losses in flow through pipes.	**03**
	(b)	Explain Reynolds experiment with the help of neat diagram.	**04**
	(c)	If power P required to transport a fluid through a pipe depends on length of pipe L, diameter D, surface roughness K, discharge Q, density ρ and coefficient of dynamic viscosity μ. Using Buckingham-Pi method, find the desired expression.	**07**
		OR	
Q.4	**(a)**	Define: (i) Equivalent pipes (ii) Water hammer	**03**
	(b)	Compare Geometric similarity, Kinematic similarity and dynamic similarity.	**04**
	(c)	Determine the optimum diameter of the pipe required to carry 100 ltr/s of crude oil (density = 950 kg/m^3, Coefficient of dynamic viscosity = 0.08 kg/m-s) and still maintaining laminar flow. Also determine the power required for its transport over one kilometer distance.	**07**
Q.5	**(a)**	Classify turbines. List selection criteria for turbines.	**03**
	(b)	Explain the application of draft tube in turbines.	**04**
	(c)	Explain the working of Fluid couplings with the help of neat diagram	**07**
		OR	
Q.5	**(a)**	Define: (i) Priming (ii) Net positive suction head (NPSH)	**03**
	(b)	Explain the characteristic curves of Pumps.	**04**
	(c)	With the help of neat diagram, Explain the working of Hydraulic accumulator.	**07**

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