Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV EXAMINATION – SUMMER 2020

Subject Code: 3141906 Date:27/10/2020

Subject Name: Fluid Mechanics and Hydraulics Machines

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Explain hypothesis of continuum.	**03**
	(b)	State and prove Pascal's law.	**04**
	(c)	Derive Euler's equation of motion. State assumptions made. How will you obtain Bernoulli's equation from Euler's equation?	**07**
Q.2	**(a)**	How repeating variables selected for dimensionless analysis?	**03**
	(b)	With neat sketch explain the conditions of equilibrium for floating body.	**04**
	(c)	Define uniform flow. Obtain stream and velocity potential function when flow is parallel to x-axis. Also plot uniform flow (parallel to x axis).	**07**
		OR	
	(c)	Derive from first principles, the conditions for ir-rotational flow. Prove that for potential flow, both the stream function and velocity potential function satisfy the Laplace equation.	**07**
Q.3	**(a)**	Differentiate between stream and streak line.	**03**
	(b)	Define centre of pressure. Obtain expression for centre of pressure for vertical plane surface submerged in liquid.	**04**
	(c)	The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 lps. The pipe has slope of 1 in 30. Find the pressure at the lower end if pressure at the higher level is 19.62 N/cm^2.	**07**
		OR	
Q.3	**(a)**	The stream function for two dimensional flow is given by $\psi = 2xy$. Find velocity potential function φ.	**03**
	(b)	Define and explain the terms: HGL, TEL	**04**
	(c)	State Buckingham's π – theorem. The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters.	**07**
Q.4	**(a)**	Derive the expression of force in x and y direction when jet striking symmetrical curved vane tangentially at one tip and leaving other end.	**03**
	(b)	Prove that maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of flow.	**04**
	(c)	Derive Darcy – Weisbach equation.	**07**

OR

Q.4	**(a)**	Define priming. Why priming is necessary in centrifugal pump?	**03**
	(b)	Classify hydraulic turbines with examples based on following criteria: i. Energy at inlet ii. Direction of flow through runner iii. Head at the inlet of turbine iv. Specific speed of turbine	**04**
	(c)	A Pelton wheel is to be designed for the following specifications: Shaft power = 11.772 kW, Head = 380 m, Speed = 750 rpm, Overall efficiency = 86%, Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: i. The wheel diameter ii. The number of jets required iii. Diameter of the jet. iv.	**07**
Q.5	**(a)**	Explain the advantages of Kaplan turbine over Fransis turbine.	**03**
	(b)	Define cavitation. State necessary precautions against cavitation in pump.	**04**
	(c)	Why governing of turbine is required? Explain governing of Pelton wheel with neat sketch.	**07**

OR

Q.5	**(a)**	Describe working of hydraulic accumulator with neat sketch.	**03**
	(b)	Write short note on NPSH.	**04**
	(c)	Explain briefly different losses and efficiencies associated with centrifugal pump.	**07**

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