

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: **04**
- i. Energy at inlet
 - ii. Direction of flow through runner
 - iii. Head at the inlet of turbine
 - iv. Specific speed of turbine
- (c) A Pelton wheel is to be designed for the following specifications: **07**
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.
- Q.5** (a) Explain the advantages of Kaplan turbine over Francis 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**
