

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV EXAMINATION – WINTER 2025****Subject Code:3141906****Date:15-11-2025****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 terms: Viscosity, Specific gravity, Surface tension	03
	(b) State and prove Pascal's law with usual notations	04
	(c) Derive an equation for continuity equation for 3D flow and reduce it for steady, incompressible 2D flow.	07
Q.2	(a) Discuss stability of submerged and floating bodies.	03
	(b) Derive the expression for discharge through rectangular notch	04
	(c) A circular opening 2.5 m diameter, in a vertical side of tank is closed by disc of 2.5 diameter which can rotate about horizontal diameter. Determine:	07
	(i) The force on the disc, (ii) The torque required to maintain the disc in equilibrium in vertical position when the head of water above horizontal diameter is 3.5 m.	
OR		
	(c) Show that the distance between the meta-center and center of buoyancy is given by BM = I/V	07
Q.3	(a) Define: Stream line, Streak line and Path line.	03
	(b) Explain terms Rotation and Vorticity.	04
	(c) The frictional torque T, of a disc of diameter D, rotating at a speed N, in a fluid of viscosity μ , and density ρ in a turbulent flow is given by, $T = D^5 N^2 \rho \Phi \left[\frac{\mu}{D^2 N \rho} \right]$ Prove this by Buckingham's π method.	07
OR		
Q.3	(a) Differentiate between (i) absolute and gauge pressure (ii) simple and differential manometer	03
	(b) The velocity components in a two- dimensional flow field for an incompressible fluid are $u = y^3/3 + 2x - x^2 y$ and $v = xy^2 - 2y - x^3/3$ obtain an expression for stream function.	04
	(c) Explain the construction and working of a Venturimeter and also derive an expression for the discharge through it.	07
Q.4	(a) What do you understand by frictional resistance offered by pipe?	03
	(b) Write short note on Say bolt Viscometer	04
	(c) Derive an expression for Hagen-Poiseuille's formula for viscous flow.	07
OR		
Q.4	(a) What is cavitation? What are its effects?	03

- (b) Explain various types of impellers used in centrifugal pump. **04**
- (c) A Pelton wheel is to be designed for following data **07**
 Power developed = 4000KW, Head = 320 m, Speed ratio = 0.45,
 Jet ratio = 12, Angle of jet deflection = 165°
 Coefficient of velocity = 0.98, Overall efficiency = 84%, Generator
 efficiency = 96%, Friction loss of bucket = 10%
 Find (i) Diameter of jet
 (ii) Tangential force on bucket
 (iii) Diameter of runner
 (iv) Synchronous Speed

- Q.5** (a) What is draft tube? Where and why it is used **03**
- (b) What do you understand by hydraulic machines? Discuss impulse momentum equation as applied to these machines. **04**
- (c) A jet of water moving with the velocity 12 m/sec impinges on a concave shaped vane to deflect the jet through 120° when stationary. If the vane moves at 5 m/sec, determine the angle of jet so that there is no shock at the inlet. What is absolute velocity of water at the exit in magnitude and direction? Also find the work done per unit mass of water. Assume that the vane is smooth. **07**

OR

- Q.5** (a) Draw a neat sketch, and explain the operation of Hydraulic Accumulator **03**
- (b) Define and explain significance of unit quantities for hydraulic turbine **04**
- (c) Prove the friction head losses is equal to one third of total head at inlet for maximum power transmission through pipe. **07**
