Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code:3141906 Date:12-05-2025

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define (i) fluid (ii) specific gravity (iii) compressibility	**03**
	(b)	Define cavitation. How does it affect the performance of hydraulic machines?	**04**
	(c)	Explain construction and working of simple hydraulic accumulator with neat sketch and derive equation of its capacity.	**07**
Q.2	**(a)**	Explain the concept of hydrostatic paradox.	**03**
	(b)	Define Metacentric height. Explain the Equilibrium conditions for a floating body.	**04**
	(c)	A rectangular plane surface is 1m wide and 1.5m deep, having circular hole of 0.5m diameter at the centre. The upper edge and lower edge are below free surface being 1m and 2m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure.	**07**
		OR	
	(c)	A cylinder block weighs 22 kN having diameter of 2m and height 2.5m is to float in sea water (S=1.025). Show that it does not float vertically.	**07**
Q.3	**(a)**	Define Velocity potential function and stream function. Explain the relation between Potential line and stream line.	**03**
	(b)	State and prove Pascal's law.	**04**
	(c)	Explain construction and working of venturimeter and deduce expression of discharge through it.	**07**
		OR	
Q.3	**(a)**	Explain hydraulic similitude in model analysis	**03**
	(b)	Define centre of pressure. Obtain expression for centre of pressure for vertical plane surface submerged in liquid.	**04**
	(c)	Using Buckingham's π- theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\ \emptyset\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ Where H- head causing flow, D- diameter of the orifice, μ-viscosity , ρ-mass density of fluid	**07**
Q.4	**(a)**	Give applications of Moody diagram.	**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)	Two sharp ended pipes of diameters 60mm and 120mm and each of length 200m are connected in parallel between two reservoirs.	**07**

The difference in water surface levels in two reservoirs is 15m. If the friction factor for each pipe is 0.3, calculate (i) rate of flow of each pipe (ii) diameter of a single pipe 200m long which would give the same flow rate if it were substitute for a original two pipes.

OR

Q.4	**(a)**	Define priming. Why priming is necessary in centrifugal pump?	**03**
	(b)	Explain Eulerian method to study the motion of fluid particles.	**04**
	(c)	Derive the equation of force exerted and work done by the jet when jet strikes tangentially at one of the tips on moving curved blades	**07**
Q.5	**(a)**	Give functions of splitter, breaking jet and spear used in pelton wheel turbine.	**03**
	(b)	Derive the equation of power absorbed in overcoming the viscous resistance in journal bearing.	**04**
	(c)	An inward flow reaction turbine has a degree of reaction 0.6. The peripheral velocity of the blade at entry is 10 m/s and velocity of flow is constant at 2.2 m/s. The rotor diameter at entry is twice that at exit. Neglecting frictional loses, find the blade angle at entry and exit. Water leaves the rotor without whirl sketch the shape and arrangement of the blades.	**07**

OR

Q.5	**(a)**	Give classification of pumps.	**03**
	(b)	Define draft tube. State functions served by draft tube.	**04**
	(c)	Derive the equation of minimum starting speed for a centrifugal pump.	**07**

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