Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3141906 Date:04/09/2021

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)**	Discuss hypothesis of continuum.	**03**
	(b)	Describe metacentric height and explain the position of the metacenter relative to the center of buoyancy.	**04**
	(c)	Discuss continuity equation in 3 dimensions.	**07**
Q.2	**(a)**	Discuss circulation and vorticity.	**03**
	(b)	Explain general equation for the variation of pressure due to gravity from a point to point in a static fluid.	**04**
	(c)	Explain Hagen Poiseuille formula for viscous flow.	**07**
		OR	
	(c)	Discuss characteristic curves of Hydraulic turbines with neat sketch.	**07**
Q.3	**(a)**	Explain dimensional analysis in brief.	**03**
	(b)	Discuss various types of fluid flows.	**04**
	(c)	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**
		OR	
Q.3	**(a)**	Explain Reynold's equipment with neat sketch.	**03**
	(b)	Explain torque converter.	**04**
	(c)	A jet of water having a velocity of 35 m/sec impinges on a series of vanes moving with a velocity of 20 m/sec. The jet makes an angle of 30° to the direction of motion of vanes when entering and leaves at an angle of 120 °. Draw velocity triangles and calculate: (a) The angles of vanes tips so water enters and leaves without shock (b) The work done per unit weight of water entering the vanes. (c) The efficiency	**07**
Q.4	**(a)**	Discuss geometric similarity, dynamic similarity and kinematic similarity.	**03**
	(b)	Explain journal bearing with the equation of power absorbed in friction.	**04**
	(c)	An inward flow reaction turbine has external and internal diameters as 1 m and 0.6 m respectively. The hydraulic efficiency of the turbine is 90% when the head on the turbine is 36 m. The velocity of flow at outlet is 2.5 m/sec and discharge at outlet is radial. If the vane angle at outlet is 15° and width of the wheel is 100 mm at inlet and outlet. Determine 1. The guide blade angle	**07**

2. Speed of the turbine
3. Vane angle of the runner at inlet
4. Volume flow rate of the turbine
5. Power developed

OR

Q.4 **(a)** Explain Hydraulic accumulator with neat sketch. **03**

(b) Discuss Bernoulli's theorem with necessary assumptions. **04**

(c) A Kaplan turbine working under a head of 20 m develops 11772 Kw shaft power. The outer diameter of the runner is 3.5 m and hub diameter 1.75 m. The guide blade angle at the extreme edge of the runner is 35 °. The hydraulic and overall efficiency of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine: **07**

1. Runner vane angles at inlet and outlet of the runner
2. Speed of the turbine

Q.5 **(a)** Types of notches & weirs **03**

(b) What is water hammer? Discuss its causes of occurrence. **04**

(c) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/sec. The vanes are set back at an angle of 40 ° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine **07**

1. Vane angle at inlet
2. Work done by the impeller on the water per second
3. Manometric efficiency

OR

Q.5 **(a)** Explain stream lines and path lines. **03**

(b) Explain characteristic curves of centrifugal pump with neat sketch. **04**

(c) Explain governing of hydraulic turbines with neat sketch. **07**

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