

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:	07
(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	
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	07
1. The guide blade angle	

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**
