

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V EXAMINATION – SUMMER 2025

Subject Code:2151903

Date:20-05-2025

Subject Name:Fluid Power Engineering

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) What is the role of a surge tank in a hydropower plant?	03
	(b) Explain the basic principle of operation of a hydraulic turbine. How does it convert hydraulic energy into mechanical energy?	04
	(c) With neat sketch explain construction and working of hydraulic press.	07
Q.2	(a) Derive an expression for the force exerted by a jet of water striking on symmetric curved vane at the center.	03
	(b) Explain the principle of jet propulsion in ships.	04
	(c) A jet of water having a velocity of 25 m/sec impinges on a series of vanes moving with a velocity of 15 m/sec. The jet makes an angle of 25° to the direction of motion of vanes when entering and leaves at an angle of 120 °. 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
	OR	
	(c) A jet of water having a velocity of 40 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock.	07
Q.3	(a) What is the function of a draft tube in reaction turbines?	03
	(b) Explain the advantages of Kaplan turbine over Francis turbine.	04
	(c) A Pelton Wheel is to be designed for the following specifications: Power (Shaft/Brake) = 9560 KW Head = 350 m Speed = 750 RPM Overall Efficiency = 85 % Jet diameter not to be exceed $1/6^{\text{th}}$ of the Wheel diameter Determine the following: (1) The Wheel Diameter (2) Diameter of the Jet (3) The number of Jets required. Take $C_v = 0.985$ and Speed ratio = 0.45.	07

OR

- Q.3** (a) Name the main components of a Kaplan turbine with neat sketch. **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) An inward flow reaction turbine has external and internal diameters as 1.1 m and 0.7 m respectively. The hydraulic efficiency of the turbine is 95% when the head on the turbine is 38 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
- Q.4** (a) What is Net Positive Suction Head (NPSH)? **03**
 (b) What is the volumetric efficiency of a reciprocating pump? Discuss the factors that affect its efficiency. **04**
 (c) A centrifugal pump is to discharge $0.118 \text{ m}^3/\text{s}$ at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and Manometric efficiency is 75 percent. Determine the Vane angle at the outer periphery of the impeller. **07**
- OR**
- Q.4** (a) What is a reciprocating pump? Define discharge coefficient in the context of reciprocating pumps. **03**
 (b) Discuss characteristic curves of centrifugal pump. **04**
 (c) A single acting reciprocating pump has a plunger diameter of 250 mm and its stroke is 300 mm. The pump runs at a speed of 60 rpm and delivers 14 litres/s of water. Find the theoretical discharge in litres/s, coefficient of discharge and percentage slip. **07**
- Q.5** (a) Draw stage velocity diagram of an axial flow compressor. **03**
 (b) Classify the Rotary compressor. **04**
 (c) Explain the construction and working of a Reciprocating air compressor. **07**
- OR**
- Q.5** (a) What are the advantages of multistage compression? **03**
 (b) Give comparison between axial flow and centrifugal compressor. **04**
 (c) Explain phenomenon of surging and choking in centrifugal compressor with neat sketch. **07**
