Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Fluid Machinery **Semester: IV**

Program: B.Tech Mechanical Engineering **Time : 03 hrs.**

Course Code: MECH2057 **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define the following for a Pelton wheel turbine a) Jet Ratio, b) speed ratio, c) Net head	**4**	**CO1**
Q 2	Compare impulse turbines and reaction turbines with examples.	**4**	**CO1**
Q 3	Write the major differences between the centrifugal and reciprocating pumps.	**4**	**CO1**
Q 4	With the help of a sketch, show the major components of a Pelton wheel turbine and write its working principle.	**4**	**CO1**
Q 5	A jet of water 80 mm in diameter and having a velocity of 20 m/s impinges at the centre of a hemispherical vane. The linear velocity of the vane is 10 m/s in the direction of the jet. Find the force exerted on the vane	**4**	**CO2**

SECTION B

(4Qx10M= 40 Marks)

Q 6	A jet of water, 60 mm in diameter, strikes a curved vane at its center with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plate to be smooth, find: a) Thrust on the plate in the direction of the jet. b) Power of the jet. c) Efficiency of the jet.	**10**	**CO2**

	OR A jet of water, 80 mm in diameter and having a velocity of 20 m/s, impinges at the center of a hemispherical vane. The linear velocity of the vane is 10 m/s in the direction of the jet. Find: a) The force exerted on the vane. b) How would this force change if the jet impinges on a series of vanes attached to the circumference of a wheel?		
Q 7	a) What is the specific speed of a turbine? b) A turbine is to operate under a head of 25 m at 200 rpm. The discharge (flow rate) is 9 m^3/s. If the overall efficiency is 90%, determine: (i) Specific speed of the machine (ii) Power generated. (iii) Type of the turbine [2+8 marks]	**10**	**CO4**
Q 8	a) Define unit speed and unit power of a hydraulic turbine. b) A turbine develops 9000kW power when running at 100rpm at 30 m head. If the head of the turbine is reduced to 18 m, determine the speed and power developed of the turbine. [3+7 marks]	**10**	**CO4**
Q9	A jet of water strikes a symmetrical curved vane, moving in the direction of the jet. The jet is striking the vane at its center. Derive the expression for a) the axial force acting on the vane b) hydraulic efficiency c) condition (speed ratio) for maximum hydraulic efficiency.	**10**	**CO2**

SECTION-C (2Qx20M=40 Marks)			
Q 10	a) A Kaplan turbine develops 22000 kW at an average head of 35 m. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 88%, calculate the diameter, speed (RPM) and specific speed of the turbine. b) A single-acting reciprocating pump operating at 120 r.p.m. has a piston diameter of 200 mm and stroke of 300 mm. The suction and delivery heads are 4 m and 20 m respectively. If the efficiency of both suction and delivery strokes is 75%, determine the power required by the pump. [12+8 marks]	**20**	**CO3**
Q 11	The internal and external diameters of the impeller of a centrifugal pump are 200mm and 400 mm, respectively. The pump is running at 1200 rpm. The vane angles of the impeller at the inlet and outlet are 20˚ and 30˚ respectively. The water enters the impeller radially, and the velocity of the flow is same at the inlet and outlet. Determine the rate of work done by the impeller per unit weight of the water. OR The following data is given for a Francis Turbine. Net Head H= 60m, Speed = 700 rpm, Shaft Power = 294.3 kW, Overall efficiency = 84%, Hydraulic Efficiency = 93%, Flow Ratio = 0.20, Breadth ratio (B_1/D_1)= 0.1, D_1/D_2 = 2. The thickness of the vanes occupies 5% of the circumferential area of the runner. The discharge is Radial at the Outlet, and the velocity of flow is constant at the inlet and outlet. Determine: a) Guide Vane Angles b) Runner Vane Angles at the inlet and outlet c) Diameter of runner at inlet and outlet d) Width of the wheel at the inlet.	**20**	**CO3**