Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

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 followings for a hydraulic turbine. a) Hydraulic efficiency b) Mechanical efficiency c) Overall efficiency	**4**	**CO1**
Q 2	Draw a schematic sketch of Reciprocating pump and show its major components.	**4**	**CO1**
Q 3	Write the major differences between the centrifugal and reciprocating pumps.	**4**	**CO1**
Q 4	With help of a sketch show the major components of a Pelton wheel turbine	**4**	**CO1**
Q 5	For a hydraulic turbine the power output (shaft power) is 20kW. If the overall efficiency of the turbine 80% and the Mechanical efficiency is 90%. Calculate the water power and the runner power.	**4**	**CO2**

SECTION B

(4Qx10M= 40 Marks)

Q 6	A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to a plate that moves away from the jet at 6 m/s. Find the following: i. The force on the plate, ii. The work done on the plate by the jet and iii. The hydraulic efficiency of the jet.	**10**	**CO2**

Q 7	a) What is 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. OR A single-acting reciprocating pump, running at 50 r.p.m. delivers 0.00736 m^3/s of water. The diameter of the piston is 200 mm and stroke length 300 mm. The suction and delivery heads are 3.5 m and 11.5 m respectively. Determine: a) Theoretical discharge b) Co-efficient of discharge c) Percentage slip of the pump and d) Power required to run the pump.	**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	**20**	**CO3**

	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]		
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 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 A Pelton wheel is working under a gross head of 400 m. The water is supplied through penstock of diameter 1 m and length 4 km from reservoir to the Pelton wheel. The co-efficient of friction for the penstock is given as 0.008. The jet of water of diameter 150 mm strikes the buckets of the wheel and gets deflected through an angle of 165°. The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of the buckets is 0.45 times the jet velocity at the inlet and mechanical efficiency as 85% then determine: a) Power given to the runner or the Runner power, b) Shaft power, c) Hydraulic efficiency and overall efficiency	**20**	**CO3**