Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2151903 **Date: 01/05/2017**

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.**

Q1		Answer following short questions	14
	(1)	Only state essential components of Hydro Electric Power Plant.	
	(2)	Write the Impulse Momentum equation	
	(3)	The maximum efficiency of Jet propulsion with inlet orifices facing the direction of motion of the ship is given by_____.	
	(4)	Define the specific speed of Turbine.	
	(5)	What is Draft tube?	
	(6)	What is phenomenon of Cavitation?	
	(7)	Give specific speed range of Francis turbine.	
	(8)	State the objective of impellers of pump in series.	
	(9)	What is NPSH?	
	(10)	What is priming?	
	(11)	Why Reciprocating pump cannot run at high speed?	
	(12)	Why clearance volume is provided in Reciprocating Compressor?	
	(13)	What do you understand by Roto-dynamic Pump?	
	(14)	What is meant by a stage in an axial compressor?	
Q2	(a)	Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of jet when the jet strikes at the centre of semi-circular plate is two times the force exerted by the jet on a fixed vertical plate.	03
	(b)	Obtain expression for the efficiency and maximum efficiency of jet propulsion when inlet orifices are at right angle to ship.	04
	(c)	A jet of water impinges on a symmetrically curved vane at the centre. The velocity of the jet is 60 m/sec and the diameter 120 mm. The jet is deflected through an angle of 120^0. Calculate the force on the vane if the vane is fixed. Also determine the force if the vane moves with a velocity of 25 m/sec in the direction of jet. What will be the power and efficiency?	07
		OR	
	(c)	A jet of water moving with the velocity 12 m/sec impinges on a concave shaped vane to deflect the jet through 120^0 when stationary. If the vane moves at 5 m/sec, determine the angle of jet so that there is no shock at the inlet. What is absolute velocity of water at the exit in magnitude and direction? Also find the work done per unit mass of water. Assume that the vane is smooth.	07
Q3	(a)	Explain with neat sketch the functions of three main components of Pelton turbine.	03
	(b)	Derive the equation of hydraulic efficiency of a Pelton turbine. Obtain condition for maximum hydraulic efficiency.	04

	(c)	A Pelton wheel is required to develop 4000 kW at 400 rev/min, operating under net head of 350m. There are two jets and the bucket deflection angle is 165^0. Calculate the bucket pitch circle diameter, the cross sectional area of each jet and the hydraulic efficiency of the turbine. Make the following assumptions (i) overall efficiency is 85% when the water is discharged from the wheel in a direction parallel to the axis of rotation(ii) Co-efficient of velocity of nozzle Kv=0.97 and the blade speed ratio Ku=0.46(iii) relative velocity of water at exit from the bucket is 0.86 times the relative velocity at inlet.	07
		OR	
Q3	(a)	Draw and explain main characteristic curves of Francis turbine.	03
	(b)	Explain governing of Francis turbine with neat sketch.	04
	(c)	Determine the main dimensions for a Francis turbine for the following conditions: Head 100m, Power 3000 kW, Speed 400 rpm, η_h= 0.89,η_o= 0.86,B_1=0.1D_1, flow ratio 0.2, D_1=2D_2, velocity of flow is constant.	07
Q4	(a)	Explain the effect of variation of discharge on the head of Centrifugal pump	03
	(b)	Define the slip in Centrifugal pump. Explain briefly with sketch, the slip in Centrifugal pump. How it can be eliminated?	04
	(c)	Test runs on the Centrifugal pump indicate that when driven at 2000 rpm, it discharges 10 m^3/min against a head of 100m. At this capacity the input is 300 kW. If a geometrical similar pump twice the size runs at 1500 rpm, find its discharge, head and power for the same efficiency.	07
		OR	
Q4	(a)	What are the functions of air vessels in Reciprocating pump? Where are they located?	03
	(b)	Compare Reciprocating pump with Centrifugal pump	04
	(c)	A Centrifugal pump impeller has diameter of 600mm and width of 60mm at the outlet. The pump runs at 1450 rpm and delivers 0.8 m^3/sec against a head of 80m.The leakage loss after the impeller is 4% of discharge, the mechanical loss is 10kW and the hydraulic efficiency is 80%.Determine the blade angle at the outlet, the power required and the overall efficiency of the pump.	07
Q5	(a)	Draw a neat sketch, and explain the operation of Hydraulic Accumulator.	03
	(b)	Explain with the help of neat sketch the principle and operation of Fluid torque converter.	04
	(c)	Explain the effect of blade shape of impellers on performance of Centrifugal compressor. Also classify the blades based on curvature.	07
		OR	
Q5	(a)	Draw a neat sketch, and explain the operation of Hydraulic Crane.	03
	(b)	Explain with the help of neat sketch the principle and operation of (i) Bramah's Hydraulic press.	04
	(c)	Sketch Symmetrical, Unsymmetrical aerofoil and compressor cascade. Define and show the important angles, chord, pitch etc.	07

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