

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2151903

Date: 08/11/2017

Subject Name: Fluid Power Engineering

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

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|-----|-----|--|---|
| Q.1 | (a) | Jet Propulsion. | 3 |
| | (b) | Prove that Force Exerted by the series of flat plate is 50% | 4 |
| | (c) | A jet of water impinges on a symmetrically curved vane at the center. The velocity of the jet is 60 m/sec and the diameter 120 mm. The jet is deflected through an angle of 120° . 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? | 7 |
| Q.2 | (a) | Explain: Hydraulic efficiency, Mechanical Efficiency. | 3 |
| | (b) | Write the Impulse Momentum equation. What is NPSH? | 4 |
| | (c) | Sketch Hydro Electric Power Plant and Explain its different element. | 7 |
| | | 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° 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. | 7 |
| Q.3 | (a) | Draw and explain main characteristic curves of Francis turbine | 3 |
| | (b) | Explain governing of Francis turbine with neat sketch. | 4 |
| | (c) | Determine the main dimensions for a Francis turbine for the following conditions: Head 100m, Power 3000 kW, Speed 400 rpm, $\eta_h = 0.89$, $\eta_o = 0.86$, $B_1 = 0.1D_1$, flow ratio 0.2, $D_1 = 2D_2$, velocity of flow is constant. | 7 |
| | | OR | |
| Q.3 | (a) | Explain with neat sketch the functions of three main components of Pelton turbine. | 3 |
| | (b) | Derive the equation of hydraulic efficiency of a Pelton turbine. Obtain condition for maximum hydraulic efficiency. | 4 |
| | (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° . 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 $K_v = 0.97$ and the blade speed ratio $K_u = 0.46$ (iii) relative velocity of water at exit from the bucket is 0.86 times the relative velocity at inlet. | 7 |
| Q.4 | (a) | What are the functions of air vessels in Reciprocating pump? Where are they located? | 3 |
| | (b) | Explain working principle of centrifugal compressor with pressure and velocity diagram. | 4 |
| | (c) | Explain the effect of blade shape of impellers on performance of Centrifugal compressor. Also classify the blades based on curvature. | 7 |
| | | OR | |
| Q.4 | (a) | Explain slip factor and power input factor for centrifugal compressor. | 3 |
| | (b) | Explain with the help of neat sketch the principle and operation of Fluid torque converter. | 4 |

	(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.	7
Q.5	(a)	Draw a neat sketch, and explain the operation of Hydraulic Accumulator	3
	(b)	Compare Reciprocating pump with Centrifugal pump	4
	(c)	For 50% degree reaction of axial flow compressor prove $\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$, notations carry usual meaning.	7
		OR	
Q.5	(a)	Write a short on Hydraulic Ram.	3
	(b)	Draw a neat sketch, and explain the operation of Hydraulic Crane.	4
	(c)	Explain Fluid Coupling with neat sketch.	7
