Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:2151903 **Date:03/02/2021**

Subject Name:Fluid Power Engineering

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Draw general layout of hydro power plant with essential components.	**03**
	(b)	Classify hydro power plant	**04**
	(c)	Derive expression of work done for impact of jet on a moving inclined plate.	**07**
Q.2	**(a)**	Explain principle of jet propulsion	**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 is 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?	**07**
Q.3	**(a)**	Differentiate between impulse and reaction hydraulic turbines.	**03**
	(b)	Explain with neat sketch the functions of main components of Pelton turbine.	**04**
	(c)	A Pelton wheel is required to develop 4000 kW at 400 rev/min, operating under net head of 350 m. 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 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**
Q.4	**(a)**	Compare Francis and Kaplan Turbine	**03**
	(b)	Derive the equation of hydraulic efficiency of a Pelton turbine. Obtain condition for maximum hydraulic efficiency.	**04**
	(c)	A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 120 cm and the flow area is 0.4 m^2. The angle made by absolute and the relative velocity at inlet are 20° and 60° respectively with a tangential velocity. Determine: (i) volume flow rate. (ii) power developed (iii) hydraulic efficiency.	**07**
Q.5	**(a)**	What is pump? Classify Pumps.	**03**
	(b)	What is cavitation? What are its effects?	**04**
	(c)	The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 rpm. Assuming a constant flow velocity through the impeller at 2.5 m/s and that the vanes at the exit	**07**

are set back at angle of 25°. Determine (i) Inlet vane angle (ii) The angle absolute velocity of water makes with the tangent at the exit and (iii) The work done per unit weight of water.

Q.6	**(a)**	Define and derive specific speed relation for pump.	**03**
	(b)	Explain submersible pump with advantages and disadvantages	**04**
	(c)	Write down difference between Positive displacement pumps and Rotodynamic pumps.	**07**
Q.7	**(a)**	Draw a neat sketch, and explain the operation of Hydraulic Accumulator.	**03**
	(b)	What is pre-whirl? Explain the effect of Pre-whirl in centrifugal compressor.	**04**
	(c)	Explain the effect of blade shape of impellers on performance of Centrifugal compressor. Also classify the blades based on curvature.	**07**
Q.8	**(a)**	Draw a neat sketch, and explain the operation of Hydraulic Crane.	**03**
	(b)	Give comparison between axial flow and centrifugal compressor	**04**
	(c)	A centrifugal compressor running at 12000 rpm delivers 1.3 m^3/s of free air. The pressure and temperature at inlet are 1 bar and 25°C. The compression ratio is 5, blades are radial at outlet, the velocity of flow is 58 m/s and is constant throughout. Assume slip factor is 0.9 and isentropic efficiency is 84 % . Determine (i) temperature of air at outlet, (ii) impeller diameter and blade angle at inlet and (iii) power required. Assume inlet diameter of impeller half of outlet diameter of impeller	**07**

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