

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- V EXAMINATION – SUMMER 2020****Subject Code: 2151903****Date: 28/10/2020****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.

		MARKS
Q.1	(a) Classify hydro- electric power plant.	03
	(b) A Pelton wheel develops 2500 K W under the head of 250 the overall efficiency of the turbine is 85% if speed ratio is 0.46 $C_v = 2.98$ and specific speed is 18.5 then calculate 1) Diameter of turbine, 2) Diameter of the jet.	04
	(c) A Pelton wheel is to be designed for the following specification power 750 KW, head 200 m, speed 800 rpm, overall efficiency 86%, jet ratio is one tenth of wheel diameter take efficient of velocity 0.98, speed ratio 0.45. Calculate 1) wheel diameter, 2) diameter of jet 3) width of the bucket 4) depth of buckets 5) number of buckets 6) Number of jets	07
Q.2	(a) With usual notations derive generalized expression for work done for impact of jet on a moving inclined plate.	03
	(b) A jet propelled boat moving with velocity of 5 m/s draws water amid-ship. The total area of Jet is 375 cm^2 , if the total resistance affected to the motion of boat is 5,000 N. Determine volume of water drawn by the pump per second and efficiency of the jet propulsion.	04
	(c) A conical draft tube having 2 m diameter at the top and pressure head as 7 m of water (vacuum) discharges water at the outlet with a velocity of 1.2 m/s at the rate of $30 \text{ m}^3/\text{s}$. If the atmospheric pressure head is 10.3 m of water and losses between inlet and outlet of draft tube are negligible. Calculate length of draft tube immersed in water. Total length of draft tube is 5 m.	07
	OR	
	(c) A single acting two stage compressor with complete intercooling deliver 10.5 kg/ min of 16 bar, the suction occurs at 1 bar and 27°C . The compression and expansion process are reversible, polytropic index $n = 1.3$ calculate 1) Power required to drive the compressor 2) The isothermal efficiency 3) Free air delivery 4) the heat transfer in intercooler .The compressor runs at 440 RPM. If the clearance ratio of low pressure and high pressure cylinder are 0.04 and 0.06 respectively calculate the swept and clearance volume for each cylinder.	07
Q.3	(a) List application of following: Screw compressor, Scroll Compressor, Reciprocating compressors	03

- (b) Draw and explain main characteristic curves of Francis turbine. **04**
- (c) Justify the need of multi-staging, with schematic p-v and T-S diagram explain two stage compression. **07**
- OR**
- Q.3** (a) Define the following: Free air delivery, compressor capacity, piston speed. **03**
- (b) What is specific speed? Derive an expression for specific speed of a turbine. **04**
- (c) Explain construction working of scroll compressor. State its advantages disadvantages and its application. **07**
- Q.4** (a) Explain the phenomena of surging and stalling in an axial flow compressor. **03**
- (b) What are air vessels? What shortcomings of the pump are made up by providing air vessel? **04**
- (c) The impeller of a centrifugal pump has blades which are swept backwards and make an acute angle ϕ with the tangent to the outer periphery. The pump has no diffuser, the velocity of flow is constant and absolute velocity of water at inlet is radial assuming flow through the impeller is frictionless and streamlines, develop from first principle that theoretical the ratio rise in pressure head in in m = $\frac{1[1 + V_{f1} \cot \phi]}{2 V_1}$
 work done/ sec /kg flow in impeller **07**
- OR**
- Q.4** (a) Compare centrifugal and reciprocating pumps. **03**
- (b) Justify the circumstances under which separation can occur in a reciprocating pump. **04**
- (c) In a eight stage axial flow compressor the overall stagnation pressure ratio is 5:1 with an overall isentropic efficiency of 90%. The inlet stagnation temperature and pressure are 292 K and 1 bar. The work is divided equally between the stages. The mean blade speed is 165 m/s and 50 % reaction is used. The axial velocity through the compressor is constant and is equal to 95m/s, calculate 1) Blade angles, 2) power required. **07**
- Q.5** (a) With neat sketch explain construction and working of hydraulic ram. **03**
- (b) State functions of draft tube and explain with neat sketches different types of draft tubes. **04**
- (c) A centrifugal compressor running at 10000 RPM deliver 660 m³/min of free air. The air is compressed from 1 bar and 20 °C to a pressure ratio of 4 with an isentropic efficiency of 82%. Blades are radial at outlet of impeller and flow velocity is 62 m/s may be assumed constant throughout. The outer radius of impeller is twice the inner and slip factor may be assumed as 0.9. The blade area coefficient is 0.98 inlet. Calculate 1)Final temperature of air 2)Theoretical power 3) Impeller diameter at inlet and outlet 4) Breadth of impeller at inlet 5) Impeller blade angle at inlet 6) Diffuser blade angle at inlet **07**
- OR**
- Q.5** (a) Define the following terms relating to centrifugal compressor: stagnation temperature, Isentropic efficiency, pre-whirl. **03**

- (b) A hydraulic lift is required to lift a load of 10 K N through a height of 12 m once in every 80 sec. The speed of the lift is 0.5 m/ s determine 1) Power required to drive the lift 2) Working period of lift in sec 3) Idle period of lift in sec. 04
- (c) Investigate the effect of blade shapes of impellers on performance of centrifugal compressor, also classify the blades based on curvature. 07

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