Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2021

Subject Code:3150102   **Date:13/09/2021**

Subject Name:Fundamentals of Turbomachines

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Give the difference between impulse turbine and reaction turbine.	**03**
	(b)	Discuss the mechanism of pressure rise achieved in centrifugal compressor.	**04**
	(c)	A centrifugal air compressor delivers 18.2 kg/s of air with a total head pressure ratio of 4 to 1. The speed of the compressor is 15000 rpm. Inlet total head temperature is 15^0C, Slip Factor 1.04, and 80% isentropic efficiency. Calculate the overall diameter of the impeller.	**07**
Q.2	**(a)**	Differentiate turbo-machines and positive displacement machines.	**03**
	(b)	What is slip factor? Why it is considering for design of turbo machine.	**04**
	(c)	The mean diameter of the blades of an impulse turbine with a single row wheel is 105 cm. and speed is 3000 rpm. The nozzle angle is 18^0, the ratio of blade velocity to gas velocity is 0.42 and the ratio of the relative velocity at outlet from the blade to that at inlet is 0.84. The outlet angle of the blade is to be made 3^0 less than the angle. The gas flow is 8 kg/s. Draw the velocity diagram for the blades and calculate the following. (a) Resultant trust on the blades (b) Tangential trust on the blades (c) Axial trust on the blades (d) Power developed by the blades (e) Blading efficiency.	**07**

OR

	(c)	The following particulars refer to a stage of a Reaction turbine comprising one ring of fixed blades and one ring of moving blade, Mean diameter of blade ring is 70 cm, 3000 rpm, gas velocity at exit from blades is 160 m/s, blade outlet angle 20^0, gas flow through blades 7 kg/s, Draw the velocity diagram and find the following, (a) Blade inlet angle, (b) Tangential force on the ring of moving blade (c) Power developed in a stage.	**07**
Q.3	**(a)**	What is relative velocity in velocity triangle and why it is different than absolute velocity?	**03**
	(b)	Explain in the detail the losses in turbo machines.	**04**
	(c)	Evaluate relations between different velocities and angles in 50% degree of reaction stages of an axial compressor. Also draw velocity triangles for the same.	**07**

OR

Q.3	**(a)**	What is the effect of blade friction on turbine performance?	**03**
	(b)	What is Degree of Reaction? Draw h-s diagram for 50% reaction axial turbine stage.	**04**

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	(c)	Draw and explain the complete velocity triangle for Axial Turbine stage and derive the expressions for work developed by the turbine and degree of reaction.	**07**
Q.4	**(a)**	Classify the turbo machines and list the differences between axial and radial turbo machines.	**03**
	(b)	Why centrifugal compressors have volute diffuser?	**04**
	(c)	Find expressions for the force, work done, diagram efficiency, gross stage efficiency and axial trust for an impulse turbine.	**07**

OR

Q.4	**(a)**	What is the principle of operation of Radial turbine?	**03**
	(b)	What is a free vortex volute? How is its shape determined?	**04**
	(c)	What is stagnation enthalpy in an axial turbine stage? Explain briefly.	**07**

Q.5	**(a)**	What is a nozzle and what is its function?	**03**
	(b)	Draw h-s diagram of an axial flow compressor.	**04**
	(c)	With the help of diagram, explain the various components of centrifugal compressor.	**07**

OR

Q.5	**(a)**	What is the main purpose of compressor in jet engines?	**03**
	(b)	Draw velocity triangles for the three types of impeller for centrifugal compressor.	**04**
	(c)	Write a short note on stalling and surging of compressor.	**07**

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