Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3150102 Date: 03/07/2023

Subject Name: Fundamentals of Turbomachines

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

			MARKS
Q.1	**(a)**	Define Turbomachines.	**03**
	(b)	Write an importance of Rotor blade in Axial flow compressor stage.	**04**
	(c)	Briefly explain:- "Difference between positive displacement machine and turbomachines".	**07**
Q.2	**(a)**	1. What is the effect of increasing flow coefficient (Φ) in an axial flow compressor on blade loading coefficient (Ψ)? a. Blade loading coefficient (Ψ) increases b. Blade loading coefficient (Ψ) decreases c. Blade loading coefficient (Ψ) remains constant d. Unpredictable 2. What is the effect of increasing number of stages in axial flow compressor on the mean work input factor (Ψ_w)? a. Mean work input factor (Ψ_w) decreases b. Mean work input factor (Ψ_w) increases c. Mean work input factor (Ψ_w) remains constant d. Unpredictable 3._____ can be defined as the ratio of the pressure rise in rotor blades to the pressure rise in stages in an axial flow compressor. a. Degree of pressure b. Degree of reaction c. Pressure ratio d. Reaction ratio	**03**
	(b)	Difference between Compressor and Turbine with proper sketch.	**04**
	(c)	Draw and Explain Pressure – Velocity variation for axial compressor stage.	**07**
		OR	
	(c)	Draw and explain H-S diagram for flow through an IFR turbine stage with an exhaust diffuser.	**07**

Q.3	**(a)**	Explain working principle of Turbine.	**03**
	(b)	1. What is the ratio of isentropic work to Euler work in an centrifugal compressor called? a. Work coefficient b. Velocity coefficient c. Pressure coefficient d. Flow coefficient 2. The ratio of actual whirl velocity to the ideal whirl velocity in the centrifugal compressor is called as _____. a. velocity factor b. slip factor c. work factor d. none of the above	**04**
	(c)	An air compressor has 4 stages of equal temperature rise 50K. The conditions of air at entry are 1 bar, 40^0C, Take polytrophic efficiency 87%. Find out 1. Pressure ratio 2. Efficiency of each stage 3. Overall efficiency of the compressor.	**07**
		OR	
Q.3	**(a)**	Define Flow co-efficient with appropriate equation.	**03**
	(b)	Explain with examples the power generating, power absorbing and power transmitting turbomachines.	**04**
	(c)	Draw and explain with equations velocity triangle for an axial compressor stage.	**07**
Q.4	**(a)**	Draw a curve for Expansion process in nozzle	**03**
	(b)	Draw a graph graph "variation of utilization factor and stage efficiency with blade-to-gas ratio".	**04**
	(c)	Draw and explain with equations velocity triangle for an axial turbine stage.	**07**
		OR	
Q.4	**(a)**	Define Centrifugal compressor.	**03**
	(b)	Write a note on stage losses for radial turbine stage	**04**
	(c)	Explain General matching procedure of jet engines.	**07**
Q.5	**(a)**	Draw performance characteristics of different types of centrifugal compressor.	**03**
	(b)	Explain Determination and procedure to find equilibrium points.	**04**
	(c)	Draw H-S diagram of Radial turbine stage.	**07**
		OR	
Q.5	**(a)**	Difference between axial turbine and radial turbine.	**03**
	(b)	Explain Performance charts.	**04**
	(c)	Write a note on Turbine Blade Cooling techniques.	**07**

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