Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022

Subject Code:3171927 Date:16-01-2023

Subject Name:Turbo Machines

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)**	Distinguish between Turbo machines with positive displacement machines.	**03**
	(b)	Prove that the turbine overall efficiency is greater than the turbine stage efficiency.	**04**
	(c)	What are geometric, kinematic and dynamic similarities? State two governing parameters for each kind of similarity.	**07**
Q.2	**(a)**	Why radial gas turbines and compressors are not suitable for large power applications?	**03**
	(b)	Describe two industrial applications for each of the following machines: Gas turbines, gas compressors and low pressure fans. Explain their roles in the overall systems.	**04**
	(c)	With necessary velocity triangles and assumption derive the expression for effect of blade discharge angle on energy transfer and degree of reaction for radial flow machines.	**07**
		OR	
	(c)	Define Degree of reaction. Obtain an expression for Utilization factor in terms of degree of reaction and absolute velocities.	**07**
Q.3	**(a)**	Explain blade to gas speed ratio of axial flow turbine?	**03**
	(b)	Show graphically the variation of efficiency with specific speed of the axial flow compressor.	**04**
	(c)	Obtain an expression for the degree of reaction of axial flow compressor in terms of rotor blade angles, axial velocity and blade speed. Assume axial velocity remains constant.	**07**
		OR	
Q.3	**(a)**	Discuss the need for compounding. Name the different methods of compounding.	**03**
	(b)	Explain the principle of outward flow radial cascade. Describe its effects.	**04**
	(c)	Explain the phenomenon of slip in centrifugal compressors and also explain significance of slip factor in deciding number of vanes.	**07**
Q.4	**(a)**	Define and explain “total to total efficiency” and “total to static efficiency”.	**03**
	(b)	What are the various parameters that affect the losses in the cascade of blades of axial machines?	**04**
	(c)	Explain the working principle of the axial flow compressor along with a neat sketch of compressor with inlet guide vane.	**07**
		OR	
Q.4	**(a)**	Give Energy flow diagram for an axial flow compressor stage.	**03**

	(b)	What is the purpose of inlet guide vanes and inducer blades in centrifugal compressor? explain briefly.	**04**
	(c)	Describe with the aid of illustrative sketches the working of a centrifugal compressor stage. State three advantages of such a machines over an axial type	**07**
Q.5	**(a)**	How are the static and total efficiencies of fans defined?	**03**
	(b)	List the aerodynamic losses occur in the radial turbine stage.	**04**
	(c)	Draw and explain Pressure coefficient V/s Flow coefficient, Performance characteristics of different types of centrifugal impeller.	**07**

OR

Q.5	**(a)**	What is the use of CFD for Turbo machineries analysis and design?	**03**
	(b)	Explain in details about the flow analysis in impeller blades-volute and diffusers in fans and blowers.	**04**
	(c)	How is the volumetric efficiency of fans and blowers defined? What are the various factors which govern this efficiency?	**07**

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