GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3171927   **Date:13-11-2025**

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)**	What is main difference between fan, blower and compressor?	**03**
	(b)	What are the main differences between incompressible and compressible flow machines?	**04**
	(c)	Draw stage velocity triangles at the entry and exit for Axial flow turbines. Discuss stage losses.	**07**
Q.2	**(a)**	What are Reynolds and Mach number? Write down their expression.	**03**
	(b)	Discuss Effect of Exhaust Diffuser in radial stage turbine.	**04**
	(c)	Explain the significance of the blade-to-gas speed ratio in axial flow turbines and how it affects the turbine's efficiency and performance.	**07**

OR

	(c)	Describe the differences between a single impulse stage and a multistage velocity compounded impulse turbine in terms of energy extraction and efficiency.	**07**
Q.3	**(a)**	What information can you learn from a velocity triangle in an axial flow turbine?	**03**
	(b)	How would you analyze and compare the performance characteristics of radial flow turbine under varying load conditions?	**04**
	(c)	Given the enthalpy and entropy values from an axial flow compressor's performance data, how would you plot the h-S diagram and calculate the overall (isentropic) efficiency of the compressor?	**07**

OR

Q.3	**(a)**	How can you use a velocity triangle to analyze the performance of an axial flow turbine stage?	**03**
	(b)	How would you design an axial flow turbine using compounding techniques to achieve higher efficiency	**04**
	(c)	With suitable sketch explain the working principle of an axial flow compressor and stage velocity triangles.	**07**
Q.4	**(a)**	Draw a sketch of the two-stage axial flow compressor with inlet guide vanes.	**03**
	(b)	What is surging in axial-flow compressors? What are its effects?	**04**
	(c)	A multistage axial compressor is required for compressing air at 293 K, through a pressure ratio of 5 to 1. Each stage is to be 50% reaction and the mean blade speed 275 m/s, flow coefficient 0.5, and stage loading factor 0.3, are taken, for simplicity, as constant for all stages. Determine the flow angles and the number of stages required if the stage efficiency is 88.8%. Take Cp = 1.005 kJ/(kg°C) and g = 1.4 for air.	**07**

OR

Q.4	**(a)**	What is diffuser? Draw Diffuser ring with cambered blades.	**03**
	(b)	List out and explain losses in centrifugal compressor.	**04**
	(c)	Explain the phenomenon of slip in centrifugal compressors and also explain significance of slip factor in deciding number of vanes.	**07**

Q.5	**(a)**	State losses in centrifugal compressor.	**03**
	(b)	Classify 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**

OR

Q.5	**(a)**	Give Energy flow diagram for an axial flow compressor stage.	**03**
	(b)	Define the volumetric efficiency of fans and blowers?	**04**
	(c)	How would you analyze the flow characteristics through the impeller blades, volute, and diffusers in a centrifugal fan or blower to optimize its performance for a given application? What steps would you take to ensure that the design minimizes losses and achieves the desired airflow and pressure?	**07**

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