



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**  
**Subject Code: 3171927**  
**Semester –VII**

**Subject Name: Turbo machines**

**Type of course:** Professional Elective

**Prerequisite:** Fluid Mechanics and Thermodynamics

**Rationale:** Turbines, compressors and fans are required to study as all turbo machines and their basic rotating components. The subject offers the thorough knowledge of fluid flow pattern, basic working principles and need of rotating element as per its requirement in all kind of turbo machines.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

**Suggested Specification table with Marks (Theory):**

Sr. No.	Content	Total Hrs
1	<b>Introduction to Turbomachineries:</b> turbines, pumps and compressors, fans and blowers, compressible flow machines, incompressible flow machines Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless parameters-specific speed-applications-stage velocity triangles-work and efficiency.	07
2	<b>Axial Flow Turbines:</b> Introduction, Stage velocity triangle, Single impulse stage, Multistage velocity compounded impulse and Multistage pressure compounded impulse, Reaction stages, Blade to gas speed ratio, Losses and efficiencies, Performance charts, Low hub-tip ratio stage. <b>Radial Flow Turbines:</b> Elements of radial turbine stage, Stage velocity triangles, H-S diagram, Stage losses, Outward flow radial stage and Performance characteristics.	12
3	<b>Axial Flow Compressor:</b> Introduction. Geometry and working principle, Stage velocity triangles, H-S diagram. Flow through blade row, Stage losses and efficiency, Work done factor, Low hub-tip ratio, Supersonic and transonic stages, Performance characteristics	08
4	<b>Centrifugal Compressor:</b> Introduction and different parts of centrifugal compressor, Principles of operation. H-S diagram. Nature of impeller flow, Slip factor, Diffuser, Volute casing, Performance characteristics and losses in centrifugal compressor.	08
5	<b>Fans and Blowers:</b> Fan and Blowers types-stage and design parameters-flow analysis in impeller blades-volute and diffusers, losses, characteristic curves and selection, drives and noise. Noise problems in fans and Blowers	07



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6	Use of CFD for Turbo machineries analysis and design.	03
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Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	40	20	0	0

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand to apply physics of flow through turbomachines.	15
CO-2	Understand the analysis of radial and axial flow turbines, its losses and performance	35
CO-3	Understand the analysis of centrifugal and axial flow compressors, its losses and performance	35
CO-4	Understand the fan and blowers machines their need and it's applications	15

### List of Experiments:

1. Study or performance of axial flow turbines performance and its efficiency.
2. Study or performance of Radial flow turbines performance and its efficiency.
3. Study or performance of axial flow Compressors performance and its efficiency.
4. Study or performance of centrifugal compressors performance and its efficiency.
5. Performance study of axial fan
6. Study of centrifugal air blower

### Reference Books:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., latest edition.
- 3.
4. Principals of Turbomachines, D. G. Shepherd, The Macmillan Company (1964)
5. Fluid Mechanics & Thermodynamics of Turbomachines, S. L. Dixon, Elsevier (2005)
6. Text Book of Turbomachines, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008
7. Turbomachine, B.K.Venkanna PHI, New Delhi 2009



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List of Open Source Software/learning website:  
<https://nptel.ac.in/courses/101/101/101101058/>

Major Equipment: Apparatus for Axial and Radial Turbines, Axial fan apparatus, Test rig for Centrifugal compressor and computer systems for CFD