GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Mechanical (Thermal)

Subject Code : ME02083011

Course / Subject Name: Advanced Thermal Turbo Machines

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective

Prerequisite:	Nil
Rationale:	The course is designed to discuss the advanced and relevant technologies of turbo machineries and related system components.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Apprise the principles and energy transfer process for various thermal turbo machines.	Evaluate
2	Explain the structural and functional aspects of major components of turbo machines.	Understand
3	Analyse the turbo machines to improve and optimize its performance	Analyze
4	Explain control and maintenance aspects of turbo machines.	Understand

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Fundamentals and Principles of Turbo Machines:** Turbo machines: classifications, applications, fundamental laws and equations, specific speed, thermodynamic and dimensional analysis applied to turbo machines, transfer of energy to fluids, performance characteristics with standard curves, comparison and selection criteria of various turbo machines	08	18
2.	**Centrifugal and Axial Flow Compressors:** Centrifugal blowers and compressors, Euler's characteristics and velocity triangles of centrifugal compressor, hydraulic efficiency, analysis of flow through impeller, diffusers and casing, pressure recovery, slip factor, disc friction, Stanitz and Stodola formula, axial flow fans and compressors, geometry of axial flow compressor, velocity diagrams, vortex and airfoil theory, stage pressure ratio, degree of reaction, stage	17	38

	design, surge, chocking and stall, blade twist and design considerations for supersonic flow		
3.	**Analysis of Axial & Radial Flow Gas Turbines:** Work done, velocity triangles and efficiencies, thermodynamic flow analysis, Zweifels relation, cascade analysis, Soderberg– Hawthrone – Ainley correlation, secondary flow, blade angles for variable degree of reaction, stresses in blades, blade assembling, materials and cooling of blades, matching of compressor and turbine; off-design performance	15	32
4.	**Testing and control of Turbo Machines:** Performance testing, noise control, speed control, throttling control at discharge and inlet and maintenance of fans, blowers, compressors, and turbines	05	12
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
-	**20**	**20**	**40**	**20**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Axial Flow Compressors: Fluid Mechanics and Thermodynamics by J. H. Horlock, Krieger Publishing
2. Centrifugal Pumps and Blowers, Austin H. Church, John Wiley and Sons
3. Element of Gas Dynamics by S. M. Yahya, McGraw Hill Publishers
4. Fluid dynamics and heat Transfer of Turbo machinery, Budugur Lakshminarayana, John Wiley and Sons
5. Fundamentals of Turbo machinery, William W Perg, John Wiley & Sons
6. Handbook of Turbo machinery, Edited by Earl Logan Jr, Ramendra Roy, Marcel
7. Theory and practice of Steam Turbines, WJ Kearton, ELBS Pitman
8. Turbines, Pumps, Compressors by S. M. Yahya, McGraw Hill Publishers

(b) Open-source software and website:

1. Students should refer to video lectures available on the websites including NPTEL.

Suggested Course Practical List: During practical sessions, students may be asked to solve problems including open ended problems. Students may also be asked to develop and run computer programs for analysis level of problems.

List of Laboratory/Learning Resources Required:

Suggested Project List:

Suggested Activities for Students: Students are required to download 3-5 research papers from reputed international journals on the recent advancement in the areas of turbo machines. They need to go through the same and prepare a review for the research papers. The review should have three parts: Summary, Critical Evaluation and Creative synthesize

Any Other:

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