GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3732106
Semester – III
Subject Name: Advanced Thermal Turbo Machines

Type of course: Elective

Prerequisite: Nil

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

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Fundamentals of Turbo Machines:** Introduction to turbo machines, classifications, applications, fundamental laws and equations, specific speed, thermodynamic and dimensional analysis applied to turbo machines.	05
2	**Principles of Turbo Machines**: Transfer of energy to fluids, performance characteristics with standard curves, comparison and selection criteria of various turbo machines	04
3	**Centrifugal & 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 formulas, axial flow fans and compressors, geometry of axial flow compressor, velocity diagrams, vortex and airfoil theory, stage pressure ratio, degree of reaction, stage design, surge, chocking and stall, blade twist and design considerations for supersonic flow.	15
4	**Analysis of Axial & Radial Flow Gas Turbines:** Work done, velocity triangles and efficiencies, thermodynamic flow analysis, Zweifels relation, cascade analysis, Soderberg–Hawthrone – ainley-correlations, 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.	14
5	**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.	04

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**20**	**20**	**10**

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.

Reference Books:

1. Axial Flow Compressors: Fluid Mechanics and Thermodynamics by J. H. Horlock, Krieger Publishing
2. Centrifugal Pumps and Blowers, Austin H. Chruch, John Wiley and Sons, Chennai, Dekker, Inc.
3. Element of Gas Dynamics by Liepeman and Roshkow, Dover Publications
4. Element of Gas Dynamics by S. M. Yahya, McGraw Hill Publishers
5. Fluid Dynamics and heat Transfer of Turbo machinery, Budugur Lakshminarayana, John Wiley and Sons
6. Fundamentals of Turbo machinery/William W Perg/John Wiley & Sons
7. Gas Turbines Theory and Practice/Zucrow/John Wiley & Sons/New York
8. Handbook of Turbo machinery, Edited by Earl Logan Jr, Ramendra Roy; Second Edition , Marcel
9. Practice on Turbo Machines/ G.Gopal Krishnan & D.Prithviraj/ Sci Tech Publishers,
10. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley & Sons/New York
11. Principles of Turbo Machines/DG Shepherd / Macmillan
12. Theory and practice of Steam Turbines/ WJ Kearton/ELBS Pitman/London
13. Turbines, Pumps, Compressors by S. M. Yahya, McGraw Hill Publishers

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To discuss the principles and energy transfer process in turbo machines.	20
CO-2	To understand the structural and functional aspects of major components of turbo machines.	36
CO-3	Analyse the turbo machines to improve and optimize its performance	34
CO-4	To understand control and maintenance aspects of turbo machines.	10

List of Experiments: NA

Major Equipment: NA

List of Open Source Software/learning website: http://nptel.ac.in/