

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (THERMAL ENGINEERING)

ADVANCED THERMAL TURBO MACHINERIES

SUBJECT CODE: 2742103

M.E. 4th SEMESTER

Type of course: Major Elective - IV

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
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No	Content	Total Hrs	% Weightage
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	15
2	Principles of Turbo Machines: Transfer of energy to fluids, performance characteristics with standard curves, comparison and selection criteria of various turbo machines	04	10
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, choking and stall, blade twist and design considerations for supersonic flow.	15	35
4	Analysis of Axial & Radial Flow Gas Turbines: Work done, velocity triangles and efficiencies, thermodynamic flow analysis, Zweifel's relation, cascade analysis, Soderberg– Hawthorne – 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	30
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	10

Reference Books:

1. Axial Flow Compressors – Horlock
2. Centrifugal pumps and blowers, Austin H. Chruuch, John Wiley and Sons, Chennai, Dekker, Inc., New York
3. Element of Gas Dynamics/Liepeman and Roshkow/ Dover Publications
4. Element of Gas Dynamics/Yahya/TMH
5. Fluid Dynamics and heat Transfer of Turbo machinery, Budugur Lakshminarayana, John Wiley and Sons, Inc.
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/Yahya/TMH

Course Outcome:

After learning the course the students should be able to:

1. To understand the principles and energy transfer process in turbo machines.
2. To understand the structural and functional aspects of major components of turbo machines.
3. Analyse the turbo machines to improve and optimize its performance
4. To understand control and maintenance aspects of turbo machines.

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.