

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE MODULE

Faculty Name: Mr. Raghu			Academic Year: 2026–27				
Department: Mechanical Engineering							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BME502	Turbomachines	Core	Elements of Mechanical Engg., Fluid Mechanics, Basics Thermodynamics	3	-	2	
Objectives	Course objectives						
	The course provides the student with knowledge about: - Understand the working principle, classifications, applications and thermodynamic processes involved in Turbo machines. - Study the energy transfer/conversion in Turbo machines, velocity triangles, utilization factor and degree of reaction. - Analyze various designs of steam turbine and their working principle. - Study on various hydraulic turbines based on the working principle, their design and performances. - Understand the working principle, elementary design and performance of radial flow type power absorbing turbo machine.						
Topics Covered as per Syllabus							
MODULE – 1							
Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Unit and specific quantities, model studies and its numerical. (Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)							
Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process. Simple Numerical on stage efficiency and polytropic efficiency.							
MODULE – 2							
Energy exchange in Turbo machines: Euler’s turbine equation, Alternate form of Euler’s turbine equation, Velocity triangles for different values of degree of reaction, Components of energy							

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transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

MODULE – 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

MODULE – 4

Hydraulic Turbines: Classification, various efficiencies. Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions.

Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

MODULE – 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

PRACTICAL COMPONENT OF IPCC

Sl. NO	Experiments
1	Performance analysis of Pelton Wheel
2	Performance analysis of Francis turbine
3	Performance analysis of Kaplan turbine
4	Performance analysis of centrifugal blowers
5	Performance analysis of centrifugal pump
6	Performance analysis of Axial Fan and Radial Fan

List of Text Books

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Text Book of Turbomachines, M. S. Govindgowda and A. M. Nagaraj, M. M. Publications, 10th Ed. An Introduction to Energy Conversion, Volume III, Turbomachinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008. Turbomachines, N. Krishnamurthy, Sunstar publisher. Turbomachines, B.K.Venkanna PHI, New Delhi 2009.	
List of Reference Books	
Principals of Turbomachines, D. G. Shepherd, The Macmillan Company (1964). Fluid Mechanics & Thermodynamics of Turbomachines, S. L. Dixon, Elsevier (2005). Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002	
List of URLs, Text Books, Notes, Multimedia Content, etc. https://nptel.ac.in/courses/112/106/112106200/	
Course Outcomes	Course outcomes: Upon the completion of the course, the students will able to,
	1. Apply the Model studies and thermodynamics analysis of turbo machines.
	2. Analyse the energy transfers in Turbo machine with degree of reaction and utilisation factor.
	3. Classify, analyse and understand various types of steam turbine.
	4. Classify, analyse and understand various types of hydraulic turbine.
	5. Understand the concept of radial power absorbing machine and the problems involved during its operation.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code:	BME502	TITLE: Turbomachines						Faculty Name:	Mr. Raghu						
List of Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO-1	3	3	-	-	-	-	-	-	-	-	-	-	2		
CO-2	3	3	2	-	-	-	-	-	-	-	-	2	2		
CO-3	3	3	2	-	-	-	-	-	-	-	-	2	2		
CO-4	3	3	2	-	-	-	-	-	-	-	-	2	2		
CO-5	3	3	2									2	2		

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution