TURBO MACHINERY

Course Code	19ME4501A	Year	III	Semester	I
Course Category:	Program Elective	Branch	ME	Course Type	Theory
Credits:	3	L – T – P	3 – 0 – 0	Prerequisites:	Nil
Continuous Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	State precise definition of turbomachinery	L1
CO2	Apply the laws of thermodynamics on turbomachinery	L2
CO3	Understand the principle of operation of Radial flow pumps	L1
CO4	Perform the preliminary design of hydraulic turbines	L3
CO5	Analyze the stage performance of compressors	L4

Course Articulation Matrix:

	Contribution of Course Outcomes towards achievement of Program Outcomes Strength of correlations (3: High, 2: Moderate, 1: Low)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	-	-	-	-	-	-	-	-	2	2	1
CO3	3	3	3	-	-	-	-	-	-	-	-	2	2	1
CO4	2	2	3	-	-	-	-	-	-	-	-	2	2	1
CO5	3	3	3	-	-	-	-	-	-	-	-	2	2	1

Course Content		Mapped CO s
UNIT-1	**Introduction:** Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.	**CO1**
UNIT-2	**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	**CO 2**
UNIT-3	**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.	**CO3**

UNIT-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.	**CO4**
UNIT-5	**Pumps and Compressors:** Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Cavitation, Need for priming, Pumps in series and parallel. Problems. Stage velocity triangles, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.	**CO5**

Learning Resources	
Text Books:	1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008. 2. Turbo Machines ,B.U.Pai , 1st Editions, Wiley India Pvt, Ltd. 3. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002
Reference Books:	1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964). 2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005). 3. Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008. 4. Gopalakrishnan G, Prithvi Raj D, "A treatise on Turbomachines", Scitec Publications, Chennai, 2002. 5. Sheppard, Principles of Turbomachinery. 6. R.K.Turton, Principles of Turbomachinery, E & F N Spon Publishers, London & New York.
E-Resources & other digital Material:	1. https://nptel.ac.in/courses/112/106/112106200/ 2. https://nptel.ac.in/courses/101/101/101101058/ 3. https://nptel.ac.in/courses/112/104/112104117/