COURSE NUMBER & COURSE TITLE: ME 300 Principles of Turbomachinery

INSTRUCTOR: Xin Jianhua	**Credits: 3**	**Language of instruction:** Chinese
REQUIRED COURSE OR ELECTIVE COURSE: Required		**TERMS OFFERED:** Autumn semester
COURSE STRUCTURE/SCHEDULE: 1. Lecture 2. Panel discussion 3. Homework 4. Lab tour		**PRE-REQUISITES:** Thermodynamics Aerodynamics Fluid mechanics Theoretical Mechanics
ASSESSMENT TOOLS: 1. One comprehensive final exam—60% 2. Homework, Quizzes—20% 3. Literature reading—10% 4. Oral—10%		**PROFESSIONAL COMPONENT:**

TEXTBOOK/READING LIST

Textbook:

Wang Zhongqi，Qing Ren：**Principles of Turbomachinery**，Machinery Industry Press，1988.

Reading List:

1. Weng shilie, **Basis For Thermal Energy and Dynamic Machine,** Higher Education Press，2004
2. Weng shilie, **Principles of gas and steam turbine**, Shanghai Jiaotong University Press，1996
3. Zhong Fangyuan, **Basical design of Gas turbine**, Machinery Industry Press，1985

COURSE DESCRIPTION:

This course is designed to illustrate the application of basic principles of fluid dynamics and thermodynamics to various kinds of turbomachinery. Turbomachinery is a subject of considerable importance in a modern industrial civilization. Steam turbines are at the heart of central station power plants, whether fueled by coal or uranium. Gas turbines and axial compressors are the key components of aeroengine. Aeroderivative gas turbines are also used to generate electricity with natural gas as fuel. Same technology is used to drive centrifugal compressors for transmitting this natural gas across continents. Blowers and fans are used for mine and industrial ventilation. Large pumps are often driven with steam turbines to provide feedwater to boilers. They are used in sanitation plants for wastewater cleanup. Hydraulic turbines generate electricity from water stored in reservoirs, and wind turbines do the same from the flowing wind. This course is on the principles of turbomachines. It aims for a unified treatment of the subject matter, with consistent notation and concepts.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]

1. Provide a thorough understanding of the principles and applications of turbomachinery in modern industry.
2. Provide an useful tool for designing and researching on turbomachinery instruments.

RELATED ME PROGRAM OUTCOMES:

A2. Engineering fundamentals

A3. Analytical skills

PREPARED BY: **REVISION DATE:** Dec. 9, 2012

ME 300 Principles of Turbomachinery

Course Syllabus

COURSE INSTRUCTORS

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COURSE PRE-REQUISITES

Thermodynamics

Aerodynamics

Fluid mechanics

Theoretical Mechanics

COURSE LEARNING OBJECTIVES

In light of the characteristics of the turbomachinery, the course is intended to provide students with the following benefits:

1. Having a basic understanding of fluid mechanics and thermodynamics in turbomachinery;
2. Providing a general treatment of the common forms of turbomachine, covering basic tluid dynamics and thermodynamics of flow through passages and over surface, with a brief derivation of the fundamental governing equations.;
3. Applying the conservation equations of mass momentum, and energy in relative and absolute coordinate systems to determine the ideal mean-line performance of turbomachine elements.
4. Understand the viscous and compressible effects responsible for non-ideal performance in turbomachines.
5. Applying performance models to estimate non-ideal performance for design and analysis of turbomachine elements.
6. Understand the fluid mechanics responsible for limits of turbomachinery operability and stability, particularly, stall, surge, cavitations, and choke.
7. Appreciating the use of laboratory and testing methods, and the value of quality data in design and development.
8. Understand the basic characteristics of radial and axial pumps, compressors, turbines and fans with different kinds of working mediums.

GRADING FORMAT AND POLICY

The grade break-down for the course is as follow:

1. One comprehensive final exam—60%

2. Homework, Quizzes—20%

3. Literature reading—10%

4. Oral—10%

COURSE ROAD-MAP AND SCHEDULE

Week#	Lecture#	Lecture Topic	Lecturer	Reference	Homework	Lab/Recitation Topics
	1	classes start: course overview, and introduction to turbomachinery	Xin Jianhua			**Lab tour**
	2-3	working principles of turbine stage	Xin Jianhua			
	4-10	the calculation of the aerodynamic performance of turbine cascade	Xin Jianhua			
	11-12	the calculation of aerodynamic performance on a Long blade stage	Xin Jianhua			
	13-14	centrifugal turbine	Xin Jianhua			
	14-15	multi-stage turbine	Xin Jianhua			
	16-19	off-design characteristics of turbine	Xin Jianhua			
	20-21	axial compressor	Xin Jianhua			
	22	radial compressor	Xin Jianhua			
	23-24	off-design characteristics of compressor	Xin Jianhua			
	25	review	Xin Jianhua			