ME 312

Thermodynamics II

Prerequisites: ME 311 - Thermodynamics I

Reason for prerequisites: *Thermodynamics II* is the second part of a two-semester course on Thermodynamics.

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Course description

Thermodynamics II focuses on the application of the First and the Second laws of thermodynamics for the design and analysis of the basic energy conversion systems.
The course combines (50%) lectures and (50%) problem-solving sessions to provide students with

- Real-world engineering applications of the First and the Second Laws of Thermodynamics
- Ability to understand the principles of the design and optimization of the basic energy conversion processes, including power generation, refrigeration, air-conditioning, combustion and fluid acceleration. Introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion will also be given,
- Ability to analyze qualitatively and numerically operation of selected conversion systems
- Ability to communicate effectively the knowledge of energy conversion systems

Course objectives

- To introduce basic energy conversion systems, including power generation, refrigeration, air-conditioning, combustion and fluid acceleration
- To apply the First and the Second laws of thermodynamics to the analysis of selected energy conversion systems
- To develop a systematic approach to problem-solving and the use of thermodynamic relations and the physical property relations, tables, and charts for the optimization of energy conversion systems

Course outline

▪ Gas Power Cycles	Concepts of gas power cycles and their applications Otto cycle Diesel cycle Brayton cycle Jet-propulsion cycles
▪ Vapor Power Cycles	Concepts of vapor power cycles and their applications Rankine cycle for vapor power plants Reheat Rankine cycle Regenerative Rankine cycle
▪ Refrigeration Cycles	Refrigerators and heat pumps Vapor-compression refrigeration cycle Heat pump systems Gas refrigeration cycles
Gas Mixtures	Composition of a gas mixture

	Thermodynamic properties of gas mixtures
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▪	
▪ Air-Air conditioning	Specific and relative humidity of air Dew-point and wet-bulb temperatures The psychrometric chart Air-conditioning processes
▪ Chemical Reactions	Fuels and combustion Theoretical and actual combustion processes Enthalpy of formation and enthalpy of combustion Steady-flow reacting systems First law analysis of reacting systems Adiabatic flame temperature
▪ Thermodynamics of Gas Flow	Stagnation properties Velocity of sound and Mach number One-dimensional isentropic flow Isentropic flow through nozzles

Required textbook

Yunus A. Cengel and Michael A. Boles. THERMODYNAMICS: An Engineering Approach , 6th Edition, McGraw-Hill, NY, 2002, ISBN 978-0-07-352921-9

Weekly listing of topics (15-week schedule)

Week	Topic	Chapt	Problems
1-3	Gas Power Cycles	9	35,38,40,55.60,62, 94,98, 114,120.145,149,141,143
5-7	Vapor Power Cycles	10	19,20,38,39,75
	Quiz 1		
8	Refrigeration Cycles	11	12,14,33,34,66
9	Gas Mixtures	13	36,38,63,74
10-11	Air-conditioning	14	74,75, 78,79, 87,88,104,109
	Quiz 2		
12-13	Chemical Reactions	15	22,23, 26, 35,37,38,59,61,83
13	Thermodynamics of Gas Flow	17	7,22,27,46,59
14	Review		
15	**Final Exam**		

Homework assignment

- Homework is issued at every lecture and is due the following week
- Homework is collected at the beginning of the lecture
- Late homework will not be accepted for grading

Homework format guidelines

- Structure the solution into the following sections:

Known -	The problem is posed
Find -	The quantities to be found are stated
Sketch -	The physical situation and/or diagram
Assumptions –	The significant assumptions in solving the problem are stated

Properties - The materials properties needed to solve the problem are listed
Analysis - The problem is solved in a systematic manner, showing all steps, the fundamental equations from which the calculation begins are included, and all numerical values (including units) are shown
Discussion - Comments are made on the results, as appropriate

- Arrange problems in numerical order
- Staple all pages together
- Print your name at the top of each page
- Write only on of 8½ x11 inch paper; start each problem on a new page

Homework grading

- Feedback on the homework will be provided during lectures, solutions will be discussed, and graded homework will be returned
- Each problem will be graded individually

Quizzes and final exam

- Two closed-book quizzes will be given on the seventh and twelfth weeks of the semester. Exact date of each quiz will be announced a week before the quiz.
- There will be a closed-book final exam during Finals week, covering all of the course materials.
- Students may bring 5 two-sided sheet of notes to the quizzes and 7 sheets to the final exam. The quizzes and the final exam must be completed individually, in accordance with the NJIT Honor Code.
- Each problem on the quizzes and the final exam will be graded individually.

A missed quiz will be averaged into the final grade as *zero*, unless an excuse is obtained. Excuses are granted only for very serious circumstances attested to by the NJIT administration, verifiable and significant medical problems, religious holidays, and also serious personal situations. A student who has been excused will be required to take a makeup exam.

Assessment criteria and grading

The course has been designed so that lectures, homework assignments, quizzes, and final exam are integral and essential parts of the learning process. Final grades will be determined from scores as follows:

Quiz 1: 20% *Quiz 2: 20%* *Homework: 20%*
Final Exam: 40%

The final grade will be assigned on the basis of "*a curve*".

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