ME 312 Thermodynamics II

Required textbook

Yunus A. Cengel and Michael A. Boles. THERMODYNAMICS: An Engineering Approach , 4th Edition, McGraw-Hill, NY, 2002, ISBN 0-07-238332-1

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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Weekly listing of topics (15-week schedule)

Week	Topic	Chapter
1-3	**Gas Power Cycles**	**8**
5-7	**Vapor Power Cycles**	**9**
	Quiz 1	
8	**Refrigeration Cycles**	**10**
9	**Gas Mixtures**	**12**
10-11	**Gas-vapor Mixtures and Air-conditioning**	**13**
	Quiz 2	
12-13	**Chemical Reactions**	**14**
13	**Thermodynamics of High-speed Gas Flow**	**16**
14	**Review**	
15	Final Exam	

Homework assignment

- Homework is generally 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 one two-sided sheet of notes to the quizzes and 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, such as deaths in the family. 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: 30%* *Final Exam: 30%*

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

Course description

Thermodynamics II focuses on the application of the First and the Second laws of thermodynamics for the design and analysis of a variety of 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 design and optimize basic energy conversion processes: power generation, refrigeration, air-conditioning, and combustion
- Ability to communicate effectively the knowledge of energy conversion systems

Course objectives

- To introduce basic energy conversion systems: power generation, refrigeration, air-conditioning, and combustion
- To apply the First and the Second laws of thermodynamics to the analysis of 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 Selecting the right refrigerant Heat pump systems Gas refrigeration cycles
▪ Gas Mixtures	Composition of a gas mixture P-v-T behavior of gas mixtures Thermodynamic properties of gas mixtures
▪ Gas-vapor Mixtures and Air-conditioning	Dry and atmospheric air Specific and relative humidity of air Dew-point and wet-bulb temperatures The psychrometric chart Air-conditioning processes Wet cooling towers
▪ Chemical Reactions	Fuels and combustion Theoretical and actual combustion processes Enthalpy of formation and enthalpy of combustion Steady-flow and closed reacting systems First law analysis of reacting systems Adiabatic flame temperature Second-law analysis of reacting systems
▪ Thermodynamics of High-speed Gas Flow	Stagnation properties Velocity of sound and Mach number One-dimensional isentropic flow Isentropic flow through nozzles

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