MEC 398 THERMODYNAMICS

Spring 2019

Instructor: **Lin-Shu Wang**. Room 214, Heavy Engineering, 632-8342, lin-shu.wang@stonybrook.edu

Bulletin Description: Psychrometrics and psychrometric charts. Thermodynamic considerations for the design and performance of cooling towers, humidifiers, and dehumidifiers. Reacting mixtures, combustion, and chemical equilibrium. Thermodynamics of fluid flow, simple compression, and expansion processes. Analysis and design of gas and vapor power cycles. Cycles with reheat, intercooling, and cogeneration plants. Refrigeration cycles.

Prerequisites: MEC 301 and 364

Overview (Course description as it is offered): The course begins with a brief review of the basic concepts introduced in Thermo I, followed by a discussion of exergy. A large portion of the classes falls into the general topic of thermodynamic cycles, discussing the operating principle of common cycles as well as practical applications. HVAC applications are another major topic, along with the topic of equilibrium thermodynamics and its application to mixture, chemical reaction and combustion.

Course time and location: TU/TH 2:30PM to 3:50PM
Instructor office hours: 11:00AM-12:30PM Monday; 10:30AM-12:00PM Thursday

Text: Cengel and Boles (2014) *Thermodynamics: An Engineering Approach* (McGraw-Hill)

SYLLABUS and EXAMINATIONS SCHEDULE

List of topics

Week	Exam date	Topics	Details
1		First law (review)	
2		Carnot's theory and Kelvin's formulation of the 2nd law (review)	Carnot's principle, absolute thermodynamic temperature, Carnot's function, Kelvin's derivation of the Carnot formula, the concept of available energy and the energy principle (of Kelvin)
3		Entropy (review)	The concept of entropy, the principle of the increase of entropy, Gibbs' development of equilibrium thermodynamics on the basis of the entropy principle
4		Exergy (introduction)	Gibbs free energy, the concept of exergy, derivation of the exergy equation and reduction of the exergy equation to the Carnot formula on the one hand and Gibbs free energy on the other hand
5		Gas power cycles	Cengel and Boles, Chapter 9: Assumptions, Otto cycle, Diesel cycle, Brayton cycle
6		Vapor power cycle	Cengel and Boles, Chapter 10: Rankine cycle, advanced Rankin cycle, cogeneration
7	**03/14**	Review and Midterm #1	Open book, cover materials of Week 1 to Week 5
8		Heat pump cycle	Cengel and Boles, Chapter 11: vapor compression heat pump cycle, refrigeration application, the operational issues of heat pump for heating
9		Thermodynamic relations	Cengel and Boles, Chapter 12: equilibrium thermodynamics, thermodynamic relations

10		Gas mixtures	Cengel and Boles, Chapter 13: ideal gas mixtures, Dalton's law, Gibbs theorem
11		Chemical reactions	Cengel and Boles, Chapter 15: fuels and combustion, enthalpy of formation and enthalpy of combustion, energy analysis of reacting systems and adiabatic flame temperature
12		Combustion	Cengel and Boles, Chapter 16: quasi-static chemical reaction processes, equilibrium criterion and the equilibrium constant, law of mass action
13	**05/02**	Review and Midterm #2	Open book, cover materials of Week 6 to Week 11
14		Special HVAC-topic	Energy and exergy analyses of a building thermal system
Final exam period	**05/16 5:30-8:00PM**		Open book, comprehensive

Basis for calculating final grade:

- Homework: 10%
- Midterm One/Midterm Two: 25%/25%
- Final: 40%

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