CBEMS 40B: Chemical Engineering Thermodynamics
Spring Quarter, 2009

UCI Catalogue Data: CBEMS40B Chemical Engineering Thermodynamics (5) S. Basic concepts and use of the thermodynamic functions of free energy, enthalpy, and entropy; properties of pure fluids and mixtures; application of dynamic processes and efficiencies. Solution thermodynamics and applications to transformations. Prerequisites: CBEMS40A, Mathematics2J, Engineering CEE10, EECS10 or MAE10. CBEMS40B and MAE91 may not both be taken for credit. (Design units: 1)

Course Schedule: (M,W,F) 1:00 – 2:50 PM in ET 204

Web Page: http://eee.uci.edu/09s/15030/

Instructor: Professor Ali Mohraz
744F Engineering Tower
Email: mohraz@uci.edu
Office phone: 824-2028

Instructor Office Hours: Wednesday, 4:00 – 5:50 PM in ICF 103, or by appointment.
Email inquiries about HW will be answered in three sentences or less.

Teaching Assistant: Bharath Rajaram
Email: brajaram@uci.edu

TA Office Hours: Monday, 9:00 – 10:30 AM in 902 Engineering Tower.

Course Description: Course topics include basic thermodynamic concepts and definitions; properties of pure fluids, thermodynamic charts; thermodynamics of flow processes, power generation and refrigeration; phase equilibrium in pure components; solution thermodynamics and properties of mixtures.

Textbook: Chemical, Biochemical, and Engineering Thermodynamics, 4th edition, by Stanley I. Sandler. Additional supplemental materials will be provided via the course website.

Prerequisites: A basic understanding of the following is necessary for this course:
• General chemistry and physics
• Use of units and significant figures in scientific calculations
• Algebraic equation solving
• Calculus and differential operations

Grading Criteria: Midterm……………………………………………………………………..30%
Final…………………………………………………………………………………35%
Homework………………………………………………………………………….15%
Design Project……………………………………………………………………….15%
Instructor’s Discretion……………………………………………………………..10%
Attendance is required, including the discussion sessions held during some of the Friday class periods.

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Course Outcomes: Upon successful completion of the course, the student will:

- Be able to understand the terminology associated with engineering thermodynamics.
- Be able to reiterate the first and second laws of thermodynamics, and understand the practical implications of these laws in engineering design.
- Be able to apply mass, energy, and entropy balances to flow processes.
- Understand the concepts of heat, work, and energy conversion, and calculate heat and work quantities for industrial processes.
- Understand processes involving power production, refrigeration and liquefaction, and be able to calculate relevant system efficiencies for these processes.
- Be able to determine changes in the properties of pure materials undergoing changes in temperature, pressure, and volume.
- Understand the underlying principles of phase equilibrium in pure component and multi-component systems, and be able to perform phase equilibrium calculations from an equation of state for a fluid.
- Be able to calculate the properties of ideal and real mixtures based on thermodynamic principles.
- Be able to understand, and deal with, the professional and ethical consequences of system design choices, and understand the impact of engineering solutions from a global and societal standpoint.
- Be able to communicate effectively the scientific and engineering principles and thermodynamic aspects of engineering design.
- Be able to identify and apply the necessary tools in mathematics, chemistry, physics, and engineering to thermodynamic problems.
- Be able to analyze and interpret data appropriately in the selection and design of advanced material systems and the design of chemical processes.
- Be able to function on multi-disciplinary teams in the conduct of engineering design and scientific exploration.
- Recognize the need for life-long learning in order to remain effective as a scientist or engineer.

ChE Outcomes: This course relates to Program Outcomes (a), and (c-m) as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/chemical/mission

MSE Outcomes: This course relates to Program Outcomes (a), (c-h), and (k) as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/materials/mission

Academic Honesty: The complete policy statement on academic honesty is available at:
http://www.editor.uci.edu/catalogue/appx/appx.2.htm

There is also a link to this policy on the course website. You are strongly encouraged to read through this policy, which will be strictly enforced.

In this class, student discussions regarding the homework and class projects are allowed before you write anything on paper. However, the homework and course projects submitted for grading must be the individual work of the student or students working as a team (in the case of the term project).

The instructor will not tolerate any acts of academic dishonesty.
Exams: There will be a 90-minute midterm exam on Monday, May 4th, and a 2-hour final exam on Wednesday, June 10th. The midterm will be closed-book, but a ‘note-sheet’ will be allowed. The final will be closed-book, open-notes. Details on the preparation of note-sheets will be provided in class. Cellphones, text-messaging devices, etc. are not allowed in the classroom during the exams. If extraordinary circumstances require that you be in contact via these devices, prior approval of the instructor must be obtained.

Homework: Homework sets will generally be given out on Fridays, and will be due a week later in class. General discussions regarding the homework are allowed, but direct collaboration or copying is not. After group discussions to understand the general concept of a problem, the students should do the homework problems on their own – and must do so for anything turned in for course credit. Using homework and solutions sets from previous years is not allowed, and accessing any printed solution manuals for the course instructional materials is considered a violation of academic honesty, and will be treated as such.

Homework solutions must be written out neatly so that they are easy to follow. Please always remember that an important quality of an engineer is to communicate effectively and neatly in writing. The instructor and teaching assistant reserve the right to assign a grade of zero to an assignment that is difficult to follow. All steps in the solution must be included in the write-up, and all work must be shown for full credit to be received. **It is highly recommended that all final answers be boxed.**

Homeworks and exams will be graded based on a predetermined set of guidelines, with assigned point values for each important step in the solution procedure (e.g. correct application of dimensional and algebraic equations, appropriately labeled diagrams, the final expression and numerical results, etc.) Thus, partial credit may be given for attempting each problem; the more you demonstrate that you understand the general concept, the higher the fraction of total points you will be awarded. All disputes over grading of homework or exams must be addressed within 7 days after materials are returned, and should be referred to the instructor. Late homework will only be accepted if an extension is received from the instructor or the TA prior to the due date. Homework that is submitted late will be docked 15% of the maximum allowable points for each day the assignment is late.

Project: The course project involves writing a report on an alternative source of energy for electricity production or transportation. The project will be done as a team-study effort. Additional details will be provided in class.