YOUNGSTOWN STATE UNIVERSITY
DEPARTMENT OF CHEMICAL ENGINEERING
CHEGR 2684 - CHEMICAL ENGINEERING PRINCIPLES 2

Catalog Description: Energy balances on reacting systems, applications of material and energy balances for transient systems. Cascade theory and design of staged separation processes. Concepts of reflux, algebraic solutions for linear systems and graphical methods of analysis. Design of distillation columns and stage-wise separations.

Prerequisite(s): CHEGR 2683 – Chemical Principles 1

Text: Felder, R.M. and Rousseau, R.W. *Elementary Principles of Chemical Processes,* 3rd ed., New York: John Wiley & Sons, Inc,. 2005
Supplemental Workbook, Optional

Course Objectives: The objectives of this course will allow the student to: 1) Understand the application of thermodynamics to systems where phase changes or temperature changes occur; 2) Derive and solve energy balance equations for chemical reactions; 3) Use a first-principles approach in the solution of systems containing a multiple of unit operations; and 4) Understand the concepts of multi-stage operations and apply these concepts in equipment design. Successful completion of the course will show a competency in the following Criterion 3 outcomes:

- Ability to apply knowledge of mathematics, science, and engineering
- Design a system, component, or process to meet desired needs
- Identify, formulate, and solve engineering problems
- Communicate effectively
- Use techniques, skills, and modern engineering tools necessary for engineering practice

A team project that focuses on the optimization of a chemical plant will be used to demonstrate stage-wise operations and plant design.

Topics Covered: Energy balances on nonreactive and reactive processes, fundamentals of computer simulation of modular processes, single equilibrium stages and flash calculations, vapor-liquid cascades, and the McCabe-Thiele graphical equilibrium-stage method.

Class Schedule: Three 50-minute sessions per week for fifteen weeks.

Course Contribution: This course satisfies the Professional Component (Criterion 4) as it is part of the one and one-half years of engineering sciences and engineering design.

Program Objectives: These objectives satisfy the following Program Criteria (Criterion 8) as defined by the American Institute of Chemical Engineers:

- material and energy balances applied to chemical processes
- thermodynamics of physical and chemical equilibria
- continuous and stage-wise separation operations
- process design
- appropriate modern computing techniques

Prepared By: Douglas M. Price, Ph.D Chemical Engineering January 10, 2010

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Website:	http://people.ysu.edu/~dmprice/CHEN 2684
Prerequisite(s):	CHEGR 2683
Text:	Felder, R.M. and Rousseau, R.W. *Elementary Principles of Chemical Process*, 3rd ed., New York: John Wiley & Sons, Inc,. 2005

Goals and Objectives of Course

The objectives of this course will allow the student to: 1) Understand the concepts of multi-stage operations and apply these concepts in equipment design. 2) Understand the application of thermodynamics to systems where phase changes or temperature changes occur; 3) Derive and solve energy balance equations for chemical reactions; 4) Use a first-principles approach in the solution of systems containing a multiple of unit operations. A team project with a presentation is required.

This course incorporates Critical Thinking Criteria to satisfy YSU General Education requirements. As students in this course you will benefit to the fullest if you are aware of and understand these goals as follows. This course involves using both qualitative and quantitative information and techniques to arrive at economical and socially responsible solutions. The student will learn to reason critically, both individually and collaboratively, draw sound conclusions from information, ideas, and interpretations gathered from various sources and disciplines, and apply those conclusions to the solutions of real-world engineering problems. It is expected that the student has developed a solid background in the fundamentals of chemical engineering material balances. In this course, the student is presented with real world problems within a team context. This provides the opportunity to apply individual skills and reasoning abilities to the collaborative solution of an open-ended problem. The student/team must gather information from a broad base of resources, identify the critical elements within that broad base, and from these develop a solution to the cases. Furthermore, the team must develop a presentation of the results that is appropriate for a broad audience representative of the modern client base for such problems. The critical thinking assignment is the final design project.

Week	Topic	Chapter
1	Energy Balances – Closed Systems	7
2	Energy Balances – Open Systems	7
3	Energy Balances – Open Systems	7
4	Balances on Nonreactive Process	8
5	Balances on Nonreactive Process	8
6	Balances on Nonreactive Process	8
7	Balances on Nonreactive Process	8
8	Balances on Reactive Process	9
	Spring Break	
9	Balances on Reactive Processes	9
10	Balances on Reactive Processes	9
11	Balances on Reactive Processes	9
12	Balances on Transient Processes	11
13	Balances on Transient Processes	11
14	Design Project	14
15	Design Project	14
16	**Finals Week**	

Grading Policy

Graded homework assignments will be given on a regular basis. No late assignments will be accepted unless notification is given to the instructor prior to the due date.

The course will be graded on a basis of 500 point maximum. The following table shows how the points are distributed:

	Number	Points Each	Total Points	Percent of Course Total
Homework	9	10	90	18
Tests	3	100	300	60
Project	1	100	100	20
Presentation	1	10	10	2
Total			**500**	**100**

Points	Final Grade
450 - 500	A
400 - 449	B
350 - 399	C
300 - 349	D
Below 300	F

Course Policy

Attendance — Required. Not all topics covered in class are in the textbook.

Class Participation — Encouraged.

Missed Exams — Tests are to be rescheduled prior to a known absence. Quizzes will not be made up after the scheduled date, however under certain circumstances they may be rescheduled after the posted date at the instructor's discretion.

DEPARTMENT OF CIVIL/ENVIRONMENTAL & CHEMICAL ENGINEERING
Policy on Academic Dishonesty

Introduction

In the professional workplace, it is essential that engineers adhere to high ethical standards. Unethical conduct may jeopardize not only the health and safety of the public, but also the career and livelihood of the engineer. Professional engineering societies have emphasized the importance of ethics in the practice of engineering by adopting codes of ethics. The Code of Ethics of the American Institute of Chemical Engineers can be found at http://www.aiche.org/About/Code.aspx.

Engineering students must become familiar with the standards of ethical conduct both at the University and the professional levels, and strive to achieve these standards. As stated in YSU's Undergraduate Bulletin, "…all members of the University community have a responsibility of maintaining high standards of honesty and ethical practice. Cheating, plagiarism, and other forms of academic dishonesty constitute a serious violation of University conduct regulations."

The purpose of this policy statement is to clarify the responsibilities of students and faculty in the Department, and the procedures to be followed in cases of academic dishonesty.

Responsibilities of Students

Basically, students are responsible for completing all examinations, papers, and course assignments in the manner prescribed by the instructor, without relying on unauthorized sources of information. As stated in YSU's Code of Student Rights, Responsibilities, and Conduct, "..students shall not submit the work of someone else as their own or utilize ideas taken from other sources without properly citing the source." Some common examples of academic dishonesty that should be avoided include:

- Copying off another student's paper during an exam;
- Using unauthorized reference material (e.g., a "cheat sheet") during an exam;
- Copying a solution to a homework problem, or a lab report, from another student and submitting it;
- Presenting information from any source (e.g., in a term paper or lab report) without citing the reference;
- Copying written text verbatim from any source without enclosing the material in quotation marks ("…").

Responsibilities of Instructors

Instructors are responsible for taking all reasonable precautions to prevent academic dishonesty. Such precautions should include:

- providing a statement concerning academic honesty on the course syllabus;
- ensuring that students are aware of the University's, the department's, and the Instructor's policies on academic dishonesty; and
- monitoring student conduct during exams and in the completion of course assignments.

In addition, instructors are responsible for deciding the course of action to be taken in the event of academic dishonesty, and following all University and departmental policies in implementing the action.

University Policies and Procedures

According to the University's Code of Student Rights, Responsibilities, and Conduct, the following procedures will be used to resolve cases of alleged academic dishonesty:

1. The faculty member should discuss the matter with the student as soon as possible following the alleged act of academic dishonesty.
2. The student shall be informed in writing of the allegations and requested to attend a conference with the faculty member and appropriate department chair.
3. In the conference, the allegations will be discussed, and the faculty member will determine whether the student is responsible. If the student is found to be responsible, the faculty member shall determine the sanction to be imposed.
4. Prior to imposing a sanction, the faculty member shall communicate with the Judicial Administrator (currently the Associate Director of Student Life) to determine if the student has been involved in any previous academic dishonesty violations.
5. The faculty member may impose one or more of the following sanctions:
    a. Warn the student;
    b. Submit an "F" grade on the exam or paper;
    c. Submit an "F" grade for the course; and/or
    d. Request additional action from the Student Academic Grievance Subcommittee.
6. The faculty member must file a Report of Academic Dishonesty if options b through d are imposed. The Judicial Administrator will then notify the student in writing of the decision as well as create a judicial file which shall be kept confidential to the extent allowed by law.
7. Following the conference, the accused student has the right to file a grievance and request that the case be reviewed by the Student Academic Grievance Subcommittee.

Grade of Incomplete See the Undergraduate Bulletin for University policy.

Students with Disabilities:

In accordance with University policy, if you have a documented disability, and require special accommodations to ensure equal access and opportunity in this course, please contact the Instructor privately to discuss your specific needs. You must be registered with the Center for Student Progress Disability Services (phone 330-941-1372), located at 36 W. Wood St., and provide a letter of accommodation to verify your eligibility.