

Course : **ChE 112 - Separation Processes**

Semester : Spring 1999

Course Format

And Credit hours : 3 hr Lecture, 2 hr Laboratory and Recitation
4 hr Credit

Prerequisites : ChE 110, ChE 111, and ChE 142

Instructor : Dr. Richard Turton, 433 Engineering Sciences Building
293-2111 ext. 2415, turton@cemr.wvu.edu

Schedule : Tuesday 11:00 to 12:15 p.m.
Wednesday 1:00 to 3:00 p.m.
Thursday 11:00 to 12:15 p.m.

Location : Room 401 Engineering Sciences Building

Office Hours: Wednesday 3:00 – 5:00 p.m. or by appointment

Course Objectives : The objectives of this course are to present the theory of equilibrium-stage and multiple-stage operations, differential counter-current contacting, membrane separations, and fluid-particle separations. Laboratory demonstrations, experiments, and detailed problem-solving sessions will supplement the materials covered in the lecture part of the course.

Expected Learning

Outcomes : Upon successful completion of this course:

1. Students will be able to recognize the difference between rate- and equilibrium-based unit operations.
2. Students will be able to solve graphically multiple equilibrium-stage calculations using the McCabe-Thiele method.
3. Students will be able to use graphical and numerical techniques to solve problems involving rate-based unit operations.
4. Students will have gained an understanding of the mechanical design of separations equipment and will have detailed knowledge of the design of plate and packed columns used for distillation and gas absorption.
5. Students will have gained the ability to recognize and formulate solutions to problems involving the design of new equipment to perform separation-based processes.
6. Students will be able to analyze the performance of existing equipment.
7. Students will be able to use the simulation package, Chemcad, to solve problems involving multiple equilibrium-stage and rate-based unit operations.
8. Students will increase their proficiency in oral and written communications.
9. Students will have gained experience in working within a team of their peers.

Required Text:

Seader, J.D., and E.J. Henley, *Separation Process Principles*, John Wiley and Sons Inc., 1998.
[defined in class notes as SH]

Related Texts and Recommended Reading (these will be placed on reserve at the Evansdale Library) :

Bennett, C.O. and J.E. Myers, *Momentum, Heat and Mass Transfer* (3rd Edition), McGraw-Hill, 1982 [BM]

Coulson, J.M., J.F. Richardson, J.R. Backhurst and J.H. Harker, *Chemical Engineering*, Volume 2 (4th Edition), Pergamon, 1991 [CRBH]

Henley, E.J. and J.D. Seader, *Equilibrium-Stage Separations in Chemical Engineering*, Wiley, 1981 [HS]

King, C.J., *Separation Processes* (2nd Edition), McGraw-Hill, 1980

McCabe, W.L., J.C. Smith and P. Harriott, *Unit Operations of Chemical Engineering* (5th Edition), McGraw-Hill, 1992.

Treybal, R.E., *Mass Transfer Operations* (3rd Edition), McGraw-Hill, 1980 [T]

Walas, S.M., *Chemical Process Equipment Selection and Design*, Butterworths, 1988 [W]

Safety, Health and Loss Prevention in Chemical Processes, The Center for Chemical Process Safety of AIChE, 1990.

<u>Grading :</u>	2 Exams (@ 22.5 % each)	45 %
	Homework Problem Sets	10 %
	Design Project	20 %
	Final Exam	<u>25 %</u>
		<u>100 %</u>

<u>Grade Assignment :</u>	100 – 90 A
	89 – 80 B
	79 – 70 C
	69 – 60 D
	59 – 0 F

Grading Policy : No make-up exams except by prior arrangement with instructor
Late assignment = no assignment
Exam grading appeals in writing on the day the exam is returned.

HW Assignments: Homework assignments will be given approximately every week and each assignment will be worth approximately the same credit (Typically there will be between 10 and 12 homeworks each worth the same amount with the total worth 10% of the final grade).

Design Project: During this course, you are expected to work in a group of 3 or 4 students to solve a design problem covering material presented in this course. The problem statement will be given to you in approximately the 4th week of the semester. A written report will be due to the instructor on the Monday of the week before dead week. You and your group members will also be required to present the results of your work in a formal oral presentation, in front of faculty and students, during the week before dead week.

Attendance Policy: Consistent with WVU guidelines, students absent from regularly scheduled examinations because of authorized University activities will have the opportunity to take them at an alternate time. Make-up exams for absences due to any other reason will be at the discretion of the instructor.

Social Justice Statement :

“West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class. Please advise me and make appropriate arrangement with Disability Services (293-6700).”

Course Schedule:

Week	Starting	Topic
1	1/11/99	Introduction, and Review of Flash Operations
2	1/18/99	Equilibrium Stage Operations Distillation
3	1/25/99	Distillation
4	2/01/99	Distillation Equipment, Design Project Assignment
5	2/08/99	Multicomponent Distillation, Batch Distillation
6	2/15/99	EXAM 1 Liquid Extraction
7	2/22/99	Liquid Extraction, Other Separating Agents/Methods
8	3/01/99	Mass Transfer Principles
9	3/08/99	Mass Transfer Coefficients - Differential Separations
10	3/15/99	Mass Transfer Equipment, Absorption/Extraction
11	3/22/99	Membrane Separation Processes, Gas Absorption
12	3/29/99	Mid Term Break
13	4/05/99	EXAM 2 A Review of Solids Separations
14	4/12/99	Filtration, Cyclones Sedimentation and Settling
15	4/19/99	Design Written and Oral Reports due
16	4/26/99	Design and Course Review
17	5/03/99	FINAL