Spring 2020

CHE 360-002: Separation Processes I

Angelo J. Perna

Separation Processes 1 – ChE 360-002

Syllabus

Term:	Spring 2020
Course Title:	Separation Processes 1
Course Description:	This is the first course in separations and examines traditional methods and technologies by which Chemical Engineers separate and purify mixtures. Emphasis here is on strippers, absorbers and distillation.
Course number:	ChE 360, Sect 002
Course instructor:	Angelo J. Perna
Office/lab location:	Campus Center Rm. 389
Telephone:	973-596-5590
E-mail:	perna@njit.edu
Office hours and location:	Monday & Wednesday 10:30 – 11:30 am Campus Center Rm. 389 Other hours by appointment only
Course hours &	Mon: 1:00 pm – 2:20 pm Wed: 1:00 pm – 2:20 pm
Location:	CKB 204
Prerequisites:	ChE 210, 240, 260, 342, 370
Course textbook:	GeanKoplis, C.J., "Transport Process and Separation Process Principles", 4th Edition, 2003, Prentice Hall. Other References are distributed by Instructor Notes McCabe, Smith & Harriott, "Unit Operations of Chemical Engineering", 4th Edition, 1986, McGraw Hill Felder & Rousseau, "Elementary Principles of Chemical Processes, 3rd Edition, 2005, Wiley

Course Outcomes:

1. Students shall have an understanding of methods and technologies by which mixture are separated and purified.
2. Students shall be able to design separation processes, such as strippers, absorbers and distillation columns and incorporate safe, environmental and energy saving considerations in the final process.

Topics Covered: (Subject to Change As Needed)

1. Chapter 10 Review of Phase Equilibrium, Material Balances and General Introduction to Separation Processes (Pgs. 655-8) (1/2 week)
2. Single and Multiple Equilibrium Stages. (Pgs. 629-636) (1.5 weeks)
3. Interphase Mass Transfer (Pgs. 636-39) (1/2 week)
4. Stripping and Absorption in Plate Towers, and Packed Towers (Pgs.653-57; 662-70) (2 weeks)
5. Review Chapter 10 (1/2 week)
6. Chapter 11 Flash and Batch Distillation (Pgs. 696-705) (1 week)
7. Simple Distillation Methods, Continuous Distillation with Reflux (Pgs. 706-718) (1 ½ week)
8. Constant Molal Overflow Systems, McCabe-Thiele Analysis (Pgs. 718-724) (1 ½ week)
9. Use of Efficiencies (Pgs. 724-9) (1 week)
10. Ponchon Savarit (1 week) NOTES
11. Multi Component Distillation (Pgs. 740-745) (1 week)
12. 4 Exams (2 weeks)

Grading:

The final course grade a student earns is the average of 4 major exams based on material covered in the lectures/ handouts, homework, assigned readings, and in class quizzes.

Final Grade Basis: 4 Exams at 100 points each = 400; 400/4 = Final Grade

$90 \leq A \leq 100$	$70 \leq C < 75$
$85 \leq B+ < 90$	$60 \leq D < 70$
$80 \leq B < 85$	$0 \leq F < 60$
$75 \leq C+ < 80$	

In rare cases a student may receive the grade of I and must be removed as stated by school policy. Make up exams will only be given with a legitimate excuse acceptable by the instructor and at a time and place set by the instructor.

NOTE: All Exams are Open Textbook Only unless otherwise specified.

Cheating:
Cheating is defined as the submission of work (homework or exam answers), which is the work of others as your efforts.

Attendance:
Students are expected to attend all scheduled classes and on time. Attendance will be taken at the beginning of each class. **Students missing or marked absent for six (6) classes are automatically given an F for the course, those with more than three (3), but less than six (6) will receive one letter grade lower than final grade.** Students entering the class after roll call are marked absent and if they turn in any assignment it will not be accepted. In addition if a student is 15 or more minutes late for an exam he/she will not be allowed to take the exam.

Notes:

The student is responsible for all information given in lectures, hand-outs whether they are present or not. The uses of audio and/or, video devices are not allowed without prior written consent of the instructor. The use of telecommunication devices (for any reason, including 1cxting and use as a calculator) is not allowed during class hours

Text message formatted e-mail by a student to the instructor will not be responded to.

*The use of cell phones during class time is prohibited. However, the use of laptops and other electronic devices will be allowed for educational activities, which will be announced prior to the lectures by the instructor. Exceptions include documented medical conditions that require the use of a device; please see the instructor

*DEPARTMENT POLICY

Student homework problems:

The Problems listed below for Chapters, 10 & 11 in your text, have been selected for student homework as illustrations of the theory covered. Solutions to the listed problems are on reserve in the Library.

Ch. 10- 2-1, 2-2, 3-2, 3-3, 6-1, 6-2, 6-4, 6-5, 6-13
Ch. 11- 1-1, 1-2, 1-3, 2-1, 3-2, 3-4, 3-5, 4-1, 4-2, 4-4, 4-5, 4-7, 5-1

Prepared by:

Dr. Angelo J. Perna
E-mail: perna@njit.edu
Office: Campus Center Rm. 389 Phone: 973-596 -3616/5590
Hours: as posted others TBA

ChE 360 Separation Process 1

Course Objectives:

1. Students shall have an understanding of methods and technologies by which mixtures are separated and purified.
2. Students shall be able to design separation processes, such as strippers, absorbers and distillation columns and incorporate safe, environmental and energy saving considerations in the final process.

Attribute	1-Not Proficient D or F	2-Progressing to proficiency C or C+	3-Proficient B or B+	4-Superior proficiency A	Score
Grasp Single Ideal stage balances concept	Cannot identify streams	Can identify steams but not relationship	Can do balances and identify streams	Correctly identify all stream and components	
Grasp concept of ideal equilibrium stage	Can not relate ideal stage to equilibrium relationship	Understands ideal stage concept and stream components relations	Able to manipulate balances and equilibrium relationship	Able to manipulate balances and equilibrium concepts	
Multistage operations	Cannot extend single stage concept	Can extend single stage concept but has difficulty with balances	Can and understands extension of single to multistage	Can extend concept and uses it in the design	
Graphical solution to multistage units	Cannot do graphical solutions	Has difficulty relating process modeling to graphical solution	Can do only simple system graphical	Able to graphically solve complete problems	
Absorption process in the plate and packed tower	Does not see relationship between multistage development	Sees stage wise concepts extended to plate and tower	Understands modeling both graphically and	Understand 2 film theory &mass transfer system	

Attribute	1-Not Proficient	2-Progressing to proficiency	3-Proficient	4-Superior proficiency	Score
Distillation material and enthalpy balances for binary systems	Cannot grasp operating line concepts and stage calculations for McCabe thiele and Ponchon savarit method	Can manipulate McCabe Thiele method but has difficulty with Ponchon savarit	Able to do simple problems using McCabe Thiele and Ponchon Savarit	Can solve complex binary distillation problems	
Sees relationship between plate and packed towers	Does not understand HETP	Grasp concept of HETP but cannot use it	Can use HETP concept	Can use HETP for design	
Environmental impact	Cannot see environmental impact due to design	Can see process impact	Able to suggest process design changes	Identifies and offers process corrections.	

Note: The above attributes are reviewed at the end of a semester in conjunction with each exam and are an input into the final grade to determine how well a student has progressed from start to finish in grasping the course materials