Spring 2019

CHE 360-006: Separation Processes 1

Angelo J. Perna

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Separation Processes 1 – ChE 360-006

Syllabus

Term: Spring 2019

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 006

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 & Thursday 10:30 – 11:30 am Campus Center Rm. 389
Other hours by appointment only

Course hours & Location: Monday: 1:00 – 2:20 pm
Thursday: 1:00 – 2:20 pm
CKB 204

Prerequisites: ChE 210, 240, 260, 342, 370

Other References are distributed by Instructor Notes
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. 3 Exams Plus Final (1.5 week)

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 pts (0.96)/4 plus 4 points for class quizzes and homework assignments

\[
\begin{align*}
90 \leq A & \leq 100 \\
85 \leq B+ & < 90 \\
80 \leq B & < 85 \\
75 \leq C+ & < 80 \\
70 \leq C & < 75 \\
60 \leq D & < 70 \\
0 \leq F & < 60
\end{align*}
\]
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 will result in an automatic grade of F. 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 texting 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.

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

Prepared by:
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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.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>1-Not Proficient D or F</th>
<th>2-Progressing to proficiency C or C+</th>
<th>3-Proficient B or B+</th>
<th>4-Superior proficiency A</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasp Single Ideal stage balances concept</td>
<td>Cannot identify streams</td>
<td>Can identify streams but not relationship</td>
<td>Can do balances and identify streams</td>
<td>Correctly identify all stream and components</td>
<td></td>
</tr>
<tr>
<td>Grasp concept of ideal equilibrium stage</td>
<td>Can not relate ideal stage to equilibrium relationship</td>
<td>Understands ideal stage concept and stream components relations</td>
<td>Able to manipulate balances and equilibrium relationship</td>
<td>Able to manipulate balances and equilibrium concepts</td>
<td></td>
</tr>
<tr>
<td>Multistage operations</td>
<td>Cannot extend single stage concept</td>
<td>Can extend single stage concept but has difficulty with balances</td>
<td>Can and understands extension of single to multistage</td>
<td>Can extend concept and uses it in the design</td>
<td></td>
</tr>
<tr>
<td>Graphical solution to multistage units</td>
<td>Cannot do graphical solutions</td>
<td>Has difficulty relating process modeling to graphical solution</td>
<td>Can do only simple system graphical</td>
<td>Able to graphically solve complete problems</td>
<td></td>
</tr>
<tr>
<td>Absorption process in the plate and packed tower</td>
<td>Does not see relationship between multistage development</td>
<td>Sees stage wise concepts extended to plate and tower</td>
<td>Understands modeling both graphically and</td>
<td>Understand 2 film theory &amp; mass transfer system</td>
<td></td>
</tr>
<tr>
<td>Attribute</td>
<td>1-Not Proficient</td>
<td>2-Progressing to proficiency</td>
<td>3-Proficient</td>
<td>4-Superior proficiency</td>
<td>Score</td>
</tr>
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<tr>
<td>Distillation material and enthalpy balances for binary systems</td>
<td>Cannot grasp operating line concepts and stage calculations for McCabe Thiele and Ponchon savarit method</td>
<td>Can manipulate McCabe Thiele method but has difficulty with Ponchon savarit</td>
<td>Able to do simple problems using McCabe Thiele and Ponchon Savarit</td>
<td>Can solve complex binary distillation problems</td>
<td></td>
</tr>
<tr>
<td>Sees relationship between plate and packed towers</td>
<td>Does not understand HETP</td>
<td>Grasp concept of HETP but cannot use it</td>
<td>Can use HETP concept</td>
<td>Can use HETP for design</td>
<td></td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Cannot see environmental impact due to design</td>
<td>Can see process impact</td>
<td>Able to suggest process design changes</td>
<td>Identifies and offers process corrections.</td>
<td></td>
</tr>
</tbody>
</table>

**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.