Department of Chemical Engineering
College of Engineering
University of the Philippines
Diliman, Quezon City

ChE 132

Stagewise Operations

Course Description: Unified treatment of stagewise operations. Numerical & graphical solution techniques. Design of multistage equipment

Course Prerequisites: ChE 123 and ChE 106

Course Credit: 3.0 units (3 h lecture)

Program Educational Objectives (BS Chemical Engineering)
The program aims to educate students such that three to five years from graduation, they:

1. take leadership roles in their respective fields and/or effectively work in or manage a team;
2. are equipped with the extensive knowledge and relevant skills necessary to succeed in their chosen careers and to become responsive citizens;
3. are able to demonstrate strong research & innovative capability as they recognize and address opportunities and challenges in their respective spheres of influence;
4. have shown strong commitment to the ethical practice of their profession; to health, safety and environment; and service to society.

Course Outcomes
At the end of the course, the student should be able to:

1. Define an equilibrium stage, explain general separation techniques and how mass and energy balances and phase equilibria play an important role in these processes.
2. Create equilibrium phase diagrams for solid-liquid equilibrium (SLE), liquid-liquid equilibrium (LLE) and vapor-liquid equilibrium (VLE) systems from experimental data & thermodynamic models.
3. Calculate the resulting amounts & compositions of exit streams from single, cascading & refluxed equilibrium stage configurations using graphical and numerical methods.
4. Understand the concepts and reasoning behind graphical solutions in stagewise operations for the different phase systems.
5. Program solutions for stagewise operations for the different phase systems.
6. Cite various examples of separation processes in industry and explain the theory behind these systems.

Student Outcomes Satisfied by Course Outcomes

[a] Ability to apply knowledge of mathematics and science to solve engineering problems

[c] Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards

[e] Ability to identify, formulate, and solve engineering problems

Course Content

1. Introduction to separation processes
2. Thermodynamics of stagewise operations
3. Single equilibrium stages
   - Leaching
   - Liquid-liquid extraction
   - Gas absorption
   - Gas adsorption
   - Flash distillation

First Exam

4. Multistage batch separations
5. Cascade systems
6. Multistage separation processes
   - Leaching
   - Gas absorption
   - Gas adsorption
   - Liquid-liquid extraction
7. Countercurrent multistage separation with reflux

Second Exam

8. Distillation of binary mixtures
9. Ponchon-Savarit method
10. Distillation with reflux
11. Simplified methods
12. Batch distillation
13. Enhanced distillation methods

Third Exam

Course Assessment

Long Examinations (4)	50%
Class Work	30%
Finals	20%

Course Policies

1. Each student is required to always be prepared with an ink pen, a pencil, a long ruler and a scientific calculator. Any student who fails to bring any one of these items during classwork day will be requested to leave the lecture room.
2. As soon as the results of a long exam or classwork is returned, a student shall be given only up to two (2) days, immediately following the release, to seek corrections and/or partial credit for the exam paper.
3. A student who misses an exam must submit an official excuse slip from the Administrative Staff Office to the instructor on or before the schedule of the next long exam. A student may miss only one long exam; any other missed long exam, whether with or without valid excuse, shall be given a score of zero.
4. University rules on student conduct shall be observed.
5. The instructor reserves the right to modify the policies and class schedule without prior notice.

Grading System

1.00	1.25	1.50	1.75	2.00	2.25	2.5	2.75	3.00	5.00
[92,100]	[88,92)	[84,88)	[80,84)	[76,80)	[72,76)	[68,72)	[64,68)	[60,64)	[0,60)

List of Instructors

Dr. Jose Muñoz
Dr. Terence Tumolva
Prof. Jonas Karl Christopher Agutaya
Engr. Louie Arelvi Villanueva

References

1. Foust, et al., *Principles of Unit Operations*, 2nd Ed.
2. J.D. Seader and E. Henley, *Separation Process Principles*, 3rd Ed.
3. McCabe, Smith and Harriot, *Unit Operations of Chemical Engineering*, 7th Ed.
4. Perry, Robert and Don Green, *Perry's Chemical Engineering Handbook*, 7th Ed.