ChE-310

Fundamentals of separation processes

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Cursus	Sem.	Type
Chemical Engineering	BA6	Obl.
Energy minor	E	Obl.
HES - CGC	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Remark

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Summary

The course will cover fundamentals concepts of separation processes involving chemical equilibrium and mass transfer. Students will design separation processes widely used in the industry, for the separation of liquid mixtures, gas-liquid mixtures, and gas mixtures.

Content

1. Mass and Energy Balances
2. Thermodynamics of Separations
3. Diffusion, Convection and Mass Transfer
4. Flash Distillation
5. Column Distillation
6. Multicomponent Distillation
7. Absorption and Stripping
8. Liquid-Liquid Extraction
9. Adsorption Processes
10. Membrane Processes

Learning Prerequisites

Important concepts to start the course

Mass and energy balance
Basics of diffusion and mass transfer

Learning Outcomes

By the end of the course, the student must be able to:

• Compute composition of streams leaving a separation process using the concepts of mass and energy balances, phase equilibria, mass transfer and diffusion.

• Design the separation process (number of equilibrium-stages, height, diameter, etc.) for the desired outlet concentration from a given feed.

• Predict the optimal separation process for a given chemical stream by comparing the energy footprint of several processes for the needed separation.

Teaching methods

• Blackboard and projector slides would be used to deliver the course content. Examples and exercise will be conducted in between the lecture. For problems using graphical approach, graph papers would be provided but students are expected to bring their own pencil, rulers, etc.

• In addition, a process simulator, Aspen Plus, will be used to illustrate the concepts, inferring the governing principles. Students are NOT expected to know Aspen Plus a priori. The use of Aspen plus will be restricted to illustrate the concepts by the instructor.

• Clickers (device that allows you to answer interactive questions in class) would be used to conduct quizzes (usually multiple choice questions). These quizzes are meant to support the learning process. For example, clicker based question would be asked at the start of every class to gauge understanding of the subject and review concepts. Clicker responses would be anonymous. Answers will not be used for formal assessment. To be able to participate in this, you can use your smartphone/tablet to answer questions. You will have to install the 'TurningPoint' app on your smartphone (Android or iOS). You can find the details here:

https://play.google.com/store/apps/details?id=com.turningTech.Responseware&hl=en-ca
https://itunes.apple.com/us/app/turningpoint/id300028504?mt=8

• For students who do not have smartphone or prefer not to use their smartphone, they can pick EPFL clickers in the first class. Students are responsible to bring them to every lecture. Student borrowing the clickers must return them in the last class of the semester. Students are responsible for getting assistance in case of technical issues (for example, low battery). Clickers can also be borrowed from the library. To borrow a clicker, visit the Library main counter at the Rolex Learning center (Mon-Fri, 8 AM to 8 PM). The loan is free of charge and the only thing you need is your CAMIPRO.

Assessment methods

6 Assignments (homework problems) during the entire course (36%). Each assignment will have 2 questions requiring student to spend 1-2 hours.
final exam (64%)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

1. Separation Process Engineering by P. C. Wankat (available online in the library)
2. Separation Process Principles by J. D. Seader, E. J. Henley, D. K. Roper

Ressources en bibliothèque

• Separation process engineering / Wankat
• Separation process principles / Henley