

ChE-459

Process development

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Cursus	Sem.	Type
Biotechnology minor	E	Opt.
Energy minor	E	Opt.
Ing.-chim.	MA2, MA4	Obl.

Language of teaching	English
Credits	8
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	240h
Weeks	14
Hours	8 weekly
Lecture	2 weekly
Project	6 weekly

Number of positions

It is not allowed to withdraw from this subject after the registration deadline.

Summary

Through a project, this course will introduce the critical steps in developing a chemical process in the context of industry decarbonisation, from the lab to industrial scale.

Content

- Integrated process development of a simple process from lab to industrial scale.
- Process flowsheeting with commercial software.
- Closing the water-waste-energy balances.
- Production costs estimation.
- Feasibility study with respect to economic and EHS compliance.
- Safety concepts application.

Learning Prerequisites**Important concepts to start the course**

This course ties together skills and knowledge previously acquired during the Chemical Engineering degree. The goal is to see how you can apply those theoretical concepts in a real case study, which resembles the type of missions you will be carrying out as Chemical Engineers in the industry. However, the course remains open to students from a different background but with a strong interest in the processing industry. If you are from a different section, please contact the teaching team ahead of the course so we can evaluate how best to accompany you through the course.

Concepts:

- Basic thermodynamic, chemistry and reaction engineering knowledge (ChE-340 The engineering of chemical reactions, or equivalent course)
- Mass and energy balances in chemical process (ChE-201 Introduction to Chemical Engineering, or equivalent course)
- Basic knowledge of process unit operations (ChE-334 Opération unitaire et technologie des procédés, or equivalent course), like chemical reactors, separation techniques (ChE-310 Fundamentals of separation processes, or equivalent course), pumps and compressor and heat exchangers
- Basics in heat integration (ChE-304 Energy systems engineering, or equivalent course)

Learning Outcomes

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

- Assess / Evaluate different production routes with knowledge extracted from the literature
- Construct process flow diagrams and solve mass balances
- Identify chemical transformation steps with unit operations
- Perform a sensitivity analysis and optimize process conditions
- Work out / Determine the size and cost process equipment with correlations
- Apply the concepts of heat integration with an in-house developed tool
- Assess / Evaluate the economic profitability of their process
- Assess / Evaluate the sustainability of their process
- Assess / Evaluate the risk and safety of their process

Transversal skills

- Assess progress against the plan, and adapt the plan as appropriate.
- Set objectives and design an action plan to reach those objectives.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Make an oral presentation.

Teaching methods

- Theoretical lectures (brief recall of knowledge acquired in previous courses and new content specific to the course)
- Tutorial sessions introducing the software and preparing the tasks that will need to be performed for the project
- Supervision of individual groups by an assigned teaching assistant, available during the class to assist in every step of the project

Expected student activities

Students are expected to:

- Participate to lectures
- Actively participate to tutorial sessions and work on the weekly workshops to learn the software
- Realize a group project to design, model and evaluate a chemical process, in small groups (typically 3 students)

Assessment methods

- Graded questionnaire on tutorials
- Group report and presentation on the project
- Individual peer review of the first chapter of the report from another group

Resources

Ressources en bibliothèque

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Moodle Link

- <https://go.epfl.ch/ChE-459>