ChE-459

Process development

Gouveia Braz Ana Catarina, Maréchal François, Ribeiro Domingos Meire Ellen Gorete

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

Language of teaching	English
Credits	8
Session	Summer
Semester	Spring
Exam	Oral
Workload	240h
Weeks	14
Hours	**8 weekly**
Courses	2 weekly
Project	6 weekly
Number of positions	

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

Moodle Link

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