LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Hållbar processdesign
Sustainable Process Design

KETN20, 15 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED B/K
Date of Decision: 2023-04-18

General Information

Language of instruction: The course will be given in English on demand

Aim

Energy and resource efficient processes are a prerequisite for a sustainable society. The efficiency of energy and material use can be achieved through optimization of existing processes in an industry, the process of integration of energy and materials between different industries, and between industry and society. This contributes to a more sustainable use of limited resources, lower production costs and reduced environmental impact. Advanced process design is the cornerstone of this work.
The aim of the course is to give the student the tools needed to combine multiple unit operations in an industrial process and to study the dependence between unit operations and how the total resource is affected when key parameters are varied.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

• Through technical design calculations be able to evaluate the energy efficiency, raw material utilization and environmental impact for different processes.
• At the design stage be able to optimize the integration of energy conversion processes with respect to energy efficiency and environmental impact, as well as discuss the strengths and weaknesses of the selected design.
• Be able to describe how the design of various process depend on physical transport processes and phase equilibria and how this affects the optimization when different processes are to be integrated into an industrial process.

• Be able to use flowsheeting as a tool to describe how energy conversion processes, separation processes and reaction technology affects the design of various process steps, and how the integration of these process steps to an optimized industrial process can be implemented.

Competences and skills
For a passing grade the student must

• Independently formulate and analyze various energy conversion processes for efficiency and environmental impact for both fossil and renewable energy sources.
• In an engineering way being able to design technical processes for industry and municipalities.
• Be able to write a technical report of good quality (in language and factually) in which the technical design and the reasons behind design choices is described as well as verbally to give a brief account of the same.
• With flowsheeting be able to make advanced models for material and energy balances in chemical engineering or biotechnological systems.
• Be able to make use flowsheeting tools to analyze and optimize chemical and biotechnological processes.
• Demonstrate the ability to cooperate in groups of different compositions.

Judgement and approach
For a passing grade the student must

• By flowsheeting calculations and written and oral communication demonstrate familiarity with industrial problems and ability in an engineering way to design a variety of industrial processes.
• Be able to assess and evaluate how the various ways to optimize an industrial process (in terms of energy efficiency and environmental impact) affect the design.
• Be able to value how different parameters affect industrial processes capacity, energy efficiency, product quality and the ability to integrate with other process steps.
• Be able to obtain relevant information from different sources and evaluate this in an independent way.

Contents

The course is structured around a number of themes. The course covers design of industrial processes using flowsheeting programs and contains in-depth sections on phase equilibria, distillation, physical transport processes and energy conversion, multi-component distillation, absorption and evaporation. Energy and environmental aspects are illustrated by the section on energy, energy production, water and waste management, as well as gas purification. Also included is optimization of industrial processes with respect to energy efficiency and environmental impact.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Active participation in subprojects, oral presentations, written reports. Written examinations. The final grade is based on the written examinations. The final grade is determined by a weighted average of the grades in the written examinations.

The examiner, in consultation with Disability Support Services, may deviate from the

regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0117. **Name:** Written Examination 1.
Credits: 5. **Grading scale:** TH. **Assessment:** Written exam with calculation tasks **Contents:** The basics of process design and in-depth on reactors, homogeneous separation processes and heterogeneous separation processes.

Code: 0217. **Name:** Written Examination 2.
Credits: 3. **Grading scale:** TH. **Assessment:** Written exam **Contents:** Process integration and energy efficiency, production of hot and cold utilities and emission control to atmosphere and water.

Code: 0317. **Name:** Projects.
Credits: 7. **Grading scale:** UG. **Assessment:** Active participation in group work and group discussions. Approved project exercises. **Contents:** Process design project,computer simulation exercises and calculation tasks.

Admission

Admission requirements:

- KETF10 Separation Processes, Basic Course or KETF40 Mass Transfer Processes in Environmental Engineering
- KETF25 Reaction Engineering or KETF40 Mass Transfer Processes in Environmental Engineering

The number of participants is limited to: No
The course overlaps following course/s: KETN15, KETN05, KET010

Reading list

- Mattias Alveteg (editor): Handbook.
- Smith: Chemical Process Design and Integration. John Wiley & Sons, 2016, ISBN: 978-1-119-99013-0.
- Kamal I.M. Al-Malah: Aspen Plus: Chemical Engineering Applications. John Wiley & Sons, 2016, ISBN: 9781119293644.

Contact and other information

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