KE2010 Industrial Energy Processes 7.5 credits

Industriella energiprocesser

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for KE2010 valid from Autumn 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Chemical Science and Engineering, Chemistry and Chemical Engineering

Specific prerequisites

Admission requirements for programme students at KTH:
At least 150 credits from grades 1, 2 and 3 of which at least 110 credits from years 1 and 2, and bachelor's work must be completed, within a programme that includes:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding.

Admission requirements for independent students:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding. Documented proficiency in English corresponding to English B.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After finished course, you should be able to:

- Analyse the technical performance for energy processes in industrial scale with the help of thermodynamic relationships.
- Calculate combustion reactions and heat yields for different fuels.
- Perform thermodynamic calculations on thermal power and combined heat and power cycles, e.g. steam cycles, combined cycles, and stationary motors.
- Estimate the potential for energy efficiency by utilizing process integration (pinch analysis) including heat exchanging, heat pumping, and waste heat recovery.
- Apply relevant system boundaries to energy-related problems.
- Analyse the performance of energy conversion systems in relation to ideal systems and with this as a starting point suggest improvements.
- Evaluate the economic consequences of different energy solutions.

Course contents

An overview of energy consumption and energy conversion systems in Sweden and globally is presented in the beginning of the course. The concepts open and closed systems are considered together with system boundaries and their relevance for thermodynamic calculations.

Energy conversion through combustion and in real thermodynamic processes such as steam, gas and heat pump cycles are studied together with common applications. The concept exergy is introduced as a tool to facilitate the understanding of what is theoretically achievable in energy conversion systems.

Different types of energy technologies utilised in industrial processes are discussed. Some basic economic prerequisites for energy systems are introduced during the work with a major home assignment. Energy efficiency is of increasing importance for the economic performance of industrial processes and so called pinch analysis will be used as a tool to examine energy efficiency measures. All the teaching/learning activities that involve calculations are covered in the exercises (tutorials).

A full day study visit is scheduled during the course.

Course literature

"Fundamentals of Engineering Thermodynamics" (6th ed., SI Version) also called Principles of Engineering Thermodynamics (7th ed. or 8th ed., SI Version) by Moran & Shapiro, John Wiley & Sons.

Tabeller och diagram för energitekniska beräkningar (Tables and Diagrammes for Energy Calculations) by Lars Wester, Marklund Solutions. It is sold at the School of Chemical Science and Engineering Students' Office at Teknikringen 42.

Additional material will be distributed or sold on lectures and exercises (tutorials).

Examination

- BER1 - Calculation Task, 3.0 credits, grading scale: P, F
- TEN1 - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

The two parts of the examination are evaluated and reported separately, but both a linked to the final grade. The homework assignment includes: a written and oral peer review of another group's assignment, a presentation, a final report and a reflective report about your own contributions in relation to the project as a whole. The final report is linked to the final grade through the number of revisions of the report before it is passed. The final grade will be one step higher than the grade for the exam if the report passes without revision and the final grade will be equal to the grade for the exam if the report passes after the first revision. The final grade will thereafter decrease with one step compared to the grade for the exam for each time the report is revised before it passes.

Over the course, two intermediate tests that together could give up to 20 credits are offered. If 12 or more credits are achieved in these tests, full score will automatically be given on one specified problem at the exam. This problem should therefore not be solved.

Other requirements for final grade

Passed examination (TEN1; 4,5 credits)

Passed homework assignment including presentation and supplementary reflecting report (BER1; 3 credits)

The grades A to F are given as the final grade after the student has passed both examination parts.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.