JÖNKÖPING UNIVERSITY
School of Engineering

COURSE SYLLABUS

Chemical Thermodynamics, 7.5 credits

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Course Code:	TCHR21	Education Cycle:	Second-cycle level
Confirmed:	Feb 01, 2025	Disciplinary domain:	Technology
Valid From:	Sep 01, 2025	Subject group:	Other Subjects within Natural Science
		Specialised in:	A1N Second cycle, has only first-cycle course/s as entry requirements
		Main field of study:	Product Development

Intended Learning Outcomes (ILO)

On completion of the course the student shall:

Knowledge and understanding

- show a basic understanding of concepts in chemical thermodynamics including the computational thermodynamics
- show familiarity with applications of chemical thermodynamics which is required in the advanced courses within the program.
- show familiarity with the conditions under which pollutants like CO2 are generated, as well as the chemical reactions and interfacial phenomena that can be utilized to develop environmentally friendly processes

Skills and abilities

- demonstrate skills of (chemical) thermodynamic calculation by commercially available software and evaluate the calculation results
- demonstrate the ability to explain the interfacial phenomena in the materials processes, which involves liquid, solid and gas phases, from thermodynamics viewpoints

Judgment and approach

- demonstrate the ability to apply thermodynamic approach to materials processes
- demonstrate the ability to explain the phenomena in the manufacturing processes with the knowledge in chemical thermodynamics

Content

The course deals with basic theoretical knowledge in chemical thermodynamics, application of chemical thermodynamics and interfacial physical chemistry.

- Lectures on the chemical thermodynamics and thermodynamics of interface, and its application (some examples in the actual processes)
- Exercises on the chemical thermodynamic calculation
- Laboratory sessions on chemical thermodynamics

The course includes the following elements:

- Calculation of thermodynamic equilibrium (Gibbs energy, van't Hoff isotherm, Ellingham diagram)
- Calculation of activity and activity coefficient (Wagner's equation, Henrian and Raoultian standards)
- Thermodynamic treatments of the surface/interface (Gibbs dividing surface, Guggenheim model, Nucleation) and interfacial phenomena in the high-temperature system
- Thermodynamic treatments of the phase and phase diagram (Gibbs energy change, phase rule, etc.)

- Calculations using a thermodynamic calculation software and a multiphysics simulation software (Lab activities)
- Chemical thermodynamics and environmental sustainability (e.g., reactions related to the CO2 emission and its calculation)

Type of instruction

Lectures, laboratory sessions, and exercises.

Language of instruction is in English.

Entry requirements

Passed courses of at least 150 credits in the program Industrial Product Realisation, or a bachelor's degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in Materials and Manufacturing, Materials Engineering, Mechanical Engineering, Chemical Engineering, Product Development, Engineering Physics or the equivalent. The bachelor's degree should comprise a minimum of 15 credits in Mathematics. Proof of English proficiency is required.

Examination and grades

The course is graded 5, 4, 3 or U.

Registration of examination:

Name of the Test	Value	Grading
Assignments	2 credits	G/U
Examination [1]	4 credits	5/4/3/U
Laboratory work	1.5 credits	G/U

[1]Determines the final grade of the course, which is issued only when all course units have been passed.

Course literature

Please note that changes may be made to the reading list up until eight weeks before the start of the course.

T. Matsushita and K. Mukai, Chemical Thermodynamics in Materials Science – From Basics to Practical Applications –, Springer, 2018.

Recommended literatures:
K. Mukai and T. Matsushita, Interfacial Physical Chemistry of High-Temperature Melts, CRC Press, 2019.