COURSE DESCRIPTION CARD - SYLLABUS

Course name
Calculation of phase equilibria [S2IChiP1>ORF]

Course

Field of study
Chemical and Process Engineering

Year/Semester
1/1

Area of study (specialization)
Chemical Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
0

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Student knows the basics of algebra and differential calculus as well as the basics of industrial processes.

Course objective

The aim of the course is to familiarize students with the basic methods of calculating physical equilibria of flash type, selected equations of state and thermodynamic models used in the calculation of liquid- vapor and liquid-liquid equilibria.

Course-related learning outcomes

Knowledge:
1. student knows the basic equations of state, e.g. the ideal gas equation of state, viral equation of state, van der waals equation, soave-redlich-kwong and peng-robinson models. [k_w03]
2. student knows the selected model describing the coefficients of activity and fugativity, e.g. nrtl, unifac, uniquac and their selected modifications. [k_w12]
3. student knows the general rules of selecting thermodynamic models for typical physical systems [k_w01]
4. student knows the basics of creating equilibrium plots based on thermodynamic models. [k_w12]

further consequences on the quality and safety of the designed technological processes. [k_k07]

Skills:
1. student can perform simplified calculations of phase equilibria with the use of a spreadsheet. [k_u09]
2. student is able to identify the essential selection steps of appropriate thermodynamic models for the selected physicochemical systems. [k_u09, k_u11]
3. student is able to calculate phase equilibria using available chemical process simulators (chemcad or aveva process simulation) and illustrate them using t-xy, p-xy, xy graphs. [k_u07, k_u09]
4. student is able to assess the suitability of selected thermodynamic models describing the vapor-liquid equilibrium (vle) and liquid-liquid (lle) equilibrium for the process simulation. [k_u09]

Social competences:
1. student knows the limitations of her/his own knowledge and understands the need for continuous education and improving her/his professional competences, with particular progress in the area of phase equilibrium modeling. [k_k01]
2. student is aware and understands the social aspects of the practical application of the acquired

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Knowledge and skills acquired during the classes are verified by completing individual tasks checking the ability to apply the acquired knowledge in calculations in a spreadsheet and in a selected process simulator. Passing from 50% of points according to the following criteria: 50%-60% (3.0), 61% -70% (3.5); 71% -80% (4.0), 81% -90% (4.5), 91% -100% (5.0).
If the classes will be held remotely, the form of assessing the course will remain unchanged and will be carried out with use of the tools provided by the Poznań University of Technology (https://elearning.put.poznan.pl/), about which students will be informed as soon as possible.

Programme content

Issues related to basic methods of calculating physical equilibria.

Course topics

The course covers:
1. Selected models describing the state of the gas phase, i.e.: ideal gas equation of state, Van der Waals equation, Soave-Redlich-Kwong and Peng-Robinson models.
2. Selected models describing the activity coefficient: NRTL, UNIQUAC, UNIFAC (org), UNIFAC v. Dortmund, UNIFAC v. Lyngby.
3. Calculations of phase equilibria such as: TP-flash, VP-flash, TV-flash.
4. Creation and practical analysis of VLE, LLE, VLLE and SLE phase equilibrium diagrams.

Teaching methods

Multimedia presentation, materials made available in the university e-Learning system, calculations using a spreadsheet and a selected process simulator.

Bibliography

Basic
1. P.T. Mitkowski, S. Woziwodzki, Komputerowe wspomaganie projektowania, Wydawnictwo Politechniki Poznańskiej, Poznań, 2011.
Additional
1. Seader JD, Henley EJ, Roper DK. Separation Process Principles. 3rd ed. Hoboken, NJ, USA: John Wiley & Sons, Inc.; 2006.
2. Smith, J. M; Van Ness, H. C; Abbott MM. Introduction to Chemical Engineering Thermodynamics. 2001.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50