COURSE DESCRIPTION CARD - SYLLABUS

Course name
Process systems design [S2IChiP1>PSP]

Course

Field of study
Chemical and Process Engineering

Year/Semester
1/2

Area of study (specialization)
Bioprocesses and Biomaterials 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 (e.g. online)
0

Tutorials
0

Projects/seminars
60

Number of credit points

4,00

Coordinators

dr inż. Maciej Staszak
maciej.staszak@put.poznan.pl

Lecturers

Prerequisites

Student has knowledge of mathematics to the extent that allows him to use mathematical methods to describe chemical processes and make calculations needed in engineering practice. Student has knowledge in the basic field related to the selection of materials used in the construction of chemical equipment and installations. Student knows the basics of kinetics, thermodynamics and catalysis of chemical processes.

Course objective

The aim of the course is to learn how to design unit operations and equipment of the chemical industry on the basis of the design of the entire chemical plant. The design of the whole chemical installation gives an opportunity to learn about many types of unit operations cooperating together in one installation. An important aspect of the subject is the use of a design support tool - Chemcad.

Course-related learning outcomes

Knowledge:
the student acquires knowledge in the area of chemical equipment design, application of thermodynamic models and taking into account different levels of complexity in the project. the

student understands the necessity of using numerical procedures by the software and their significant influence on the way of conducting calculations. (k_w01, k_w03, k_w06, k_w07)

Skills:
students will have skills to create a project on three levels of complexity: basic balance based on defined design requirements and declared flows, rating the dimensioning of equipment and hydraulics based on defined pressures. the student is able to identify key problems related to system non-ideality, eliminate incorrect and illogical installation settings and conduct analysis based on the use of parametric sensitivity technique. (k_u01, k_u06, k_u07, k_u14)

Social competences:
the student is aware of the impact of applied solutions in the project on the environment. particular emphasis is placed on the impact of the installation on the environment through the identification of environmental hazards using the war procedure. (k_k02)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Semester evaluation of the completed project, which consists of a preliminary pre-design analysis, the quality of the completed project and the preparation of a final report. The completed project is evaluated on the basis of design calculations made by the student. In particular, the assessment consists of: the implemented complexity of the installation, the mass and energy balance of the installation, the sizing calculations of the equipment, flow (hydraulic) analysis, forecast of the impact of the designed installation on the environment. The projects are evaluated by the instructor without the participation of students and subsequently the students have the opportunity to defend the questionable design solutions used. Therefore, there is no difference in the verification of learning outcomes between the full-time and remote mode.

Programme content

Unit oparations mass, ionic and heat balances. Sizing the equipment, including: chemical tank and tubular reactors, tray and packed distillation columns, heat exchangers, separation vessels, pipelines, control valves, hydraulic operations. Verification analysis for sized equipment. Hydraulic analysis using the "equation oriented" model.

Teaching methods

Extensive presentation of the using and operation of the design support tool - Chemcad. Detailed overview of individual unit operations available in Chemcad. Detailed analysis and explanation of the ways of declaring the kinetics of chemical reactions with formulations significantly deviating from the classical arrhenius forms. Presentation of methods of taking into account chemical catalysts. Based on the presented examples, the students perform preliminary, test projects of single unit operations during the classes. At this stage, the teacher assists students in the use of the CAD tool, without solving any design problems.
During the final semester project, students are assisted in the area of functioning of the Chemcad program, but they make design decisions for which they are responsible. All solutions regarding schematic flowsheet streaming, media usage, apparatus selection, process settings, design requirements, design sizes are the students" responsibility.
The stationary and remote modes do not differ in the way the classes are conducted. In the stationary mode students use the software personally in the laboratories and consult current problems with the teacher. In the remote mode students connect to the computers in the labs from home and consult their projects on an ongoing basis through the appropriate platform for direct online contact such as: emeeting or Teams.

Bibliography

Basic
Ruch ciepła i wymienniki / Tadeusz Hobler. Autor: Hobler, Tadeusz. Wydawnictwa Naukowo-Techniczne, 1986.
Dyfuzyjny ruch masy i absorbery / Tadeusz Hobler. Autor: Hobler, Tadeusz. Autor, Wydawnictwa

Naukowo-Techniczne. Wydawnictwa Naukowo-Techniczne, 1976.
Additional
Projektowanie systemów procesowych, Krzysztof Alejski, Maciej Staszak, Piotr Wesołowski. Politechnika Poznańska. Wydawnictwo Politechniki Poznańskiej, 2013.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50