COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mass balance industrial installation [S1TCh2>BMIP]

Course

Field of study
Chemical Technology

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
30

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Student has basic knowledge of mathematics in the field enabling him to use mathematical methods to describe chemical issues and processes and perform calculations needed in engineering activities. He has basic knowledge of chemistry in the scope enabling him to understand chemical phenomena and processes. He has basic knowledge of products and processes used in chemical technology.

Course objective

The aim of the course is to familiarise students with the principles of preparing mass balances for industrial installations and with computer methods supporting this objective, including Mathcad, a numerical calculation tool, and Ms Visio, a tool for creating diagrams and process flowcharts.

Course-related learning outcomes

Knowledge:
The student has knowledge in the field of chemical technology and engineering, machinery and

apparatus of the chemical industry. The student has basic knowledge about the life cycle of products, equipment and installations in the chemical industry. Student knows basic methods, techniques, tools and materials used in solving simple tasks in the field of chemical technology and engineering (K_W01, K_W03, K_W06, K_W07).

Skills:
The student is able to work both individually and as a team in professional and other environments. He/she can prepare technological documentation and communicate using various techniques in a professional and other environment, also in a foreign language. (K_U01, K_U06, K_U07, K_U14)

Social competences:
The student is aware of the cost of conducting numerical calculations. The student understands the importance of using a digital approach to solving issues in an engineering environment. Additionally, the student is aware of the necessity of using solutions in terms of apparatus and energy savings. (K_K02)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Semester evaluation of the performed mass balance of an industrial plant in the field of inorganic chemical technology, consisting of a preliminary analysis, the quality of the performed balance, preparation of a final report, and evaluation of the ability to solve problems related to the balancing of scalar quantities. In addition, independent problem solving is assessed in the context of a written test. In the case of stationary classes, credit is given in a computer laboratory, while in the case of online classes credit is given using the university's network and computer infrastructure (VPN) via the Remote Desktop Protocol (RDP) using a remote desktop connection tool.

Programme content

In this course, students are introduced to the principles of preparing mass balances of industrial installations based on installations used in inorganic chemical technology through the construction of an algebraic equation model solved with the support of numerical methods using available CAD software. On the basis of the drawn block diagram of a process plant, students are introduced to the idea of locating control loops by analysing critical plant components in terms of monitoring and control. The final result is the ability to independently draw up a mass balance of the analysed technological process, including the preparation of a network of interconnections of unit operations, using available CAD software, specifying the type of materials, raw materials and fuels used and the equipment used.

Course topics

none

Teaching methods

Demonstration of how to write a mass balance for industrial installations and how to solve equations and systems of nonlinear equations using the Mathcad tool, as well as the creation of diagrams of industrial installations using the MS Visio package. The instructor assists the students at this stage in the area of use of the CAD tool, without solving any of the given balance problems.
During the completion of the target mass balances, students are assisted in the functioning of the software but make the design decisions for which they are responsible themselves.

Bibliography

Basic:
1. K. Schmidt, J. Sentek, J. Raabe, E. Bobryk, Podstawy technologii chemicznej. Procesy w przemyśle nieorganicznym. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.
2. A. Sobczyńska, J. Szymanowski, ”Bilanse masowe procesów stacjonarnych”, Wydawnic-two Politechniki Poznańskiej, Poznań 2003.
3. J. Kępiński, Technologia Chemiczna Nieorganiczna, PWN, Warszawa,1984.
4. E. Bortel, H. Koneczny, Zarys technologii chemicznej, PWN, Warszawa 1992
5. J. Molenda, Technologia Chemiczna, Wyd. Szk. i Ped., Warszawa 1997.
6. T. Grzywa, J. Molenda, Technologia podstawowych syntez chemicznych, tom 1 i tom 2, WNT,

Warszawa 2008.
7. K. Staszak, K. Wieszczycka, B. Tylkowski, Chemical Technologies and Processes , de Gruyter, 2020.

Additional:
1. Praca zbiorowa pod redakcją W. Bobrownicki, Technologia chemiczna nieorganiczna, WNT, Warszawa 1965.
2. Current articles in the field of chemical technology.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00