COURSE DESCRIPTION CARD - SYLLABUS

Course name
Selected issues of modern chemical knowledge [N2TCh2-TCO>WZWWC]

Course

Field of study
Chemical Technology

Year/Semester
2/3

Area of study (specialization)
General Chemical Technology

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

prof. dr hab. inż. Teofil Jesionowski
teofil.jesionowski@put.poznan.pl

dr hab. inż. Łukasz Klapiszewski prof. PP
lukasz.klapiszewski@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge in the fields of general, inorganic and organic chemistry, chemical technology and apparatus of chemical industry (first cycle degree program of full-time studies). Student can obtain information from literature, databases and other sources, can interpret the obtained information to draw conclusions and formulate opinions in the area of inorganic chemical technology. Student is able to apply that knowledge in practice, both during the implementation work and the further education. Student is able to interact and work in a group.

Course objective

Obtaining of the basic theoretical knowledge in the fields of production, properties and potential directions of use of functional materials of organic, inorganic and composite/hybrid origin, with designed structure and properties. Gaining knowledge on the use of advanced techniques for the synthesis of selected materials with defined properties. Acquaintance with innovative industrial technologies used to improve the efficiency of chemical transformations. Gaining and expanding knowledge about the latest chemical technologies and materials used in advanced chemical and technological processes. Understanding the essence of biomimetics in the context of design and synthesis of bioinspired materials. Acquiring the ability to select selected technological solutions/materials in terms of their practical use in large-scale processes.

Course-related learning outcomes

Knowledge:
The student has expanded knowledge in the field of chemistry and other related areas of science, allowing the formulation and solving of complex tasks related to chemical technology, as well as knowledge of complex chemical processes, which includes the appropriate selection of materials, raw materials, synthesis methods and techniques, apparatus and equipment for carrying out chemical processes and the characteristics of the products obtained. The student has expanded knowledge about the latest chemical and material technologies and advanced materials technology, as well as knows current trends in the development of chemical industrial processes and has a basic knowledge of raw materials, products and biotechnological processes. Student can find a correlation between functional natural and synthetic materials at the molecular and macroscopic level. The student knows advanced methods of analyzing the structure and properties of selected materials, and has extensive knowledge of advanced devices and apparatus used in chemical technology. The student also has knowledge of selected issues of modern chemical knowledge and industrial property.
Reference to the field of learning outcomes: K_W2; K_W3; K_W5; K_W6; K_W7; K_W11; K_W13 and K_W14.

Skills:
The student has the ability to obtain and critically evaluate information from literature, databases and other sources, and formulate opinions and reports on this basis, and also has the ability to communicate with specialists and non-specialists in the field of chemical technology and related fields. The student also has the ability to adapt knowledge of modern chemical knowledge and related fields to solve problems in the field of chemical technology. The student has the skills to rationally plan the use of natural resources in the chemical industry, guided by the principles of environmental protection and sustainable development. Manifests innovative and unconventional thinking in the design of materials and products, based on a thorough understanding of the structure of materials at the nano-; micro and macro level of structural organization. Has knowledge of biological structures, is able to identify key phenomena and structures observed in natural materials and assess their function and benefits in modern technological aspects, or use them to design new solutions. The student is able to critically analyze industrial chemical processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology, and is able to assess the technological suitability of raw materials and the selection of the technological process in relation to the quality requirements of the product, and is able to critically assess the practical usefulness of using new developments in chemical technology.
Reference to the field of learning outcomes: K_U1; K_U2; K_U5; K_U11; K_U12; K_U15; K_U16 oraz K_U23.

Social competences:
The student is aware of the need for lifelong learning and professional development and forms awareness of the limitations of science and technology related to chemical technology, including environmental protection. The student is able to think and act in a creative and entrepreneurial way and understands the need to provide the public with information about the current state and directions of development of chemical technology, about the principles of use and handling of chemical products, about the risks of obtaining raw materials, chemical production and distribution.
Reference to the field of learning outcomes: K_K1; K_K2; K_K4; K_K6.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Stationary form - the knowledge acquired during the lecture is verified in the form of a scientific discussion (3-5 questions) after the completed cycle of lectures.
Online form - the knowledge acquired during the lecture of Inorganic Technology is verified in the form of a scientific discusion after the completed cycle of lectures via the eKursy platform. The discussion includes 3-5 open questions that students answer in the "live view" mode with the webcam turned on, using emeeting or Zoom via the eKursy platform.
Criterion: 3 - 50.1%-70.0%; 4 - 70.1%-90.0% and 5 from 90.1%.

Programme content

Selected information on biomineralization processes and properties, occurrence and use of biomaterials, as well as basic information on biomimetics and directions of its development. Presentation of the most important information on hybrid/composite materials, with particular emphasis on materials obtaining from the combination of inorganic precursor (metal oxide) and biopolymer precursor; characteristics of manufactured materials, examples and directions of potential applications. Selected information on biocatalysis and the process of enzyme immobilization, including the advantages and disadvantages of biocatalytic reactions, selected uses of enzymes and the definition and the most important information on the process of enzyme immobilization; presenting its advantages and disadvanatges, as well as potential directions of practical application.

Teaching methods

Lectures - multimedia presentation

Bibliography

Basic:
1. A. Szymański, Biomineralizacja i Biomateriały, Wydawnictwo Naukowe PWN, 1991.
2. A. Tylicki, S. Strumiło, Enzymologia. Podstawy, Wydawnictwo Naukowe PWN, 2019.
3. J.A. Rodriguez, M. Fernandez-Garcia, Synthesis, Properties, and Applications of Oxide Nanomaterials, Wiley, 2006.
4. P. Gomez-Romero, C. Sanchez, Functional Hybrid Materials, Wiley, 2003.
5. K. Konopka (2013) Biomimetyczne metody wytwarzania materiałów. Oficyna Wydawnicza Politechniki Warszawskiej
6. Hermann Ehrlich (2017) Extreme Biomimetics, Springer Nature
7. D. Levy, M. Zayat (2015) The Sol-Gel Handbook, vol. I. Wiley-Verlag.

Additional:
1. Scientific articles related to the content of the lecturers.
2. L. Cao, Carrier-bound Immobilized Enzymes: Principles, Application and Design. Wiley, 2005.
3. V.K. Thakur, M.K. Thakur, Functional Biopolymers, Springer, 2018.
4. L. Klein et al. (2018) Handbook of Sol-Gel Science and Technology. Springer International Publishing
5. J.F. Mano (2012) Biomimetic Approaches for Biomaterials Development. Wiley-VCH

Breakdown of average student's workload

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