COURSE DESCRIPTION CARD - SYLLABUS

Course name
Selected fields of technology [S2TCh2-PTiB>WDT]

Course

Field of study
Chemical Technology

Year/Semester
1/1

Area of study (specialization)
Technological Processes and Bioprocesses

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
30

Laboratory classes
45

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

6,00

Coordinators

dr inż. Martyna Rzelewska-Piekut
martyna.rzelewska-piekut@put.poznan.pl

dr hab. inż. Magdalena Regel-Rosocka prof. PP
magdalena.regel-rosocka@put.poznan.pl

Lecturers

Prerequisites

1. A student has basic theoretical systematic knowledge of general and inorganic chemistry, organic and chemical technology, including the key issues of natural and synthetic raw materials, products and processes used in the organic chemical technology. 2. A student has the ability to assess the technological suitability of raw material sources and the selection of the technological process in relation to the product quality requirements. He can obtain information from the literature, databases, and other sources in English and to interpret the data obtained, draw conclusions and formulate and justify opinions. 3. A student understands the need for further education and improvement of his professional and personal competences, knows how to interact and work in a group, can think and act in a creative and entrepreneurial way.

Course objective

Extending of knowledge of organic chemical technology enabling students to link flows in selected technological processes with the fundamental physico-chemical properties of raw materials, intermediate and end products. Deepening of the students knowledge in the field of the technological process conducting, calculation of the efficiency and selectivity, analytical testing, and the use of by-products and waste.

Course-related learning outcomes

Knowledge:
1. A student has broad and deep knowledge of organic technology and related fields of science, allowing him to formulate and solve complex tasks associated with chemical technology. [K_W01, K_W02, K_W11]
2. A student has knowledge of complex chemical processes involving selection of appropriate materials, raw materials, methods, techniques, apparatus and equipment for chemical processes and the characterization of the resulting products. [K_W03, K_W11]
3. A student has extended knowledge about the newest chemical technologies and problems of environmental protection resulting from chemical processes, he/she knows contemporary trends of development of industrial chemical processes. [K_W06, K_W08, K_W11]

Skills:
1. A student has the ability to obtain and critically evaluate information from literature, databases and other sources and to formulate on the basis of opinions and reports. [K_U01]
2. A student has the ability to team work and team leadership. [K_U02]
3. A student is able to design and conduct chemical reactions in the laboratory under various conditions and proper use of the results of that research to scale-up. [K_U09]
4. A student is able to plan reasonable use of natural resources for chemical industry taking into account rules of environmental protection and sustainable development. [K_U13]
5. A student is able to critically analyze industrial chemical processes and modify or improve them applying the aquired knowledge, particularly the state-of-the-art. [K_U15]

Social competences:
1. A student is aware of the need for lifelong learning and professional development. [K_K01]
2. A student is aware of the limitations of science and technology related to chemical technology, including environmental protection. [K_K02]
3. A student understands the need to provide the public with information on the current state and directions of development of chemical technology, on the principles of use and handling of chemical products, about the risks of obtaining raw materials, chemical production and distribution. [K_K07]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written examination covering material from lectures. Student activity during classes. Ongoing examination of the knowledge related to the implementation of laboratory exercises, reports on exercises carried out, attendance at a visit to a production plant.

Programme content

Issues concerning obtaining, properties and use of the most common semi-finished and organic products, implemented on an industrial scale, taking into account current raw materials for the organic industry. Discussion in detail the selected petrochemical processes and industrial organic synthesis processes.

Course topics

The lecture covers the issues of obtaining, properties and use of the most common semi-finished and organic products, implemented on an industrial scale, taking into account current raw materials for the organic industry. It enables students to learn in detail the selected petrochemical processes and industrial organic synthesis processes, to analyze the course of individual stages of the technological process. The thematic scope of lectures includes the following issues:
• The role of chemistry and chemical technology in economic development. Raw materials and new

process solutions.
• Selected aspects of sustainable production.
• Preparation, properties and applications of the most typical semi-finished and organic products, implemented on an industrial scale, taking into account current raw materials for the organic industry.
• Solid and liquid fuels as energy-chemical raw materials, processing directions of natural gas, hard coal and crude oil.
• Modern processes of chemical coal processing, e.g. coal gasification, gasification agents, methanation, modern methods of coal gasification, CTL or CTO processes, i.e. obtaining liquid fuels (MTG (Mobil) process) or olefins (MTO) from methanol.
• Crude oil and its characteristics, crude oil processing - tube and tower distillation, thermal processes in crude oil processing - types of processes, catalytic cracking, hydrocracking, catalytic reforming.
• Hydrogen production for industrial processes, hydrogenation and dehydrogenation reactions.
• Methods for producing light olefins and 1,3-butadiene, production of olefins by the steam cracking, characteristics of steam cracking products, isolation of butadiene from the C4 fraction by the method of extraction distillation.
• Methanol - production and application.
• Biorefineries, platform chemicals and bioethanol or Production of vinyl chloride or Production of terephthalic acid and caprolactam.

As the laboratory classes, exercises are carried out in two thematic groups. The subject of the 1st group of exercises is related to the use of alcohols as raw materials in organic synthesis (obtaining ethylene from ethanol, MTG (methanol-to-gasoline) process). The second group of exercises is related to the use of aromatic hydrocarbons as raw materials in the organic industry (dehydrogenation of ethylbenzene, hydrogenation of toluene, catalytic cracking of cumene). Performing exercises should deepen students' knowledge of how to conduct the technological process, calculate efficiency and selectivity, analytical control and the use of by-products and waste.
As part of the course, the teachers take students to the production plant related to the chemical industry.

Teaching methods

Lecture, discussion, practical exercises (laboratories), study visit

Bibliography

Basic:
1. E. Grzywa, J. Molenda, Technologia podstawowych syntez organicznych, tomy 1 i 2 (Surowce do syntez, Syntezy), WNT, Warszawa 2000.
2. M.S. Peters, K. D. Timmerhaus, Plant design and economics for chemical engineers; Ed. Mc Graw-Hill International Book Company, Aucland, London, Paris, Tokyo 1981.
3. J. Surygała (Red.), Vademecum rafinera. Ropa naftowa, właściwości, przetwarzanie, produkty, WNT, Warszawa 2006.
4. R. Bogoczek, E. Kociołek-Balawejder, Technologia chemiczna organiczna. Surowce i półprodukty. Wyd. Akademii Ekonomicznej we Wrocławiu, Wrocław 1992.
5. E. Kociołek-Balawejder (Red.), Technologia chemiczna organiczna - wybrane zagadnienia. Wyd.Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław 2013.
6. Poradnik inżyniera. Przemysł tłuszczowy, WNT, Warszawa 1976.
7. E. Bortel, H. Koneczny, Zarys technologii chemicznej, WN PWN, Warszawa 1992.
8. P. Wiseman, Zarys przemysłowej chemii organicznej, WNT, Warszawa 1977.
e-zasoby Biblioteki PP, baza ebooków Knovel:
1. D.Y. Murzin, Chemical Reaction Technology, De Gruyter, 2015.
2. J. Speight, Handbook of industrial hydrocarbon processes, GPP-Elsevier, Oxford 2011.

Additional:
1. Podstawy technologii chemicznej i inżynierii reaktorów, red. M. Wiśniewski, K. Alejski, Wyd. Politechniki Poznańskiej, Poznań 2006.
2. L. Sobczyk, A. Kisza, Chemia fizyczna dla przyrodników, PWN, Warszawa 1975.
3. Przemysł tłuszczowy, poradnik inżyniera, WNT, Warszawa 1976.
4. M. Anielak, Chemiczne i fizykochemiczne oczyszczanie ścieków, PWN, Warszawa 2000.
5. R. Bogoczek, E. Kociołek Balawejder, Technologia chemiczna organiczna. Surowce i półprodukty,

Wydawnictwo Akademii Ekonomicznej we Wrocławiu, Wrocław 1992

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	79	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	71	3,00