# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Environmentally friendly technologies [S2IChiP1-IC>TPS]

## Course

Field of study
Chemical and Process Engineering

Year/Semester
2/3

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
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

In-depth knowledge of physical, general, organic and inorganic chemistry. In-depth knowledge of inorganic chemical technology and the apparatus of the chemical industry (program basis of the III year of full-time first cycle studies). The ability to solve elementary problems in inorganic chemical technology based on knowledge, the ability to obtain information from the indicated sources in Polish and a foreign language. Understanding the need for further education, understanding the need to expand their competences, readiness to cooperate within a team.

## Course objective

Acquiring basic knowledge in the field of waste management generated within inorganic chemical technology. Understanding the methods of obtaining inorganic products and identifying waste streams generated during their acquisition. Indication of the possibility of using post-production waste in inorganic technology processes. Understanding the methods of reducing the harmful impact of the implementation of technological processes and obtaining energy on the environment. Acquisition of basic information related to waste management. A proposal for the use of environmentally friendly technologies in the field of biofuel production, the use of renewable raw materials, as well as new ways of conducting chemical syntheses based on the principles of green chemistry.

## Course-related learning outcomes

Knowledge:
k_w03 - has expanded and in-depth knowledge in chemistry and other related areas of science, allowing to formulate and solve complex tasks related to inorganic chemical technology
k_w04 - has knowledge in the field of complex chemical processes, including the appropriate selection of materials, raw materials, apparatus and equipment for carrying out chemical processes and characterizing the products obtained
k_w05 - has knowledge of the phenomena occurring on the surface of catalysts (sorbent) and knows the basics of using catalysts in industrial processes
k_w07 - has knowledge of the latest chemical and material technologies, including technologies of advanced materials and nanomaterials, knows current trends in the development of chemical industrial processes
k_w09 - has knowledge of environmental protection problems related to the implementation of industrial chemical processes
k_w12 - has a well-established and expanded knowledge of the selected specialty

Skills:
k_u01 - has the ability to obtain and critically evaluate information from literature, databases and other sources, and formulate opinions and reports on this basis
k_u05 - can independently determine the directions of further education and implementation of self-education
k_u12 - is able to properly use natural resources in industry, guided by the principles of environmental protection and sustainable development
k_u13 - can critically analyze industrial processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology
k_u14 - has the ability to assess the technological suitability of raw materials and the selection of the technological process in relation to the quality requirements of the product

Social competences:
k_k01 - understands the need for lifelong learning; can inspire and organize the learning process of others; is aware of the importance and non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken
k_k02 - is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions
k_k03 - is able to interact and work in a group, taking on various roles in it

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Stationary form - the knowledge acquired during the lecture is verified in the form of a written exam at the last class. The exam consists of 5-10 open questions. Online form - the knowledge acquired during the lecture is verified in the form of a written exam at the last class via the eKursy platform. The exam includes 20-40 open and closed test questions (multiple choice), which students answer using the test module on the eKursy platform. Grading criteria: 3 - 50.1% -60.0%; 3.5 - 60.1% -70%; 4 - 70.1% - 80.0%; 4.5 - 80.1% -90%; 5 - from 90.1%.

## Programme content

The program covers the topics related to environmentally friendly technologies used in chemical industry and other industrial fields.

## Course topics

1. Sustainable development.
2. Green chemistry, green technology, green engineering
3. New methods of handling chemical reactions
4. Supercritical fluids
5. Renewable feedstocks
6. Biopolymers
7. Biofuels and sustainable energy production
8. (Bio)conversion of waste glycerol
9. Green surfactants
10. Methods for corrosion protection
11. Characteristics of generated inorganic and organic pollutant streams within inorganic chemical technology
12. Overview of methods for purifying waste aqueous solutions
13. Characteristics and methods of waste management generated during the acquisition of energy from fossil fuels (fly ash, saline mine water)

## Teaching methods

Lecture - multimedia presentation, materials in the form of pdf files on the eKursy platform

## Bibliography

Basic
1. Skrypt pod red. K. Prochaska i M. Wiśniewskiego, Technologie przyjazne środowisku, Wydawnictwo PP, Poznań 2012
2. B. Burczyk, Zielona chemia. Zarys. Wyd. II, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2014
3. J.A. Moulijn, M. Makkee, A. van Diepen: Chemical Process Technology, Wiley-Blackwell, Chichester 2013.
4. M.B. Hocking, Handbook of chemical technology and pollution control, Elsevier, Amsterdam 2005.
Additional
1. J. Jabłoński (red.), Technologie zero emisji, Wyd. Politechniki Poznańskiej, Poznań 2011
2. E. Klimiuk, T. Pokój, M. Pawłowska, Biopaliwa. Technologie dla zrównoważonego rozwoju. WNT, Warszawa 2012
3. W. Lewandowski, M. Ryms Biopaliwa. Proeklogiczne odnawialne źródła energii. WNT, Warszawa 2013
4. A. Marteel-Parrish, M.A. Abraham, Green chemistry and Engineering, Wiley- AIChE, 2014
5. C.H. Bartholomew and R.J. Farrauto, Fundamentals of industrial catalytic processes, Wiley, Hoboken, New Jersey 2006.
6. G. Ertl, H. Knözinger, F. Schüth, J. Weitkamp, Handbook of heterogeneous catalysis, WILEY-VCH Weinheim 2008.
7. M. Taniewski: Technologia chemiczna - surowce, Wydawnictwo Politechniki Śląskiej, Gliwice 1997.

## 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 |