



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Inorganic Chemical Technology

		Course
Field of study		Year/Semester
Chemical Technology		III/5
Area of study (specialization)		Profile of study
-		general academic
Level of study		Course offered in
First-cycle studies		English
Form of study		Requirements
full-time		compulsory

		Number of hours
Lecture	Laboratory classes	Other (e.g. online)
30	30	0
Tutorials	Projects/seminars	
0	0	
<b>Number of credit points</b>		
5		

		Lecturers
Responsible for the course/lecturer:		Responsible for the course/lecturer:
D. Sc. Filip Ciesielczyk		D. Sc. Katarzyna Siwińska-Ciesielczyk
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Institute of Chemical Technology and Engineering		Institute of Chemical Technology and Engineering
Berdychowo 4, PL-60965 Poznan		Berdychowo 4, PL-60965 Poznan

**Prerequisites**

Student has knowledge of general and inorganic chemistry, physical chemistry and apparatus of chemical industry, knows the basic methods, techniques and tools used in chemical analysis (core curriculum of I and II year of the 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 general and inorganic chemistry. 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.



Student is able to properly identify the priorities used to perform a specific task. Student understands the need for further education.

### Course objective

Acquiring basic knowledge in the field of inorganic chemical technology. Understanding the basic industrial processes and operations related to inorganic technology. Ability to select raw materials and chemical intermediates. Understanding the methods of obtaining inorganic products and their identification. Indication of the possibility of using products manufactured in inorganic technology processes. Proper waste handling. Proposal of using environmentally friendly technologies.

### Course-related learning outcomes

#### Knowledge

K\_W03 - has the necessary knowledge of chemistry to enable understanding of chemical phenomena and processes

K\_W07 - knows the rules of environmental protection related to inorganic chemical technology and waste management

K\_W08 - has a systematically, theoretically founded general knowledge in the field of general and inorganic chemistry

K\_W09 - has the necessary knowledge about both natural and synthetic raw materials, products and processes used in inorganic chemical technology, as well as about the directions of development of the chemical industry in the country and in the world

K\_W10 - knows the basics of thermodynamics, kinetics, surface phenomena and catalysis of chemical processes

K\_W13 - has knowledge of inorganic chemical technology and the apparatus of the chemical industry

K\_W14 - has a basic knowledge of the life cycle of products, equipment and installations in the chemical industry

#### Skills

K\_U01 - can obtain the necessary information from literature, databases and other sources related to chemical sciences, correctly interprets them, draws conclusions, formulates and justifies opinions

K\_U02 - can work both individually and as a team in a professional and other environment

K\_U04 - can prepare and present in Polish an oral presentation on chemical technology

K\_U05 - has the ability to self-study

K\_U16 - based on general knowledge, explains the basic phenomena associated with significant processes in inorganic chemical technology



K\_U18 - distinguishes between types of chemical reactions and has the ability to select them for chemical processes

K\_U22 - knows the physical and chemical properties of chemical compounds and materials

K\_U25 - assesses the risks associated with the use of chemical products and processes

#### Social competences

K\_K01 - understands the need for further training and raising their professional, personal and social competences

K\_K02 - is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including their impact on the environment and the associated responsibility for decisions made

K\_K03 - is able to cooperate and work in a group, inspire and integrate engineering environments

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - exam, criterion: 3 - 50.1%-70.0%; 4 - 70.1%-90.0% and 5 from 90.1%

Laboratory - reports from laboratory exercises, colloquium, oral/written answer, presentation of theoretical and experimental material, solving scientific problems, assessment of student's activity in laboratory classes, evaluation of practical classes, evaluation of teamwork; criterion: 3 - basic theoretical and practical knowledge, preparation skills concerning reports from laboratories, basic participation in theoretical and practical classes without additional involvement; 4 - practical preparation supported by theoretical knowledge, the ability to formulate the right conclusions from the data obtained during the laboratory, active participation in classes supported by the desire to acquire additional practical and theoretical knowledge; 5 - complete preparation for classes, the ability to draw conclusions at an advanced level, and also posed defense, precise execution of entrusted tasks, independent search additional theoretical knowledge, coordination of work in a research team, an ambitious approach to the subject matter.

#### Programme content

1. Chemical concept of method and technological principles with particular reference to inorganic processes.
2. Mineral and fuel resources.
3. Wet and dry methods of enrichment of minerals.
4. Coal processing core processes: combustion, gasification and degasification of coal, desulfurization of coal.
5. Production of synthesis gas.



6. Heterogenous catalysis.
7. Technology of sulfur compounds (sulfur combustion, oxidation of SO<sub>2</sub>-SO<sub>3</sub>, absorption of SO<sub>3</sub>, sulfuric acid).
8. Technology of nitrogen compounds (ammonia synthesis, combustion of ammonia, absorption of nitrogen oxides, synthesis of urea, nitrogen fertilizers, nitric acid).
9. High pressure processes in gas and liquid phases.
10. Production of soda.
11. Industry of phosphorus and phosphate fertilizers.
12. Preliminary information on trends in the inorganic chemical technology.

### Teaching methods

Lecture - multimedia presentation

Laboratory - teaching materials for the laboratory in pdf files, practical exercises

### Bibliography

#### Basic

1. K. Schmidt-Szałowski, J. Sentek, J. Raabe, E. Bobryk, Podstawy technologii chemicznej. Procesy w przemyśle nieorganicznym, Oficyna Wydawnicza Politechniki Warszawskiej Warszawa 2004.
2. J.A. Moulijn, M. Makkee, A. van Diepen: Chemical Process Technology, Wiley-Blackwell, Chichester 2013.
3. J. Szarawara, J. Piotrowski, Podstawy teoretyczne technologii chemicznej, WNT Warszawa 2010.

#### Additional

1. C.H. Bartholomew and R.J. Farrauto, Fundamentals of industrial catalytic processes, Wiley, Hoboken, New Jersey 2006.
2. M.B. Hocking, Handbook of chemical technology and pollution control, Elsevier, Amsterdam 2005.
3. G. Ertl, H. Knözinger, F. Schüth, J. Weitkamp, Handbook of heterogeneous catalysis, WILEY-VCH Weinheim 2008.
4. S. Bretsznajder, W. Kawecki, J. Leyko, R. Marcinkowski: Podstawy ogólne technologii chemicznej, WNT, Warszawa 1973.
5. M. Taniewski: Technologia chemiczna - surowce, Wydawnictwo Politechniki Śląskiej, Gliwice 1997.
6. H. Konieczny: Podstawy technologii chemicznej, PWN, Warszawa 1975.
7. J. Kępiński: Technologia chemiczna nieorganiczna, PWN, Warszawa 1975.



## 8. Laboratory materials

### Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	50	2,0

<sup>1</sup> delete or add other activities as appropriate