COURSE DESCRIPTION CARD - SYLLABUS

Course name
Inorganic chemical technology [N1TCh2>TCN]

Course

Field of study
Chemical Technology

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
20

Other
0

Tutorials
10

Projects/seminars
0

Number of credit points

7,00

Coordinators

dr hab. inż. Agnieszka Kołodziejczak-Radzimska
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Lecturers

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. The ability to define and design basic industrial processes and unit operations related to inorganic technology, mainly in the field of stoichiometric and termodynamic calculations as well as energy values of fuels. Material and energy balances of selected inorganic 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.
Exercises - colloquium/final test, criterion: 3 - 50.1%-70.0%; 4 - 70.1%-90.0% and 5 from 90.1%; reports from exercises, colloquium, oral/written answer, solving scientific problems, assessment of student's activity in exercises, evaluation of teamwork; criterion: 3 - basic theoretical and practical knowledge, preparation skills concerning reports accounting exercises, 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 exercises, active participation in classes supported by the desire to acquire additional practical and theoretical knowledge, precise execution of entrusted tasks; 5 - complete preparation for classes, the ability to draw conclusions at an advanced level, and also posed defense, additional theoretical knowledge, coordination of work in a research team, an ambitious approach to the subject matter.

Programme content

Issues related to inorganic chemical technology.

Course topics

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 SO2-SO3, absorption of SO3, 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.
13. Mine raw materials as basic energy sources.
- fuels (liquid, gas and solid)
- combustion and gasification of fuels (excess air coefficient)
- energy value of fuels (lower and upper calorific value)
- combustion kinetics
14. Material and energy balances of selected processes in inorganic technology
15. Kinetic and thermodynamic aspects of technological processes
- reaction kinetics
- balance constant
- the degree of change

Teaching methods

Lecture - multimedia presentation. In special cases, the online form of the lecture is allowed.
Laboratory - teaching materials for the laboratory in pdf files, practical exercises
Exercises - multimedia presentation illustrated with examples given on a board and realization of tasks given by the teacher - practical (accounting) 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	175	7,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	120	5,00