COURSE DESCRIPTION CARD - SYLLABUS

Course name
Environmental protection in chemical technology - green chemistry

Course

Field of study
Chemical Technology
Year/Semester
2/3
Area of study (specialization)
Chemical Technology
Profile of study
general academic
Level of study
Second-cycle studies
Course offered in
Polish
Form of study
part-time
Requirements
compulsory

Number of hours

Lecture
40
Laboratory classes
0
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
D. Sc. Katarzyna Materna, Professor

D. Sc. Małgorzata Osińska

D. Sc. Dominik Paukszta

Prerequisites

Structured and systematic knowledge in the field of general and inorganic chemistry, organic chemistry, polymers and chemical technology, and apparatus of the chemical industry (the curriculum of the full-time first cycle studies). Ability to solve elementary engineering problems based on knowledge. 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 substances managment raising from the processes of inorganic chemical technology. Indication of the possibility of using post-production wastes in inorganic technology processes. Learning methods of reducing the harmful impact of technological processes and methods of energy acquisition on the environment. Acquisition of basic information related to waste management. Proposal of using environmentally friendly technologies. Gaining knowledge about the impact of polymers on the environment in the context of false media reports. Understanding the methods of material recycling, material recovery and energy recovery of polymer materials.

Course-related learning outcomes

Knowledge

K_W2 - has expanded and in-depth knowledge in chemistry and other related areas of science, allowing to formulate and solve complex tasks related to chemical technology

K_W3 - has knowledge of complex chemical processes, including the appropriate selection of materials, raw materials, methods, techniques, apparatus and equipment for carrying out chemical processes and characterizing the products obtained

K_W6 - has expanded knowledge of the latest chemical and material technologies, including advanced materials and nanomaterials technologies, knows current trends in the development of chemical industrial processes

K_W7 - knows modern methods of testing the structure and properties of materials, necessary to characterize raw materials and products of the chemical and related industries

K_W11 - has a well-established and expanded knowledge of the selected specialty

K_W13 - has extended knowledge of advanced devices and apparatus used in chemical technology

K_W14 - has knowledge of selected issues of modern chemical knowledge and aspects of copyright and industrial property

Skills

K_U1 - has the ability to obtain and critically evaluate information from literature, databases and other sources, and formulate opinions and reports on this basis

K_U2 - has the ability to work in a team and lead a team

K_U5 - can independently determine the directions of further education and implement self-education

K_U11 - is able to properly verify the concepts of engineering solutions in relation to the state of knowledge in technology and chemical engineering

K_U12 - has the ability to adapt knowledge of chemistry and related fields to solve problems in the field of chemical technology and planning new industrial processes

K_U15 - can 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

K_U16 - 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

K_U23 - has the ability to use the knowledge acquired under the specialty in professional activity

Social competences

K_K1 - is aware of the need for lifelong learning and professional development

K_K2 - is aware of the limitations of science and technology related to chemical technology, including environmental protection

K_K4 - observes all rules of teamwork; is aware of the responsibility for joint ventures and achievements in professional work

K_K6 - can think and act in a creative and entrepreneurial way

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Stationary form - the knowledge acquired during the lecture is verified in the form of a written exam (test) at the last class. The exam consists of 20-40 opened and closed test questions (single or multiple choice). 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 opened and closed test questions (single or multiple choice), to which students answer using the test module on the eKursy platform. Grade 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

1.The importance of green chemistry and sustainable development. Objectives and principles of green chemistry. Quantitative measures of sustainable chemistry.

2. Unconventional methods of conducting chemical reactions (electrochemical, photochemical, sonochemical, microwave radiation, without solvents).

3. Alternative reaction media - green solvents (water, supercritical fluids - water and carbon dioxide, ionic liquids, fluorine liquids).

4.Characteristics of inorganic and organic pollutant streams within inorganic technology

5. Overview of methods for purifying waste aqueous solutions

6. Characteristics and methods of waste management generated during the acquisition of energy from fossil fuels (fly ash, saline mine water)

7. Standards and regulations regarding environmental protection and measures applied to prevent water, soil and atmosphere pollution with solid, liquid, gas and dust waste.

8. Technological possibilities of waste reduction, recycling, methods used for material recovery.

9. Methods for stabilizing and solidifying solid and liquid waste

10. Recycling and recovery of polymeric materials. Principle 3/4 R. Method of identification and segregation of polymers.

11. Recycling polymers form automotive industry and WEEE (waste electrotechnical and electronic equipment). Recycling of rubber. Selected technological lines in material recycling: PE foils, PET bottles, other. Partial recycling.

12. Life cycle assessment. Legislation in recycling and recovery area.

Teaching methods

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

Bibliography

Basic

1. Burczyk B.: Zielona chemia: zarys, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2014.

2. K. Schmidt-Szałowski, J. Sentek, J. Raabe, E. Bobryk, Podstawy technologii chemicznej. Procesy w przemyśle nieorganicznym, Oficyna Wydawnicza Politechniki Warszawskiej Warszawa 2004

3. M.B. Hocking, Handbook of chemical technology and pollution control, Elsevier, Amsterdam 2005.

4. Moulijn Jacob A., Chemical Process Technology, Wiley-Blackwell 2013, ISBN13 (EAN): 9781444320251, ISBN10: 1444320254.

5. T.Stefanowicz, Gospodarka wodno-ściekowa i odpadowa w przemyśle elektrochemicznym, Wyd. Politechniki Poznańskiej, Poznań, 2001.

6. A. K. Błędzki, Recykling materiałów polimerowych", WNT, Warszawa, 1997.

Additional

1. C.H. Bartholomew and R.J. Farrauto, Fundamentals of industrial catalytic processes, Wiley, Hoboken, New Jersey 2006.

2. F. A. Henglein, Chemical Technology, Elsevier, 2013, ISBN 1483160254, 9781483160252.

3. J. Szarawara, J. Piotrowski, Podstawy teoretyczne technologii chemicznej, WNT Warszawa 2010

4. S. Bretsznajder, W. Kawecki, J. Leyko, R. Marcinkowski: Podstawy ogólne technologii chemicznej, WNT, Warszawa 1973.

5. Kolb V.M.: Green organic chemistry and its interdisciplinary applications, CRC Pres Taylor & Francis Group, Boca Raton 2016.

6. B.Bartkiewicz, Oczyszczanie ścieków przemysłowych, Wyd. Naukowe PWN, Warszawa 2010.

7. L.K Wang, N.K. Shammas, Y.-T. Hung (eds) Advances in Hazardous Industrial Waste Treatment CRC Press, Taylor and Francis Group, Boca Raton Fl. USA 2009.

8. Proceedings of the Central-European Conferences RECYCLING AND RECOVERY OF THE POLYMER MATERIALS, SCIENCE - INDUSTRY, Wrocław/Szczecin, 2000-2018.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for passing) [1]	25	1,0

[1] delete or add other activities as appropriate