



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Recycling of materials

### Course

Field of study

Year/Semester

Chemical Technology

II/3

Area of study (specialization)

Profile of study

Composites and Nanomaterials

general academic

Level of study

Course offered in

Second-cycle studies

English

Form of study

Requirements

full-time

compulsory

### Number of hours

Lecture

Laboratory classes

Other (e.g. online)

15

0

0

Tutorials

Projects/seminars

0

0

**Number of credit points**

2

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

Instytut Technologii i Inżynierii Chemicznej

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### Prerequisites

Structured and systematic knowledge in the field of general, organic chemistry, polymers and chemical technology, and apparatus of the chemical industry. 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 competencies, readiness to cooperate within a team.

### Course objective

Understanding the methods of material recycling, material recovery and energy recovery of various materials. Gaining knowledge about the impact of polymers on the environment in the context of misleading media reports.



### Course-related learning outcomes

#### Knowledge

K\_W2 - has expanded an 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\_W11 - has a well-established and extensive knowledge of the selected specialty

K\_W13 - has extended knowledge of advanced devices and apparatus used in chemical technology

#### 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\_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

#### 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\_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 - test. Evaluation of prepared presentations.

### Programme content

Importance of the recycling of materials. Basics of functioning of the recycling system. 3/4 R principle. Life cycle assessment (LCA), primarily with reference to packaging materials. Recycling of materials from the automotive and electrotechnical industries. Reprocessing and recovery of tires and rubber waste.



Legal aspects of material recycling and recovery of materials and energy from plastics and other materials. The problem of recycling in various countries of the world.

Identification and sorting of plastics. Agglomeration as a processing method used in material recycling. Methods of material recovery used for plastics. Energy recovery (combustion) of plastics, ecological aspects, combustion of plastics in the light of emissions of pollutants and dioxins. Material recycling, material recovery and energy recovery for specific types of polymers such as: polyethylene, polypropylene, polystyrene, polar polymers, polyurethanes, duroplastics and others.

Recycling of paper, aluminium cans, steel, precious and rare metals, non-Ferrous metals, carpeting, textiles, batteries, hazardous waste, mercury-containing devices and lamps, composite materials and other materials.

### Teaching methods

Lecture - multimedia presentation

### Bibliography

Basic

1. „Plastics Fabrication and Recycling”, M. Chanda, S. K. Roy, CRC Press Taylor&Francis Group, 2008
2. “Plastics and the Environment”, A. L. Andrady, Wiley-Interscience, 2003
3. “Polymers, the Environment and Sustainable Development”, A. Azapagic, A. Emsley & I. Hamerton, J. Wiley et Sohns Ltd. 2003

Additional

1. 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	45	2,0
Classes requiring direct contact with the teacher	25	1,1
Student's own work (literature studies, preparation for passing) <sup>1</sup>	20	0,9

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