COURSE DESCRIPTION CARD - SYLLABUS

Course name
Recycling and recovery of polymeric materials [S1TOZ1>RiOMP]

Course

Field of study
Circular System Technologies

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of chemistry and polymer processing The student can obtain information from the literature, databases and other properly selected sources The student is aware of the importance of the effects of engineering activities

Course objective

Teaching students environmentally safe techniques for plastic recycling, recovery of chemicals and recovery of energy from waste plastics or end-of-life plastics

Course-related learning outcomes

Knowledge:
the student has knowledge of the negative impact of manufacturing and processing technologies on the natural environment [k_w08]
the student has the knowledge to describe the basic development trends related to circular system technologies [k_w13]
the student has a basic knowledge of environmentally friendly modern industrial technologies ("zero emission technologies", decarbonization) [k_w14]

Skills:
the student is able to obtain information from literature, databases and other sources related to circular system technologies, also in a foreign language to integrate them, interpret them, draw conclusions and formulate opinions [k_u01]
the student is able to co-operate with other people as part of work on circular system technologies as well as work of an interdisciplinary nature [k_u09]
the student has the ability to plan and supervise technologies related to material recycling of municipal plastic waste [k_u16]
the student has the ability to plan and supervise technologies related to the recycling of polymer industrial waste, in particular in the area of automotive, electrotechnical and bulding industry [k_u16]
the student knows how to estimate production costs in installations based on circular system technologies [k_u23]

Social competences:
the student participates in discussions and is able to lead discussions, is open to different opinions and ready to assertively express thoughts and criticisms [k_k08]
the student is aware of the negative impact of human activity on the state of the environment and actively counteracts its degradation [k_k10]
the student understands the need to pass on to the society, including through the mass media, the full information about the benefits and challenges related to the implementation of the circular economy concept [k_k11]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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1. Exam in an on-site system: the knowledge acquired during the lecture is verified in the form of a written or oral exam at the end of the lecture cycle.
Remote exam: closed-ended question test with twenty questions at the end of the lecture cycle.
2. Evaluation of laboratory exercises and reports

Programme content

Recycling. Techniques for plastic recycling, recovery of chemicals and
recovery of energy from waste plastics or end-of-life plastics. Legal aspects of recycling and material recovery.

Course topics

Basics of functioning of the recycling system. 3/4 R principle. Life cycle assessment (LCA), primarily with reference to packaging materials.
Identification and sorting of plastics. The methods of identification and sorting of polymers.
Material recycling, chemical and energy recovery.
Recycling of materials from the automotive and electrotechnical industries. Reprocessing and recovery of tires and rubber waste. Agglomeration as a processing method used in material recycling. Technology of material recycling of poliethylene foils and PET bottles. Partical recycling of duroplasts and composites (Scheet moulding compounds - SMC and Bulk moulding compounds - BMC).
The methods of material recovery - pirolisis process, depolymerisation and other. Technologies of pirolisis process for the mixture of polymers and for selected plastics, for example for pure polymers. Glycolysis, hydrolysis, phenolysis, alcoholysis and other technologies.
Energy recovery (combustion) of plastics, ecological aspects, combustion of plastics in the light of emissions of pollutants and dioxins.
Material recycling, raw material recovery and energy recovery for specific types of polymers such as: polyethylene, polypropylene, polystyrene, carbonates, polar polymers, polyurethanes, duroplastics and others.
Recycling of carpets, metallized foils, composites, laminates and other materials.
Legal aspects of material recycling and recovery of materials and energy from plastics. Tasks related to the design of technological lines for polymer processing and recycling. Recycling and recovery of polymers in other countries in the world.

Laboratory exercises:
- Material recycling of thermoplascic polymers
- Material recycling of duroplasts
- Material recovery of plastics on an example of a PMMA
- Material recovery of waste PET bottles
- Recycling of foamed materials on the example of polyurethane foams
- Evaluation of the mechanical properties of recyclates

Teaching methods

Lecture - multimedia presentation.
Laboratory - educational materials for the laboratory in the form of pdf files, practical exercises.

Bibliography

Basic
1. „Recykling materiałów polimerowych”, A.K. Błędzki , WNT, Warszawa, 1997
2. „Podstawy recyklingu tworzyw sztucznych”, M. Kozłowski , Wydawnictwo Politechniki Wrocławskiej, Wrocław, 1998
3. Dzienniki Ustaw, Warszawa
4. „Plastics Fabrication and Recycling”, M. Chanda, S. K. Roy, CRC Press Taylor&Francis Group, 2008
5. “Plastics and the Environment”, A. L. Andrady, Wiley-Interscience, 2003
6. “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	100	4,00
Classes requiring direct contact with the teacher	63	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50