



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Recycling and Recovery of Polymeric Materials

		Course
Field of study		Year/Semester
Environmental Protection Technologies		I/1
Area of study (specialization)		Profile of study
		general academic
Level of study		Course offered in
Second-cycle studies		Polish
Form of study		Requirements
full-time		compulsory

		Number of hours
Lecture	Laboratory classes	Other (e.g. online)
30	45	0
Tutorials	Projects/seminars	
0	15	
Number of credit points		
5		

		Lecturers
Responsible for the course/lecturer:		Responsible for the course/lecturer:
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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 knows the basic principles of conduct in the neutralization and recovery of industrial waste [K_W08]

The student has detailed knowledge of technological solutions for environmental protection [K_W13]

The student has an established knowledge of environmentally friendly modern industrial technologies (green chemistry, "zero emission technologies") [K_W17]

Skills

The student is able to create and collect documentation of an undertaken research or technological task [K_U05]

The student is able to propose ways to utilize various types industrial waste [K_U09]

The student understands the need for continuous training (post-graduate studies, courses, training) - raising one's professional competencies [K_U15]

Social competences

Student is able to critically evaluate and verify the results of experimental research [K_K02]

Student is aware of personal responsibility for team achievements in professional work [K_K04]

Student understands the need to popularize knowledge in the field of environmental protection [K_K06]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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

3. Assessment of activity during seminars

Programme content

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. 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. 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, raw material recovery and energy recovery for specific types of polymers such as: polyethylene, polypropylene, polystyrene, polar polymers, polyurethanes, duroplastics and others. 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.



Laboratory exercises:

- material recycling of polymers,
- material recovery of plastics (PMMA),
- processing of polymeric materials - injection moulding,
- polymer identification analysis by WAXS method (Wide Angle X-ray Scattering),
- assessment of mechanical properties of recyclates obtained in the extrusion process,
- assessment of plastic flammability properties.

Teaching methods

Lectures, laboratory classes, seminars

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	150	5,0
Classes requiring direct contact with the teacher	90	3,0
Student's own work (literature studies, preparation for passing) ¹	60	2,0

¹ delete or add other activities as appropriate