



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Recycling [S1MiBM2>REC]

### Course

Field of study

Mechanical Engineering

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

elective

### Number of hours

Lecture

15

Laboratory classes

15

Other

0

Tutorials

0

Projects/seminars

15

### Number of credit points

3,00

### Coordinators

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### Lecturers

### Prerequisites

Basic knowledge in the field of materials technology, chemistry, and material processing (plastics and metals and metals alloys).

### Course objective

Learning basic problems related to waste management and their importance for sustainable civilization development.

### Course-related learning outcomes

Knowledge:

Allowing identification of waste regarding materials for their further re-processing (recycling). Allowing identification of relations between manufacturing processes and the environment (places of forming the waste). Allowing indication of actions limiting quantities of wastes in production processes used in mechanical engineering.

Skills:

Organization of segregation of industrial waste (plastics and metals/metals alloys). Conducting recycling

processes for waste of metals and plastics. Critical evaluation of technical and manufacturing process activities on the environment; can propose actions (processes) reducing quantities of wastes formed during production. Self-education in field of recycling (knowledge of processes and laws).

Social competences:

Awareness of the influence of manufacturing processes in mechanical engineering on the natural environment. Awareness of the necessity of cooperation between specialists in different fields. Can think and act in an initiative manner. Understands the need of lifetime education.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written a test (20 questions), criterion: 3 from 50.1 to 60%, 3.5 from 60.1 to 70%, 4 from 70.1 to 80%, 4.5 from 80.1 to 90.0% and 5 above 90.1%.

Laboratory: Attendance to all classes. Positive assessments from reports and answers for questions asked by a teacher.

Project: project credit for evaluation.

### Programme content

Lecture: World consumption of materials and energy. Resources of raw materials. Primary and secondary, renewable and non-renewable raw materials. Waste and environmental protection. Administrative and law conditioning of waste management. Classification of waste. Post-production and post-used waste. Reclaiming and recycling of materials. Recycling of metal and non-metal materials (plastics, paper). Ecological aspects of recycling. Logistical problems in recycling processes. Techniques of recycling of plastics, metals, rubber, etc. Preparation of materials (waste) for manufacturing processes. The course of processing processes and their effects. material testing of polymer regranulated and recovered metal.

Laboratory: Systems of waste segregation. Classification and segregation of metals waste, alloys and plastics. Examples of processing waste out of selected plastics. Processing complex waste on a selected example. Re-melting of metal scrap and plastics reprocessing.

Project: Design of a line disassembling and recycling products (vehicles, electronics, packaging).

### Course topics

none

### Teaching methods

Lecture: multimedia presentation. Laboratory exercises: performing exercises, discussion, teamwork.

Project: IT tools supporting disassembling of automotive and electronic products.

### Bibliography

Basic:

1. Czarnecka-Komorowska Dorota, Przetwórstwo tworzyw i kompozytów polimerowych w obiegu zamkniętym, Wyd. Politechniki Poznańskiej, Poznań 2023. ISBN 978-83-7775-725-31.
2. Tim A. Osswald Natalie Rudolph, Polymer Rheology Fundamentals and Applications, Hanser Publishers, Munich 2015. Book ISBN978-1-56990-517-3.
3. Mark E. Schlesinger, Aluminum Recycling, Second Edition, CRC Press 2013.
4. Ulewicz M., Siwka J., Procesy odzysku i recyklingu wybranych materiałów, Wyd. Wydziału Inż. Proc., Mat. i Fizyki Stosowanej Politechniki Częstochowskiej, Częstochowa 2010.

Additional:

1. Brandrup, J., Bittner, M., Menges, G., and Michaeli, W. (1996) Recycling and recovery of plastics, Carl Hanser Verlag, Germany.
2. Letcher T., Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions, 1st Edition, Academic Press 2020.
3. Pascoe, R. D. (2000) Sorting of Waste Plastic for Recycling, Rapra Review Reports, 11.
4. Oprzędkiewicz J., Technologie i systemy recyklingu samochodów, WNT Warszawa 2003.
5. Praca zbiorowa pod red. Jerzego J. Sobczaka, Odlewnictwo Współczesne. Poradnik Odlewnika, Wyd.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00