



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Recycling [N1ZiIP1>REC]

Course

Field of study

Management and Production Engineering

Year/Semester

4/8

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

8

Laboratory classes

8

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

1,00

Coordinators

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PP

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Lecturers

Prerequisites

Basic knowledge in materials technology, chemistry and management (metal and non-metal-plastics,).

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 processing (recycling). Allowing identification of relations between manufacturing processes and environment (places of creating the waste). Allowing indication of actions limiting quantities of wastes in production processes used in mechanical engineering.

Skills:

Organization of segregation of industrial waste (metal and plastics). 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.

Social competences:

Awareness of influence of manufacturing processes in mechanical engineering on natural environment.
Awareness of necessity of cooperation between specialists of different fields.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written a test (10 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.

Programme content

Lecture: Classification and definitions of waste (after-production and after-use waste). Reclaiming and recycling of materials. Recycling of metal and non-metal materials (plastics, paper). Ecological aspects of recycling. Logistical problems in recycling processes. Studies of polymer regranulated and metal.

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

Course topics

Lecture Plastics Recycling:

- Circular economy of plastics
- Analysis of recovery and recycling processes of polymeric plastics (chemical recycling, mechanical recycling, energy recovery)
- Techniques of sorting and separation of polymeric materials
- Examples of mechanical recycling lines for plastics

Lecture Metal recycling:

- Methods of processing metal waste (shredding, classification, sorting, compaction),
- Recycling of steels and cast irons (classification of steel and cast iron scrap, process of making steel from scrap),
- Recycling of aluminum and its alloys (classification of aluminum alloys, sorting, thermal stripping, fine and coarse scrap melting furnaces, refining, integrated melting plant, can recycling, can melting line),
- Recycling of copper and its alloys (classification of copper alloys, copper-bearing materials, processing of waste electronic and electrical equipment, cable recycling),

Laboratory in Plastic Recycling:

- Evaluation of granulometric characteristics of secondary raw materials
- Technologies for flotation and electrostatic separation of plastics

Laboratory in Metal Recycling:

- Melting of thin-walled scrap,
- Refining of aluminum alloys,

Teaching methods

Lecture: multimedia presentation. Laboratory exercises: performing exercises, discussion, team work.

Bibliography

Basic:

1. Kozłowski M., Plastics Recycling in Europe, Wyd. Politechniki Wrocławskiej 2006.
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.

Additional:

1. Hong Hocheng, Mital Chakankar, Umesh Jadhav, 1st Edition, Biohydrometallurgical Recycling of Metals from Industrial Wastes, CRC Press 2018.

3. Brandrup, J., Bittner, M., Menges, G., and Michaeli, W. (1996) Recycling and recovery of plastics, CarlHanser Verlag, Germany.

4. Letcher T., Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions, 1st Edition, Academic Press 2020.

5. Pascoe, R. D. (2000) Sorting of Waste Plastic for Recycling, Rapra Review Reports, 11, 4.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	16	0,60
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	9	0,40