COURSE DESCRIPTION CARD - SYLLABUS

Course name
Waste management [N1Mech2>GO]

Course

Field of study
Mechatronics

Year/Semester
3/5

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
16

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

Lecturers

Prerequisites

A student entering this subject should have knowledge of general chemistry and ecology. He should demonstrate the ability for effective self-education in areas related to environmental protection and waste management.

Course objective

To learn about the basic issues related to waste management, physical and chemical properties of waste and technologies for its treatment, disposal and disposal. To acquire the ability to see the benefits and cause-and-effect relationships between waste management, economics and environmental elements.

Course-related learning outcomes

Knowledge:
The student has knowledge of industrial and municipal waste, hazardous waste , legal and organizational conditions in waste management (linear via circular model) modern organizations of sustainable waste management, technical activities in waste disposal and disposal (landfills, thermal, chemical and mechanical methods), including composting. The student is able to propose some models and tools for complex waste treatment.

Skills:

The student independently knows how to propose solutions to specific waste management problems. Able to correctly use standards, environmental legal regulations, MFA or LCA type IT tools to solve problems in the field of waste management and environmental costs. Can communicate with the industrial and business environment in the field of waste management technology and management, and demonstrate the need for continuous improvement of knowledge in the area of waste management in light of increasing environmental requirements.

Social competences:
The student is aware of following good practices in waste management observing ethical principles; demonstrates self-reliance and readiness to take new initiatives in social activities in the field of waste management.

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 (0.3) and written answers (0.7) for questions asked by a teacher.

Programme content

Lecture_plastics: Legal issues and organisation of waste management in the light of the legal conditions in force in the European Union. Implementation of waste management systems (collection, transport of waste and secondary raw materials). Waste neutralisation and disposal methods (landfill systems, classification, legal and administrative requirements in Poland and Europe).
Lecture_metals: global consumption of metal materials and energy consumption for their production, renewable and non-renewable raw material resources, legal and organizational issues of metal waste management, management and processing of metal waste.
Laboratory_metals: classification and segregation systems for metal waste, characteristics of plants processing metal waste
Laboratory_plastics. Development of a waste management scenario using the LCA and/or MFA method. Assessment of potential environmental impacts using the adopted methodology.

Course topics

Lecture plastics: Thermal waste disposal technologies (municipal waste incineration plants, solid and gaseous waste treatment methods). Methods of biological treatment of organic waste (anaerobic and aerobic composting). Methods for the mechanical treatment of polymeric waste (treatment costs and investment) and methods for the organic generation of post-production waste. Waste management concept with application of waste management and material and energy balance analysis tools (MFA, LCA).
Lecture_metals: basic principles of metal waste management, metal waste management systems, characteristics of the waste catalog, collection methods, copper metallurgy waste management, electronic and electrical scrap management, collection methods, reloading and transport of metal waste, metal waste sorting methods.
Laboratory_plastics: Comparative assessment of waste management systems (data collection, transport, assessment of environmental impact categories, material and energy balance) with an application such as SimaPro10, Stan. Field activities at municipal waste management, transformation and disposal facilities. Laboratory_metals: functioning of a secondary raw materials collection point - fieldwork, vehicle dismantling station, principles of metal waste sorting, carbon footprint analysis in the production of metal parts, processing of metal chips.

Teaching methods

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

Bibliography

Basic:
1. Bilitewski, B., Hardtle G., Marek. K. Podręcznik gospodarki odpadami. Teoria i praktyka, 2003.

2. Czarnecka-Komorowska Dorota, Przetwórstwo tworzyw i kompozytów polimerowych w obiegu zamkniętym, Wyd. Politechniki Poznańskiej, Poznań 2023.
3. Witryna internetowa: https://simapro.com/wp-content/uploads/2023/07/SimaPro-Tutorial.pdf
4. https://www.sciencedirect.com/topics/engineering/material-flow-analysis
5. Tchobanoglous George, Kreith Frank, Handbook of Solid Waste Management, 2nd Edition. 2002, The McGraw-Hill Companies, Inc. ISBN: 9780071356237.
6. Allen Alexander , Stefano Pascucci and Fiona Charnley, Handbook of the Circular Economy Transitions and Transformation, De Gruyer 2023, https://doi.org/10.1515/9783110723373.
7. Ulewicz M., Procesy odzysku i recyklingu metali nieżelaznych i stali, Wyd. Politechniki Częstochowskiej 2015. ISBN 978-83-7193-636-4.
8. Ulewicz M., Siwka J., Procesy odzysku i recyklingu wybranych materiałów, Wyd. Wydziału Inż. Proc., Mat. i Fizyki Stosowanej Politechniki Częstochowskiej, Częstochowa 2010.
9. Podstawy gospodarki odpadami, Producent: Wydawnictwo Naukowe PWN Autor: Czesława Rosik-Dulewska, rok wydania: 2022, wydanie pierwsze.

Additional:
1. Lerwen Liu, Seeram Ramakrishna, An Introduction to Circular Economy, Springer 2021
2. Stijn van Ewijk and Julia Stegemann, An Introduction to Waste Management and Circular Economy, UCLPRESS 2023,
3. Oprzędkiewicz J., Technologie i systemy recyklingu samochodów, WNT Warszawa 2003.
4. Brandrup, J., Bittner, M., Menges, G., and Michaeli, W. (1996) Recycling and recovery of plastics, Carl Hanser Verlag, Germany. ISBN: 9781800084650.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	24	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	76	3,00