COURSE DESCRIPTION CARD - SYLLABUS

Course name
Eco-Balance of processes and products [S2MiBM2>EWiP]

Course

Field of study
Mechanical Engineering

Year/Semester
1/2

Area of study (specialization)
Production Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

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 fields of materials technology, chemistry, and ecology, waste management.

Course objective

Learn the basics of ecotechnology, sustainability principles, environmental footprint and eco-design of processes and products using SimaPro. The student is able to prepare a report of the performed study (LCA) of the selected product or technological process.

Course-related learning outcomes

Knowledge:
The student should be able to characterize the basic issues of ecobalance and recycling. The student should be able to characterize the methods of ecobalances and describe the principles of eco-design of products. The student should be able to use "clean production" and environmental footprint methods. Has deepened and extended knowledge in the field of engineering materials. Knows modern engineering materials with specific properties and their use as elements of machines and tools. Has basic knowledge of the life cycle of devices, facilities and technical systems.
Knows and understands the basic concepts and principles of economic, legal, ethical and other non-

technical conditions of various types of professional activity related to the field of Mechanics and Machine Construction, including the principles of protection of industrial property and copyright.

Skills:
The student will be able to evaluate the environmental aspects. The student will be able to analyze the product life cycle and select the techniques of ecobalances. The student will able to design a product or process according to a selected method, taking into account the principles of recycling.
Is able to take into account social, economic, legal, ecological and other non-technical conditions in solving engineering problems. Is able to obtain information from literature, databases and other properly selected sources in the field of mechanics and machine construction; is able to integrate the information obtained, interpret and critically evaluate it, as well as draw conclusions and formulate and fully justify opinions.
Able to work individually and in a team. Is able to use information and communication techniques appropriate to carry out tasks, communicate using various techniques in a team and environment in the field of mechanics and machine construction, and conduct a debate. He is able to manage the work of a team of people.

Social competences:
The student will be aware of the effects of engineering activities both in the technical and non-technical areas. The student will understand the need for lifelong learning; can inspire and organize the learning process of other people. The student will be aware of the importance of the relationship between the manufacturing processes and the environment. Correctly identifies and resolves dilemmas related to the profession.

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% . The credit will include the knowledge and skills presented/practiced as part of the classes, in accordance with the program content.
Project exercises:
Prepare a report (0.7) and give a presentation on the LCA study conducted (weight of 0.3).

Programme content

Introduction to process and product eco-balancing, system analysis. Environmental load balance, including polymeric materials. Types and importance of eco-balancing methods. Methodology of energy-environmental analysis of products for the whole life cycle. Environmental impacts of industrial processes. Examples of description of any industrial production and use process. Improvement of environmental indicators in exemplary technologies. Environmental life cycle assessment using LCA and MFA techniques. Eco-technologies in various fields of industry, e.g. municipal waste management, and plastics processing. Eco-design of products (principles and legal basis, IPP, EuP, WEEE, RoHS). Environmental product labelling (role, importance, examples of application in industrial practice)..Cleaner production (examples of implementation in industry).
Design exercises:
Overview, and discussion of SimaPro software for conducting LCA study.
Defining the project topic/defining the product or process/identifying the system, system boundaries, functional unit/data collection/evaluating life cycle impacts/interpreting LCA results/reporting/preparing and giving a presentation on the LCA study conducted.

Course topics

1 Introduction to life cycle analysis (LCA) based on SimaPro 9: definition, standards, structure, stages.
2) LCA Stage I: Purpose and scope of the study
3) Stage II: Collection Analysis
4) LCA Stage III: Life cycle impact assessment
5) Stage IV: Interpretation of LCA results/limitations.

Teaching methods

Lecture: multimedia PowerPoint presentation.

Bibliography

Basic:
1. Górzyński J.: Podstawy analizy środowiskowej wyrobów i obiektów, Wyd. Naukowo-Techniczne W-wa 2007.
2. Walter Klöpffer, Birgit Grahl, Life Cycle Assessment (LCA): A Guide to Best Practice 1st Edition
3. Jabłoński J.: Technologie zero emisji, Wyd. Politechniki Poznańskiej, Poznań 2011.

Additional:
1. Kowalski Z.:Ekologiczna ocena cyklu życia procesów wytwórczych (LCA), PWN, W-wa 2007
2. Antoinettevan Schaik, Markus A.Reuter. Handbook of Recycling, State-of-the-art for Practitioners, Analysts, and Scientists 2014, Pages 307-378.
3. Åkermark AM. (1997) Design for Disassembly and Recycling. In: Krause FL., Seliger G. (eds) Life Cycle Networks. Springer, Boston, MA. https://doi.org/10.1007/978-1-4615-6381-5_20
4. Robert U. Ayres and Leslie W. Ayres, A Handbook of Industrial Ecology. eds. 2002. Edward Elgar Publishing, Northampton, MA
5. Lewandowska A.: Środowiskowa ocena cyklu życia na przykładzie wybranych typów pomp przemysłowych; Wyd. UEP;2006, ISBN 83-7417-133-2
6. Czasopisma tematyczne:
Journal of Cleaner production, https://www.sciencedirect.com/journal/journal-of-cleaner-production),
The International Journal of Life Cycle Assessment https://www.springer.com/journal/11367/

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