COURSE DESCRIPTION CARD - SYLLABUS

Course name
Pro-recycling design of finished products [S1TOZ1>PPWG]

Course

Field of study
Circular System Technologies

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
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student has the knowledge, skills and social competences resulting from passing the subjects included in the plan in the first five semesters of full-time first-cycle studies in the field of Circular System Technologies, or has achieved learning outcomes equivalent to the above-mentioned by studying at an analogous or related field at the Poznan University of Technology or in another university, and therefore. Knowledge: W1) Knows the meaning of the concept and structure of the Circular Economy, as well as the conditions and rules of the practical implementation of this system W2) Knows the rules and principles of sustainable development in relation to human manufacturing (productive) activity; knows about the existence of a close relationship between human economic activity and the state of the natural environment W3) Has general chemical knowledge, as well as knowledge of applied geology, bioorganic chemistry, basics of biotechnology. Has mastered issues related to materials science, basics of chemical technology and process apparatus W4) Knows the unit operations used in the acquisition and processing of raw materials and in the recycling of waste W5) Knows the basic concepts of ecology, the laws governing nature and its individual components (ecosystems) Skills: U1) Is able to derive knowledge about the world around him from various sources and use it properly U2) Can identify the network of connections between technological, economic and environmental factors in the human productive activity Social competences: K1) Understands the need and has the habit of constantly learning and improving his knowledge and qualifications K2) Is aware of the close relationship between the level of productive activity of the society

and the state of the natural environment and understands the need to introduce such solutions in the field of technologies, management systems and legal solutions that will reduce the environmental anthropopressure resulting from this activity

Course objective

The aim of the course is to familiarize students with the principles and conditions of modern, so-called pro-recycling approach to the design of finished products. Particular emphasis will be placed on demonstrating the key role of comprehensive product characterization in terms of its environmental impact over the full life cycle. The designing of product will be presented against the background and in close connection with the system of supervision of engineering tasks aimed at reducing the consumption of raw materials, intermediates, materials and energy in the product design process.

Course-related learning outcomes

Knowledge:
1. the student knows the sources, mechanisms and causes of the anthropogenic impact of human productive activity on the natural environment, as well as the effects caused by this activity (k_w04, k_w06, k_w08)
2. has knowledge of the methods of environmental protection against the negative effects of anthropogenic impact, including the methods resulting directly from the implementation of the idea of pro-recycling design (k_w06, k_w07, k_w14, k_w15)
3. is familiar with the issues of modern construction materials, such as steels and alloys, polymer materials, composites, ceramics; knows their structure and applications, and has a basic knowledge of the technologies of their processing (k_w18)
4. has a general knowledge of the life cycle of finished products, the dangers of their use and the processes leading to their gradual destruction (k_w03, k_w05, k_w12)
part of production processes used and manufactured products (k_k05)
3. he is aware the importance of knowledge in solving the cognitive and practical problems in the field of pro-recycling design and consults experts in the event of difficulties with the independent solution of such problems [k_k02]

Skills:
1. the student is able to analyze and estimate the life cycle of specific products on a general level (k_u14)
2. is able to combine the observed facts and phenomena related to the environmental impact of products and properly interpret and describe the mechanisms of this impact (k_u14)
3. can estimate the potential threats to the natural environment and people, derived from the designed finished product [k_u14]
4. can interact with other people as part of interdisciplinary work on pro-recycling product designing and take a leading role in these teams (k_u08, k_u09)

Social competences:
1. the student is aware of the most serious global ecological problems (k_k09, k_k10)
2. demonstrates the need and understands the need to systematically expand and deepen his

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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The form of the final verification of learning outcomes/obtaining the grade from the subject, is chosen by students during the first class in the semester. Three possible variants to choose from, are: 1) independent preparation of a paper on a topic given by the teacher (a different topic for each student); 2) final colloquium, consisting of 10-15 open-ended problem questions of varying degrees of difficulty (variously scored); 3) final test, consisting of about 40-60 single-choice test questions, with varying degrees of difficulty (variously scored). In the case of a final colloquium or test, passing credit: 50% of the total points. As the final grade from the subject will be accepted the grade issued for the prepared paper, or the grade from the final colloquium or final test, issued on the basis of the number of points obtained. Ratings are issued using the scale of grades in force at Poznan University of Technology. Final colloquium or test may be performed stationary or remotely - depending on the form of the lecture.

Programme content

The lecture will cover the following issues:
1. Pro-recycling design - introduction (concept and assumptions of ecological product design; pro-recycling design in the stages: manufacturing, operation and disposal; legal ecological requirements for products; ecological labeling of products)
2. Environmental anthropopression as a factor inherent in human productive activity
3. The key importance of knowing the full life cycle of a product for the proper assessment of its environmental impact and selection of an appropriate concept at the design stage
4. Implementation of the principle of waste minimization by adopting the appropriate designing concept
5. Controlled elimination of waste at the design stage by promoting bio-based raw materials
6. Designing technical materials (polymers, alloys, composites, etc.) in a way that enables their recovery, renewal and improvement
7. Designing products in accordance with the principle of renewal and material reproducibility
8. The key importance of the selection of materials (raw materials) in the design of non-waste products
9. The importance of financing material science research in the practical implementation of the principle of waste minimization
10. Basic design support activities aimed at minimizing waste: material selection; standardization of components, the use of solutions that extend the life of products; using innovative solutions in the field of sorting and segregation, separation or re-use of used products and materials
11. Considering at the design stage, the possibility of the useful application of by-products and production waste
12. Development and implementation of information exchange mechanisms linking all stages from design to the end of the product life cycle
13. Implementation of the principle of focusing attention by producers not on input materials (raw materials), but on determining the method of use and the necessary properties of end products
14. The trend in designing to increase the use of clean materials, easier to separate and recycle after product use
15. Systemic support for initiatives in the field of pro-recycling design of finished products: appropriate shaping of Polish and EU legislation and active support of modern initiatives through national and EU aid funds

Teaching methods

The lecture is based on multimedia presentations containing relevant examples along with their discussion and explanation; the presentations additionally contain extensive illustrative material (photos) for individual issues discussed

Bibliography

Basic
1. Z. Korzeń, Ekologistyka, Instytut Logistyki i Magazynowania, Poznań, 2001
2. A. Sadowski, Ekonomiczne i ekologiczne aspekty stosowania logistyki zwrotnej w obszarze wykorzystania odpadów, Wydawnictwo Uniwersytetu Łudzkiego, Łódź, 2010
3. W. Adamczyk, Ekologia wyrobów, PWE, Warszawa, 2004
4. Cz. Rosik-Dulewska, Podstawy gospodarki odpadami, Wydawnictwo Naukowe PWN, Warszawa, 2010
Additional
1. Ustawa z 14.12.2012 r. o odpadach (z późn. zm.)
2. A. Budnikowski, Ochrona środowiska jako problem globalny, Polskie Wydawnictwo Ekonomiczne, Warszawa, 1998
3. A. Bogda, C. Kabała, A. Karczewska, K. Szopka, Zasoby naturalne i zrównoważony rozwój, Wydawnictwo Uniwersytetu Przyrodniczego we Wrocławiu, Wrocław, 2010
4. W.M. Lewandowski, Proekologiczne odnawialne źródła energii, WNT, Warszawa, 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50