Materials: Properties, Selection and Sustainability

Educational subject description sheet

Basic information

Field of study Joint Bachelor in Sustainability	**Education cycle** 2025/26
Speciality Economics, Management & Engineering	**Subject code** UJ.WPAJBSEMES.880.16490.25
Organizational unit Faculty of Law and Administration	**Lecture languages** english
Study level first cycle (joint degree programme)	**Subject related to scientific research** Yes
Study form full-time degree programme	**Disciplines** Material Engineering, Economics and finance
Education profile General academic	**ISCED classification** 0311 Economics
Mandatory obligatory	**USOS code**

Subject coordinator	Piotr Szwedo
Lecturer	Karel Van Acker

Period Semester 4	**Examination** exam **Activities and hours** Lecture: 44	**Number of ECTS points** 5.0

Goals

C1	This course deals with materials science and technology as an example of a technological discipline, integrating aspects such as resource scarcity, material properties and scientific foundations, technical processes, materials and process selection and economic and environmental aspects.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the key material properties from basic physical principles	JBS_K1_W07	written exam
W2	the relationship between material properties, design and functionality	JBS_K1_W07	written exam, essay, presentation
W3	how to place technological knowledge of materials and materials processing in a broader sustainability context	JBS_K1_W03, JBS_K1_W06	written exam, essay, presentation
Skills – Student can:			
U1	make responsible choices of resources and materials and to evaluate their application in a balanced way with respect to performance and sustainability	JBS_K1_U02, JBS_K1_U03	essay, presentation
Social competences – Student is ready for:			
K1	to critically approach and verify statements around resource supply, sustainability and circularity of materials using recent information and insights, and to discuss this with peers	JBS_K1_K04	written exam, essay, presentation

Calculation of ECTS points

Activity form	Activity hours*	
Lecture	44	
preparation of a multimedia presentation	30	
preparation for classes	24	
preparation for the exam	27	
Student workload	**Hours** 125	**ECTS** 5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	Introduction and societal relevance Material families, properties and materials selection	W1, W2, W3, U1, K1
2.	Resources and materials consumption	W1, W2, W3, U1, K1
3.	Stiffness The atomic structure of materials	W1, W2, W3, U1, K1

No.	Course content	Subject's learning outcomes
4.	Strength Defects in materials	W1, W2, W3, U1, K1
5.	Masterclass materials selection & eco-audit (software)	W1, W2, W3, U1, K1
6.	Fracture and Fatigue Thermal properties	W1, W2, W3, U1, K1
7.	Electrical properties Materials processing	W1, W2, W3, U1, K1
8.	Environmental impact of materials	W1, W2, W3, U1, K1
9.	Life Cycle Analysis Eco-audit	W1, W2, W3, U1, K1
10.	Circular economy: recycling, substitution and circular business models	W1, W2, W3, U1, K1
11.	Group work presentations	W1, W2, W3, U1, K1

Course advanced

Teaching methods :

project method, conversation lecture, practicals

Activities	Examination methods	Credit conditions
Lecture	written exam, essay, presentation	Written closed-book exam with open and multiple choice questions (minimal passing score: 10/20). Active participation. The paper and presentation will count for 20% of the final scores. Students pass if they achieve minimally 10/20 in total.

Entry requirements

None

Literature

Obligatory

1. Slides and own course text (partially) published on Toledo.

Effects

Code	Content
JBS_K1_K04	The graduate can critically assess and verbalize own competencies and skills related to different aspects of sustainability as well as their need for development.
JBS_K1_U02	The graduate can present and report knowledge, methodologies, ideas, problems and solutions, clearly and comprehensively, in different forms destined for different audiences – including discussions and debates which require defending a substantiated opinion, as well as conversations in a foreign language at the CEFR B2 level.
JBS_K1_U03	The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.
JBS_K1_W03	The graduate can give examples of sustainability-related dilemmas and hypothesize on the optimal course of action.
JBS_K1_W06	The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities).
JBS_K1_W07	The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.