GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Sustainable development, PG_00071182						
Field of study							
Date of commencement of studies	February 2027		Academic year of realisation of subject	2026/2027			
Education level	second-cycle studies		Subject group				
Mode of study	Part-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	1		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Chemistry Technology and Biotechnology of Food -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Szymon Mania				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	9.0	0.0	0.0	9.0	0.0	18
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	18	3.0	29.0	50

Subject objectives	To provide students with screening-level tools for identifying and assessing environmental, economic and social impacts of chemical, materials and recycling technologies from a life-cycle perspective, and for proposing improvement options aligned with current EU/Polish regulatory requirements and industrial practice (circular economy, environmental footprints, eco-design, reporting and due diligence across value chains).

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] has extended and in-depth knowledge of mathematics, physics, chemistry and other areas, useful for formulating and solving complex tasks in materials technology and their recycling	The student knows and understands the principles of preparing a simplified material and energy balance for a process or product, as well as the basic environmental indicators (e.g., screening carbon footprint of a product, resource and waste indicators) used in the assessment of chemical and material technologies.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K7_K03] is aware of the non-technical aspects and effects of the Master of Science in Chemical Engineering's activities, including the impact on the environment, and is aware of the responsibility for the decisions made, the observance and development of the principles of professional ethics and actions to ensure compliance with these principles	The student consciously considers non-technical aspects of decisions (engineering ethics, chemical safety, environmental and social impact) and is able to identify typical trade-offs between impact categories. Validation: Evaluation of the arguments in the report and the discussion during the presentation.	[SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice
	[K7_K71] is able to explain the need to apply knowledge from humanistic, social, economic or legal sciences in order to function in a social environment	The student communicates the results of the analysis in a way that is understandable to non-scientific stakeholders (management, regulators, clients), indicating the need for interdisciplinarity (chemistry–law–economics–environment). Verification: presentation + answers to questions (Q&A) + assessment of the clarity and logic of the conclusions.	[SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice
	[K7_W07] ma wiedzę o trendach rozwojowych i najistotniejszych nowych osiągnięciach dotyczącą zagadnień związanych z technologią materiałową i recyklingiem	Students knows and identify key trends and regulations impacting materials technologies and recycling (circular economy, PEF/EF, product and waste requirements), and understand their implications for raw material selection, material design, and recycling pathways in various industrial sectors. Assessment: test/quiz + "background & compliance" element in the report.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K7_U02] is able to determine directions for further development and implement a self-education process in order to improve professional competences	The student independently obtains data and sources (industry reports, EPDs, databases, EU/PL documents) and is able to expand their competencies in new methodologies/standards required for case analysis. Verification: bibliography and footnotes in the report + assessment of the quality of sources and the accuracy of inferences.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_U71] is able to apply knowledge from humanistic, social, economic or legal sciences in order to solve problems	The student applies basic economic/legal/organizational tools to solve a technological problem (e.g., analysis of PPWR/battery/waste requirements, analysis of stakeholders and supply chain risks, justification of variant selection from a regulatory and cost perspective). Verification: analytical and regulatory section of the report + project presentation.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Lecture (9 h):

- (3 h) Sustainable development foundations in chemical/material engineering; EU context (Green Deal) and circular economy.
- (3 h) Metrics and tools: LCA/PEF basics, product carbon footprint, mass-based green metrics (E-factor/ PMI) at screening level.
- (3 h) Sectoral requirements and case studies: batteries, packaging, waste; reporting basics (CSRD/ ESRS) and implications for value chains.

Course content – project

Project (9 h):

- (3 h) Project scoping: problem definition, stakeholders, goal & scope, functional unit, system boundaries, data plan.
- (3 h) Screening assessment: calculations, scenario comparison, hotspot analysis, initial regulatory risk scan.
- (3 h) Recommendations and communication: improvement options, trade-offs, report & presentation, peer review.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture tests	60.0%	50.0%
Project report	60.0%	50.0%

Recommended reading

Basic literature

Podstawowa lista lektur (priorytet: UE/PL, normy, artykuły):

1. European Green Deal (COM/2019/640).
2. New Circular Economy Action Plan (COM/2020/98).
3. Regulation (EU) 2020/852 (EU Taxonomy).
4. Commission Recommendation (EU) 2021/2279 (Environmental Footprint / PEF-OEF).
5. Regulation (EU) 2023/1542 (Batteries and waste batteries).
6. Regulation (EU) 2025/40 (Packaging and packaging waste).
7. ISO 14067:2018 (Carbon footprint of products) opis normy i zakres.
8. ISO 14001:2015 (Environmental management systems) opis normy i założenia EMS.

Supplementary literature

Uzupełniająca lista lektur:

1. Directive (EU) 2018/851 amending the Waste Framework Directive.
2. Directive (EU) 2022/2464 (CSRD) Official Journal view.
3. Commission Delegated Regulation (EU) 2023/2772 (ESRS) akt delegowany.
4. R.A. Sheldon, Metrics of green chemistry: Waste minimization (2022) metryki masowe i logika waste prevention.
5. I. Kekessie i in., Process Mass Intensity (PMI) (2024) PMI jako metryka zielonej chemii w wytwarzaniu API.
6. S.L. Nordahl i in., Recommendations for life-cycle assessment of recyclable plastics (2024).
7. A.M. Domingues i in., Review of life cycle assessment on lithium-ion batteries and recycling (2024).
8. L. Pilon i in., Development of a solvent sustainability guide (2024) rozpuszczalniki w farbach/powłokach.
9. Międzynarodowa Agencja Energetyczna, Net Zero Roadmap 2023 Update (kontekst transformacji energetycznej przemysłu).
10. IPCC, AR6 WGIII SPM (2022) kontekst redukcji emisji i przemysłu.

eResources addresses

Example issues/ example questions/ tasks being completed

- Functional unit and system boundaries in screening LCA/PEF.
- Hotspot identification across chemical/material value chains.
- Regulatory-driven eco-design: packaging, batteries, waste, reporting in value chains.
- Team project: screening assessment + improvement options + short compliance check.

Practical activites within the subject

Not applicable

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