GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00069227		
Field of study	Zrównoważone technologie i materiały budowlane		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Mechanics of Materials and Structures -> Faculty of Civil and Environmental Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marzena Kurpińska	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	30.0	0.0	0.0	0.0	45

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	45	10.0	70.0	125

Subject objectives

The aim of the course **Sustainable Technologies and Building Materials** is to familiarize students with modern, environmentally friendly material solutions and technologies applied in construction in accordance with the principles of the circular economy. Students will acquire skills in designing, analyzing, and evaluating innovative low-emission materials and structural concepts within the framework of sustainable development

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K03] Can effectively, clearly and unambiguously convey information, describe activities and communicate their results/ outcomes to engineers or a wider audience using appropriate communication methods and tools.	The aim of the course is to develop the ability to clearly and professionally present the results of analyses, research, and projects related to modern construction technologies. The student learns to effectively communicate the outcomes of their work using appropriate engineering and multimedia tools, both within professional environments and to non-specialist audiences.	[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce
[K6_K04] Engages in independent lifelong learning and individually follows the development of science and technology in the field of civil engineering.	The learning outcome of the course is the development of the student's ability to independently research and analyze modern, eco-friendly material and technological solutions in construction. The student is able to critically evaluate innovations in the field of sustainable development and continuously update their knowledge in line with scientific and technological advancements in civil engineering.	[SK2] Ocena postępów pracy

Subject contents

Course content – lecture
1. Principles of sustainable development and EU policy in the context of construction.
2. Circular economy material recycling and reuse of raw materials.
3. Eco-binders and green building materials geopolymers, eco-cements, natural fibers.
4. Next-generation concretes low-emission, self-compacting, and recycled concretes.
5. Prefabrication and sustainable design material and energy efficiency, BIM.
6. Energy efficiency and climate neutrality in construction.
7. Digitalization and the use of AI in sustainable design (BIM, LCA, simulations).
8. Examples of innovative sustainable projects and technologies in Poland and worldwide.

Course content – exercises
1. Evaluation and comparison of the properties of recycled and traditional materials.
2. Design of low-emission concrete mixes and analysis of their technical parameters.
3. Assessment of the carbon footprint and economic efficiency of building materials.
4. Development of a structural element concept using innovative technologies and materials.
5. Testing methods for eco-friendly construction materials.

Prerequisites and co-requisites

Prerequisites:

1. Basic knowledge of construction. Understanding of basic concepts related to design, building materials and construction processes.

2. Understanding of basic principles of sustainable development. Knowledge of general principles of ecology and sustainable development.

3. Analytical and critical thinking skills. Ability to analyze, evaluate and think critically.

4. Basic science. Basic knowledge of physics, chemistry and mathematics.

Additional requirements:

1. Interest in environmental issues. Motivation and interest in issues of sustainable development, environmental protection and the impact of construction on the natural environment and society.

2. Willingness to work in a team.

3. Research skills. Ability to independently search, analyze and synthesize information from various sources.
4. Knowledge of basic CAD tools or other design visualization programs.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
projekct	60.0%	30.0%
paper, presentation	60.0%	70.0%

Recommended reading

Basic literature

[1] M. Janiszek, Green Innovations and Their Town Applications, Pr. Nauk. Uniw. Ekon. we Wrocławiu, no. 502, pp. 8594, 2018, doi: 10.15611/pn.2018.502.08.

[2] A. López-Malest, M. R. Gabor, M. Panait, A. Brezoi, and C. Veres, Green Innovation for Carbon Footprint Reduction in Construction Industry, Buildings, vol. 14, no. 2, 2024, doi: 10.3390/ buildings14020374.

[3] T. Ahmad, Innovation in Green Building Projects: An Exploratory Inquiry, Buildings, vol. 13, no. 9, 2023, doi: 10.3390/buildings13092359.

[4] J. Pakulska and M. Rutkowska, Ecological innovations as an element of the organization strategy, Ekon. i Sr., vol. 1, no. 68, pp. 5766, 2019, doi: 10.34659/9y46-6p57.

	Supplementary literature	[1] P. Antuña Rozado, Carmen Huovila, A. Huovila, and Á. Corredor Ochoa, Eco-innovative construction business models for social development, Proc. 24th Annu. RESER Conf., no. September, 2014. [2] J. Markiewicz, Sustainable Solutions in Construction from the Perspective of Innovation Activity, Eur. Res. Stud. J., vol. XXV, no. Issue 4, pp. 241252, 2022, doi: 10.35808/ersj/3079. [3] United Nations Environment Programme (UN Environment), Eco i Manual, p. 376, 2017.
	eResources addresses	
Example issues/ example questions/ tasks being completed	(mandatory) I Written work (sample topic). 1. Considering the case study X EcoDom, identify key design elements that contribute to its environmental, economic, and social sustainability. What lessons can be learned from this project for future construction projects? (selected works) II Presentation (selected works).Discussion of the impact of globalization on sustainable construction, both in terms of the movement of technologies and materials and urbanization patterns. Does globalization have a positive or negative impact on the pursuit of sustainability in the construction sector? III Test, multiple choice questions (optional). 1.Which of the following practices most effectively contributes to reducing the carbon footprint in construction? a) use of local building materials, b) use of advanced energy management systems in buildings, c) use of prefabricated building elements, d) all of the above; 2. Which of the following building materials is considered the most sustainable?: a) concrete, b) steel, c) certified wood, d) plastic; 3. What is the main assumption of passive construction?: a) minimizing the building's operational energy consumption, b) maximizing solar heat gains, c) using only renewable energy sources, d) a and b are correct; 4. Which of the following strategies is NOT considered part of sustainable design:? a) increasing natural light in the building, b) using highly processed materials with low durability, c) collecting and using rainwater, d) using high-efficiency HVAC systems; 5. Which of the following is an example of a bioclimatic approach to design?: a) designing a building with the local climate in mind, to maximize the use of natural heating, cooling, and ventilation, b) installing air conditioning in every room, c) using only artificial lighting for interior lighting, d) building in places where the climate does not have a major impact on buildings;	
Practical activites within the subject	Not applicable	

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