



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Sustainable structures [S2Bud1E-ZBZ>ZKB]

Course

Field of study

Civil Engineering

Year/Semester

2/3

Area of study (specialization)

Sustainable construction and management

Profile of study

general academic

Level of study

second-cycle

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge, skills and competences acquired during the education process in the field of structural design. The ability to formulate and solve technical problems in the field of civil engineering.

Course objective

To acquaint students with the principles of designing structural systems in accordance with sustainable development goals, focusing on minimizing the carbon footprint and utilizing eco-friendly materials throughout the entire life cycle of a building object.

Course-related learning outcomes

Knowledge:

1. Students know in detail the principles of analysing, constructing and dimensioning selected elements for structures, taking into account the idea of sustainable construction.
2. Students have extended and detailed knowledge of modelling of sustainable materials as well as structures made of them.
3. Students know in detail currently utilised construction materials and products, that can lead to a smaller carbon footprint.

4. Students know in detail the rules of design, construction and operation of selected building units, taking into account the idea of sustainable construction.
5. Students have structured and theoretically based knowledge of the processes in the full life cycle of building structures and their management rules. They also know and understand the need for systematic evaluation and maintenance of structure technical condition.
6. Students have detailed knowledge of the impact of building investments on the environment and understand the need to implement the rules of sustainable development.

Skills:

1. Students can prepare an evaluation and statement of strengths influencing a floor and beams made with sustainable materials.
2. Students can design elements of a floor, working both individually and in a team.
3. Students are able to correctly define a computational model of a floor beam and carry out its analysis.
4. Students are able to obtain information from literature, databases and other properly selected information sources; can integrate the obtained information, interpret and evaluate it as well as draw conclusions, formulate, justify, discuss and present opinions.

Social competences:

1. Students take responsibility for the reliability of working results and their interpretation.
2. Students are ready to autonomously complete and broaden (extend) knowledge in the field of modern processes and technologies of building engineering.
3. Students are aware how important is sustainable development in building engineering.
4. Students can realise that it is necessary to improve professional and personal competence; are ready to critically evaluate the knowledge and received content.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written test.

Grading scale:

- <90 to 100%> of points - very good (A)
- <80 to 90%> of points - good plus (B)
- <70 to 80%> of points - good (C)
- <60 to 70%> of points - a satisfactory plus (D)
- <50 to 60%> of points - satisfactory (E)
- below 50% of points - insufficient (F)

Credit of projects on the basis of: substantive evaluation of the prepared design documentation, regular work (design consultation and attendance at classes), project defense (written form).

Programme content

The course covers sustainable design principles through Life Cycle Assessment (LCA) and the use of low-emission materials and innovative solutions, e.g., engineered wood products. The project involves comparing beams made of different materials.

Course topics

Lectures:

Introduction to Sustainable Development in Civil Engineering.

Life Cycle Assessment (LCA) of structures.

Low-emission materials: Green concrete and recycled steel.

Thin-walled structures.

Timber and composite structures as a sustainable alternative.

Circular economy in construction: Reusing and recycling components.

Future trends: Carbon-neutral building technologies.

Project:

Comparative analysis of beams made of different materials regarding environmental impact and material efficiency.

Teaching methods

Lectures: informative and problem lecture, case study method
Projects: project method, solving project tasks given by the teacher

Bibliography

Basic:

1. EN 1990: Eurokod 0 - Basis of structural design
2. EN 1991: Eurokod 1 - Actions on structures
3. EN 1992: Eurokod 2 - Design of concrete structures
4. EN 1993: Eurokod 3 - Design of steel structures
3. EN 1994: Eurokod 4 - Design of composite structures
5. EN 1995: Eurokod 5 - Design of timber structures
6. Life Cycle Assessment (LCA) of Environmental Impact in Construction and Civil Engineering, International Organization for Standardization, ISO 14040.
7. Sustainability in Buildings and Civil Engineering Works - Framework for Methods of Assessment of the Environmental, Social and Economic Performance of Construction Works as a Basis for Sustainable Development, ISO 15392.

Additional:

1. Barbhuiya S., Das B.B., Life Cycle Assessment of construction materials: Methodologies, applications and future directions for sustainable decision-making, Case Studies in Construction Materials, 2023, 19:e02326.
2. Strzelecka J., Polus Ł., Chybiński M., Theoretical and Numerical Analyses of Steel-timber Composite Beams with LVL Slabs, Civil and Environmental Engineering Reports, 2023, 33(2):64-84.
3. Ciesielczyk K., Studziński R., Chybiński M., Ścigała J., Szymkuć W., Grabski J., Marciniak T., Polus Ł., An Assessment of the Behaviour of Ceiling Beams of Different Structure, Applied Sciences, 2025, 15(21):11543.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00