



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Composite steel-concrete structures [S2Bud1E-IOB>S-BKZ]

Course

Field of study

Civil Engineering

Year/Semester

1/2

Area of study (specialization)

Smart and resilient buildings

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

Basic knowledge of the strength of materials and structural mechanics, metal and reinforced concrete structures. The ability to obtain information from the indicated sources, e.g., standards. Ability to design a typical steel and reinforced concrete structure. Awareness of the need to expand professional competences and take serious responsibility in designing.

Course objective

Acquiring skills in designing steel-concrete composite structures.

Course-related learning outcomes

Knowledge:

1. Student knows in detail the principles of analysing, constructing and dimensioning elements and connections in selected building structures.
2. Student know in detail the rules of design, construction and operation of selected building units.

Skills:

1. Student can prepare an evaluation and statement of strengths influencing both simple and complex building units.
2. Student can design elements and connections in complex building units, working both individually and in a team.
3. Student can perform a classical static and dynamic analysis and stability analysis of statically determinate and non-determinate bar structures (trusses, frames and strands); as well as surface construction (discs, plates, membranes and shells).
4. Student are able to prepare a building unit design and technical documentation in the environment of selected CAD software, including the usage of BIM technology.

Social competences:

1. Student take responsibility for the reliability of working results and their interpretation.
2. Student are ready to autonomously complete and broaden (extend) knowledge in the field of modern processes and technologies of building engineering.
3. Student 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

Lecture:

- general rules of composite structures designing (limit states, calculation schemes, failure modes),
- design methods of composite slabs, steel-concrete composite beams, bending and shear load-bearing capacity, load-bearing capacity of connectors, stiffness.

Project: Design of the steel-concrete composite ceiling.

Course topics

Lectures:

1. Introduction to composite structures
2. Material properties and assumptions of composite structures
3. Basics of designing composite structures
4. Shear connection design
5. Composite slab
6. Composite beam
7. Design of composite structures in fire conditions

Projects: Design of the steel-concrete composite ceiling.

Teaching methods

Monographic lecture with a multimedia presentation with elements of a problem-solving lecture.

Projects: practical solution of an engineering task (introductory discussion of the task, preparation of calculations by students, consulting and approval of work stages, clarification of doubts by the teacher).

Bibliography

Basic:

1. EN 1990: Eurokod 0 - Basis of structural design
2. EN 1991: Eurokod 1 - Actions on structures.
3. EN 1994: Eurokod 4 - Design of composite steel and concrete structures. Part 1-1: General rules and rules for buildings.
4. EN 1994: Eurokod 4 - Design of composite steel and concrete structures. Part 1-2: General rules - Structural fire design
5. Roger P. Johnson, Designers' Guide to Eurocode 4: Design of Composite Steel and Concrete Structures: EN 1994-1-1. ICE Publishing, 2012.
6. Roger P. Johnson, Composite Structures of Steel and Concrete: Beams, Slabs, Columns and Frames for Buildings, Wiley-Blackwell, 2018.

Additional:

1. Szmitigiera E., Niedośpiał M., Grzeszykowski B., Projektowanie konstrukcji zespolonych stalowo-betonowych. Część 1: Elementy zginane, Warszawa, Wydawnictwo Naukowe PWN, 2019.
2. Kurzawa Z., Rzeszut K., Szumigala M., Stalowe konstrukcje prętowe. Cz. Konstrukcje z łukami, elementy cienkościenne, pokrycia membranowe, elementy zespolone, dachy pierścieniowe i belki podsuwnicowe, Poznań, Wydawnictwo Politechniki Poznańskiej, 2017.
3. Giżejowski M., Budownictwo ogólne, Tom 5, Stalowe konstrukcje budynków, projektowanie według eurokodów z przykładami obliczeń, Warszawa, Arkady, 2010.
4. Łukasz Polus, Maciej Szumigala, An experimental and numerical study of aluminium-concrete joints and composite beams. Archives of Civil and Mechanical Engineering 19(2), 375-390, 2019.
5. Marcin Chybiński, Łukasz Polus, Theoretical, experimental and numerical study of aluminium-timber composite beams with screwed connections, Construction and Building Materials 226, 317-330, 2019.
6. Maciej Szumigala, Ewa Szumigala, Łukasz Polus, Laboratory tests of new connectors for timber-concrete composite structures, Engineering Transactions 66(2), 161-173, 2018.
7. Marcin Chybiński, Łukasz Polus, Bending resistance of metal-concrete composite beams in a natural fire. Civil and Environmental Engineering Reports 28(4), 149-162, 2018.

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