COURSE DESCRIPTION CARD - SYLLABUS

Course name
Composite structures [N2Bud1-KB>KZ]

Course

Field of study
Civil Engineering

Year/Semester
2/3

Area of study (specialization)
Structural Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
10

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 the design of modern steel and concrete composite structures.

Course-related learning outcomes

Knowledge:
1. KB_W02 know in detail the principles of analysing, constructing and dimensioning elements and connections in selected building structures. [P7S_WG (I)]
2. KB_W04 have extended and detailed knowledge of material strength, modelling and constructing; have knowledge of theoretical principles of the finite element method as well as general rules of non-linear calculations of engineering structures. [[P7S_WG (O/I)]
3. KB_W07 know in detail the rules of design, construction and operation of selected building units.

[P7S_WG (I)]

Skills:
1, KB_U01 can prepare an evaluation and statement of strengths influencing both simple and complex building units. [P7S_UW (I)]
2. KB_U02 can design elements and connections in complex building units, working both individually and in a team. [P7S_UW (I)]]
3. KB_U03 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). [P7S_UW]
4. KB_U04 use advanced specialized tools in order to search for useful information, communication and in order to obtain software supporting the designer and organizer of building engineering works. [P7S_UW (O/I)]
5. KB_U05 are able to correctly define a computational model and carry out an advanced linear analysis of complex building units, their elements and connections; are able to apply basic nonlinear computational techniques together with a critical evaluation of numerical analysis results. - [P7S_UW (I)]
6. KB_U07 are able to correctly define a computational model and carry out an advanced linear analysis of complex building units, their elements and connections; are able to apply basic nonlinear computational techniques together with a critical evaluation of numerical analysis results.[P7S_UW (I)]
7. KB_U15 are able to prepare a building unit design and technical documentation in the environment of selected CAD software, including the usage of BIM technology. [P7S_UW (I)]

Social competences:
1. KB_K01 take responsibility for the reliability of working results and their interpretation. [P7S_KK (O)]
2. KB_K03 are ready to autonomously complete and broaden (extend) knowledge in the field of modern processes and technologies of building engineering. [P7S_KR (O)]
3. KB_K05 can realise that it is necessary to improve professional and personal competence; are ready to critically evaluate the knowledge and received content. [P7S_KK (O)]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written test.
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)
Grading scale:
between 91 - 100% points - very good (A)
between 81 - 90% points - good plus (B)
between 71 - 80% points - good (C)
between 61 - 70% points - sufficient plus (D)
between 51 - 60% points - sufficient (E)
below 50% points - insufficient (F)

Programme content

Lecture:
At the lecture of Composite Structures the following are presented:
- 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,
- design methods of composite columns.
Project:
Design of the steel-concrete composite ceiling with a composite slab and beams

Course topics

The lecture programme comprises the following topics:

1. Introduction to composite structures
2. Composite slabs
2.1. Composite slabs with profiled steel sheeting
2.2. Verification of profiled steel sheeting
2.3. Ultimate limit states of composite slabs
3. Composite beams
3.1. Resistances of cross-sections of steel-concrete composite beams
3.2. Shear connection
3.3. Deflections
4. Composite columns

The projects programme comprises the following topics:
Design of the steel-concrete composite ceiling with a composite slab and beams:
1. Composite slab
2. Composite beam
3. Steel-concrete composite girder

Teaching methods

Monographic lecture with a multimedia presentation with elements of a problem-solving lecture. The knowledge acquired during the lectures will be verified in a final written test.
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). The knowledge acquired during the project classes will be verified through completing a project and its defence (written form).

Bibliography

Basic
1. PN-EN 1994-1-1 (2008) Eurokod 4, Projektowanie zespolonych konstrukcji stalowo-betonowych, Część 1-1: Reguły ogólne i reguły dla budynków.
2. Szmigiera E., Niedośpiał M., Grzeszykowski B. (2019), Projektowanie konstrukcji zespolonych stalowobetonowych. Część 1: Elementy zginane, Warszawa, Wydawnictwo Naukowe PWN.
3. Kucharczuk W., Labocha S. (2008), Konstrukcje zespolone stalowo-betonowe, Warszawa, Wydawnictwo Arkady.
4. Kurzawa Z., Rzeszut K., Szumigała M. (2017), Stalowe konstrukcje prętowe. Cz. 3, Konstrukcje z łukami, elementy cienkościenne, pokrycia membranowe, elementy zespolone, dachy pierścieniowe i belki podsuwnicowe, Poznań, Wydawnictwo Politechniki Poznańskiej.

Additional
5. Giżejewski M. (2010), Budownictwo ogólne, Tom 5, Stalowe konstrukcje budynków, projektowanie według eurokodów z przykładami obliczeń, Warszawa, Arkady.
6. PN-EN 1990 (2004), Eurokod 0, Podstawy projektowania konstrukcji. Polski Komitet Normalizacyjny.
7. PN-EN 1991-1-1 (2004), Eurokod 1, Oddziaływanie na konstrukcje, Część 1-1: Oddziaływanie ogólne – Ciężar objętościowy, ciężar własny, obciążenie użytkowe w budynkach. Polski Komitet Normalizacyjny.
8. PN-EN 1993-1-1 (2006) Eurokod 3, Projektowanie konstrukcji stalowych, Część 1-1: Reguły ogólne i reguły dla budynków, Polski Komitet Normalizacyjny
9. PN-EN 1992-1-1 (2008) Eurokod 2, Projektowanie konstrukcji z betonu, Część 1-1: Reguły ogólne i reguły dla budynków.
10. Johnson R.P. (2012) Designers' Guide to Eurocode 4: Design of Composite Steel and Concrete Structures EN 1994-1-1, London, ICE Publishing.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	20	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50