

SYLLABUS

Course title: Special Structures

Course title (in Polish): Konstrukcje specjalne

The syllabus is valid since the summer semester of the academic year 2025/26 and its content is not subject to changes during the semester.

Course details:

Unit offering the course: Faculty of Civil Engineering

Course designated for the unit: The Silesian University of Technology

Specialization:

Didactic cycle: Summer semester 2025/2026 - the third year of first degree studies

Coordinator of the course: dr inż. Szymon Dawczyński

Delivery mode: in-person

Number of ECTS credits: 2

Language:
English
Course homepage:
https://platforma.polsl.pl/rb/course/view.php?id=572
Prerequisites:
prior completion of the Concrete Structures basic course
Short description:
<p>The main aim of the subject is to prepare a student for an individual work as a structural designer of complex engineering structures subjected to non-typical complex loads of different natures. The course consists of three independent parts: Composites, Mining and Modelling.</p> <ol style="list-style-type: none">1. Composites: composite materials in structural engineering, Fibre Reinforced Polymers, pre-cast composite elements, structures made out of composites2. Mining: geological structure of the Upper Silesian Industrial Area, methods of deposit mining, effects of underground coal mining on the surface, influence of deforming subsoil on buildings, method of the Limit States in the context of mining interactions, basic and unique load combination.3. Numerical modelling: introduction to Finite Element Method, finite element types, principles of modelling of building structures, plane strain/stress approach, software for engineering applications
Description:
LECTURES: 25h
Composite structures: Composite materials classification, composite materials in structural engineering, Fibre Reinforced Polymers, pre-cast composite elements in structures, structures made

out of composites, novel and innovative technologies of creating composite structures. Dimensioning of FRP composites.

Mining: Geological structure of the Upper Silesian Industrial Area. Basic terms used in mining. Methods of deposit mining. Effects of underground coal mining on the surface. Parameters of formation of a mining through. Division of types of deformations of the ground. Continuous deformations. Description and determination of parameters of the mining through edge. Discontinuous deformations. Influence of subsoil deformation on structures. Categories of mining areas. Influence of mining deformations on buildings. The influence of horizontal mining deformations. The influence of deforming subsoil on buildings. Method of the Limit States in the context of mining interactions. Basic and unique load combination. The influence of horizontal ground deformations on building structures. Shear stresses under the surface of foundations. Influence of horizontal ground deformations on foundations. Axial forces in continuous footing. Bending moments in the continuous footing. Anchor and diagonal tie rods used for continuous footing systems. Principles of reinforcement distribution in foundations.

Modelling: Introduction to Finite Element Method, finite element types, principles of modelling of building structures, plane strain/stress approach, software for engineering applications.

PRACTICAL CLASSES: 5h

Composites: Introduction to FRP composites design.

Mining: Introduction and explanation of the design exercise.

Modelling: Presentation of selected examples of numerical models of structures.

PROJECT: 6h

Composites: individual project of composite beam subjected to flexure.

Mining: Determination of mining impacts on reinforced concrete foundation structure. Calculation of the reinforcement in continuous footing. Structural drawing.

LABORATORY: 4h

Modelling: Building a numerical model of a selected building structure (geometry, cross- sections, loads, combinations), running analysis and interpretation of results, preparing calculation report.

Bibliography:

- fib: „Fib bulletin no. 14 “. fib
- J.L. Clarke: „Structural Design of Polymer Composites: Eurocomp Design Code and Background Document“. CRC Press
- Kratzsch H.: „Mining subsidence engineering“. Springer
- Standards: EN 1990, EN 1991

Learning outcomes:

KNOWLEDGE:

K1A_W05,
K1A_W06.

SKILLS:

K1A_U02,
K1A_U04.

The student can:

- use their knowledge - formulate and solve complex and unusual problems,
- explain selected processes and chemical phenomena affecting the manufacturing technology and durability of materials and building components

- plan and perform simple experiments leading to the assessment of mechanical and physical properties and durability of building materials
- read architectural, construction and geodetic drawings and prepare graphic documentation in the environment of selected CAD and BIM software
- select appropriately sources and information
- select and apply appropriate methods and tools, including advanced information and communication technologies
- evaluate critically knowledge and recognize of knowledge in solving cognitive and practical problems
- formulate expert opinions on technical and technological processes carried out in the construction industry

Assessment methods and assessment criteria:

Course credit requirements:

- 1) Attendance (may be monitored)
- 2) Passing the lecture tests.
- 3) Defense of the completed projects.
- 4) Obtaining a positive grade for the projects.

Final grade:

Composites: The final grade is based on the results of the written test (50%) and the quality and accuracy of the design task (50%).

Mining: The final grade is based on the results of the written test (50%) and the quality and accuracy of the design exercise (50%).

Modeling: The final grade is based on the quality and accuracy of the project report.

The final grade is calculated as a weighted average of three grades: Composites (40%), Mining (40%), and Computer Modeling (20%).

To have partial grades transferred, students should contact their instructor within the first two weeks of the semester.

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ECTS points: 2