

## SYLLABUS

**Course title:** Advanced Structural Design - Selected Topics (BudAB>SI8ASDSET19)

**Course title (in Polish):** -

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:** Structural Engineering

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

**Coordinator of the course:** Barbara Klemczak

**Delivery mode:** in-person/hybrid

**Number of ECTS credits:** 2

<b>Language:</b>
English
<b>Course homepage:</b>
Distance Education Platform: <a href="https://platforma.polsl.pl/rb/">https://platforma.polsl.pl/rb/</a>
<b>Prerequisites:</b>
Passed courses in Mechanics and Reinforced Concrete Structures
<b>Short description:</b>
The course provides an in-depth understanding of advanced topics in the design and analysis of reinforced concrete structures, with a focus on thermal, shrinkage, and fire-related effects.
<b>Description:</b>
<b>LECTURES:</b> 20 hours The course provides an in-depth understanding of advanced topics in the design and analysis of reinforced concrete structures, with a focus on thermal, shrinkage, and fire-related effects. Students will learn to account for these time-dependent and environmental influences in both design and assessment processes. The course introduces fundamental principles of structural modelling and explores selected analytical and numerical methods, including finite element modelling (FEM), to simulate the behaviour of concrete structures under complex load conditions. Learning objectives: <ul style="list-style-type: none"><li>• Understand the mechanisms and significance of thermal and shrinkage effects in reinforced concrete structures.</li><li>• Learn design methodologies for addressing temperature and shrinkage-induced stresses.</li><li>• Analyse the influence of fire exposure on structural performance and design for fire resistance.</li><li>• Develop skills in modelling and simulating concrete structures using FEM tools.</li><li>• Apply theoretical knowledge to practical design and assessment problems involving thermal, shrinkage, and fire-related effects.</li></ul>

**SEMINAR: 10 hours**

The seminar complements the lecture series by providing students with the opportunity to deepen their understanding of advanced topics in the design and analysis of reinforced concrete structures affected by thermal, shrinkage, and fire-related effects. Through case studies, problem-solving sessions, and discussions, students will critically engage with real-world examples and research findings. The seminar emphasizes the interpretation of analytical and numerical results, development of modelling strategies, and the application of theoretical concepts to practical engineering problems.

Students will:

- Discuss and analyse case studies illustrating the impact of thermal, shrinkage, and fire effects on reinforced concrete structures.
- Interpret and compare analytical, experimental, and numerical results related to time-dependent and environmental influences.
- Develop and present simplified and advanced modelling approaches using FEM-based tools.
- Apply theoretical knowledge to practical assessment and design scenarios.
- Enhance their ability to communicate technical findings through written reports and oral presentations.

**Bibliography:**

Flaga K., Klemczak B.: „Konstrukcyjne i technologiczne aspekty naprężeń termiczno-skurczowych w masywnych i średniomasywnych konstrukcjach betonowych”.

Wydawnictwo Politechniki Krakowskiej, 2016

ACI Committee 207:: „ACI 207.2 R-07. Report on Thermal and Volume Change Effects on Cracking of Mass Concrete. ”. American Concrete Institute, 2007

Bamforth PB: „CIRIA C660. Early-age thermal crack control in concrete.”. CIRIA, Classic House London 2007

Japanese Concrete Institute : „Guidelines for Control of Cracking of Mass Concrete 2016”. JCI 2017

**Learning outcomes:****KNOWLEDGE**

- (1) theoretical models of materials and principles of modelling and analysis of bar structures in the field of statics, dynamics and stability, and knows selected software supporting design, also with the use of BIM technology [efekt kierunkowy K1A\_W04]

**SKILLS**

- (2) present, assess and discuss various opinions and positions concerning structural, material and technological solutions, taking into account the cost effectiveness and durability of the analysed solution [efekt kierunkowy K1A U12]

**Assessment methods and assessment criteria:**

Course Completion Requirements:

1. Attendance at the seminar
2. Delivery of a presentation during the seminar
3. Obtaining a positive grade for the presentation
4. Obtaining a positive grade on the final test

The final grade for the course is calculated as follows:

Final Grade = 0.5 × Presentation Grade + 0.5 × Final Test Grade

To have partial grades from previous semesters recognized, the student must contact the course instructor within the first two weeks of the semester.

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**Description of the ECTS calculation method:**

**Number of ECTS credits assigned to the course**

**2**