Nazwa w języku polskim: Utrzymanie, naprawy i wzmacnianie konstrukcji
Nazwa w jęz. angielskim: Maintanence, Repair and Strengthening of Structures

Dane dotyczące zajęć:
Information on course:

Jednostka oferująca: Wydział Budownictwa
Course offered by: Faculty of Civil Engineering

Język wykładowy:
J. Angielski
Language:
English
Strona WWW: **Course homepage:**
https://platforma.polsl.pl/rb/course/view.php?id=804
Skrócony opis:
The course provides revision of problems and methods connected with the assessment, repair and strengthening of different types of structures (masonry, timber, reinforced concrete, steel) for historical, urban, and industrial buildings. The course covers aspects related to building maintenance, structural inspections, types of inspections and the scope of construction expertise. The course broadly discusses the causes of damage to various types of buildings, including the influence of the subsoil, mechanical and non-mechanical, dynamic, environmental influences, ageing, fatigue and corrosion. The student gets acquainted with modern methods and tools for the inspection of various types of structures. The course presents methods of SHM, including techniques based on Vibration and Vision Methods, Data and Model Driven Methods based on ANN. The student learns about modern, innovative diagnostic techniques and devices based on UAV and robots, self-monitoring structures, etc.
Short description:
The course provides revision of problems and methods connected with the assessment, repair and strengthening of different types of structures (masonry, timber, reinforced concrete, steel) for historical, urban, and industrial buildings. The course covers aspects related to building maintenance, structural inspections, types of inspections and the scope of construction expertise. The course broadly discusses the causes of damage to various types of buildings, including the influence of the subsoil, mechanical and non-mechanical, dynamic, environmental influences, ageing, fatigue and corrosion. The student gets acquainted with modern methods and tools for the inspection of various types of structures. The course presents methods of SHM, including techniques based on Vibration and Vision Methods, Data and Model Driven Methods based on ANN. The student learns about modern, innovative diagnostic techniques and devices based on UAV and robots, self-monitoring structures, etc.
Opis:
Treści programowe **Wykłady:** Przyczyny katastrof budowlanych. Utrzymanie obiektów budowlanych. Monitoring i diagnostyka budynków. Przeciwdziałanie katastrofom i uszkodzeniom budynków. Przyczyny uszkodzeń konstrukcji. Rodzaje uszkodzeń konstrukcji różnego typu: murowanych (z uwzględnieniem specyfiki obiektów zabytkowych), drewnianych, stalowych i betonowych. Konsekwencje uszkodzeń budynków. Metody naprawy konstrukcji wykonanych z różnych materiałów. Tradycyjne i nowoczesne metody wzmacniania konstrukcji. Przegląd technik i urządzeń diagnostyki konstrukcji. Przegląd metod monitorowania konstrukcji. Monitorowanie stanu konstrukcji. Nowoczesne, innowacyjne metody lokalizacji uszkodzeń konstrukcji. Metody oceny bezpieczeństwa konstrukcji. BIM. Cyfrowy bliźniak budownictwa. Konstrukcje inteligentne. **Seminarium:** Indywidualne prezentacje studentów na wybrane tematy lub studia przypadków związane z zakresem kursu.

Liczba godzin zajęć z bezpośrednim udziałem nauczycieli akademickich lub innych osób prowadzących zajęcia i studentów.

Wykład:

- **stacjonarne: 20h**

Seminarium:

- **stacjonarne: 10h**

Liczba punktów ECTS: 2

Description:

Lectures:
Causes of construction disasters. Building maintenance. Monitoring and diagnostics of buildings. Counteracting disasters and building damage. Causes of structural damage. Types of damage to structures of various types: masonry (taking into account the specificity of historic buildings), wooden, steel and concrete. Consequences of building damage.
Methods of repairing structures made of various materials. Traditional and modern methods of structural reinforcement.
Overview of construction diagnostics techniques and devices. Overview of construction monitoring methods. Structural Health Monitoring. Modern, innovative methods of locating structural damage. Methods of assessing the safety of structures. BIM. The digital twin of construction. Intelligent constructions.
Seminar:
Individual presentations of students on chosen subjects or case studies related to the scope of the course.

- **full-time studies: 30h (20 lecture, 10 seminar)**

Number of ECTS credits: 2

Literatura:

1. Naprawa i ochrona konstrukcji betonowych. Lech Czarnecki, Peter H. Emmons. Kraków 2002
2. fib Bulletin 14 (Triafantafillou T. et al.) Externally bonded FRP reinforcement for RC structures. fib, July 2001.
3. fib Bulletin No. 102. Guide for Protection and Repair of Concrete Structures. Guide for good practice (291 pages, ISBN 978-2-88394-155-7, March 2022)
4. fib Bulletin No. 103. Guide for Strengthening of Concrete Structures. Guide for good practice (316 pages, ISBN 978-2-88394-158-8, May 2022)
5. fib Bulletin No. 109. Existing concrete structures life management, testing and structural health monitoring. ISBN 978-2-88394-172-4. DOI:10.35789/fib.BULL.0109, 11.2023
6. The Athens Charter for the Restoration of Historic Monuments, 1933
7. The Venice Charter for the Conservation and Restoration of Monuments and Sites, 1964

Bibliography:

1. Naprawa i ochrona konstrukcji betonowych. Lech Czarnecki, Peter H. Emmons. Kraków 2002
2. fib Bulletin 14 (Triafantafillou T. et al.) Externally bonded FRP reinforcement for RC structures. fib, July 2001.
3. fib Bulletin No. 102. Guide for Protection and Repair of Concrete Structures. Guide for good practice (291 pages, ISBN 978-2-88394-155-7, March 2022)
4. fib Bulletin No. 103. Guide for Strengthening of Concrete Structures. Guide for good practice (316 pages, ISBN 978-2-88394-158-8, May 2022)
5. fib Bulletin No. 109. Existing concrete structures life management, testing and structural health monitoring. ISBN 978-2-88394-172-4. DOI:10.35789/fib.BULL.0109, 11.2023
6. The Athens Charter for the Restoration of Historic Monuments, 1933
7. The Venice Charter for the Conservation and Restoration of Monuments and Sites, 1964

Efekty uczenia się:

K1A_W05

Student knows the principles of construction, dimensioning, strengthening and repair of construction elements: metal, reinforced concrete, composite, timber and masonry, as well as selected construction elements of bridge/communication construction.

K1A_W10

Student knows fundamental dilemmas of contemporary civilization, prospects for the development of construction and consequences of the impact of construction investments on the environment, as well as the impact of environmental factors on the durability of buildings.

K1A_U14

Students know how to use their knowledge - formulate and solve complex and unusual problems and perform tasks in conditions not fully predictable by: - appropriate selection of sources and information derived from them, evaluation, critical analysis and synthesis of this information, - selection and application of appropriate methods and tools, including advanced information and communication technologies

Learning outcomes:

K1A_W05
Student knows the principles of construction, dimensioning, strengthening and repair of construction elements: metal, reinforced concrete, composite, timber and masonry, as well as selected construction elements of bridge/communication construction.
K1A_W10
Student knows fundamental dilemmas of contemporary civilization, prospects for the development of construction and consequences of the impact of construction investments on the environment, as well as the impact of environmental factors on the durability of buildings.
K1A_U14
Students know how to use their knowledge - formulate and solve complex and unusual problems and perform tasks in conditions not fully predictable by: - appropriate selection of sources and information derived from them, evaluation, critical analysis and synthesis of this information, - selection and application of appropriate methods and tools, including advanced information and communication technologies

Metody i kryteria oceniania:

Wymagany udział w wykładach, prezentacjach i dyskusjach podczas seminariów. (50%)
Ocena indywidualna na podstawie obecności, aktywności i jakości prezentacji. (50%)

Assessment methods and assessment criteria:

Demanded participation in lectures, presentations and discussions during seminars. (50%)
Individual evaluation is based on the presence, activity and quality of the presentation. (50%)

Przynależność do grup przedmiotów w cyklach:
Element of course groups in various terms:

Opis grupy przedmiotów Course group description	Cykl pocz. First term	Cykl kon. Last term
przedmioty obieralne studia stacjonarne stopień studiów – I kierunek studiów – Civil Engineering semestr dowolny – 8BSc		