**Nazwa przedmiotu:**

Special Concrete Structures

**Koordynator przedmiotu:**

Rafał Ostromęcki, Ph.D., Eng.

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia II stopnia

**Program:**

Civil Engineering

**Grupa przedmiotów:**

Obligatory

**Kod przedmiotu:**

1080-BUKBD-MSA-0405

**Semestr nominalny:**

2 / rok ak. 2021/2022

**Liczba punktów ECTS:**

4

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

Total 105 h = 4 ECTS: lecture 30 h, project tutorial 30 h, execution of the individual project 20 h, literature study 5 h, preparation and presence at the exam 20 h.

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

Total 70 h = 3 ECTS: lecture 30 h, project tutorial 30 h, consultations 10 h.

**Język prowadzenia zajęć:**

angielski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

Total 60 h = 2 ECTS: project tutorial 30 h, execution of individual projects 20h, preparation to exam 10 h.

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład:  | 30h |
| Ćwiczenia:  | 0h |
| Laboratorium:  | 0h |
| Projekt:  | 30h |
| Lekcje komputerowe:  | 0h |

**Wymagania wstępne:**

It is assumed, that students have basic knowledge of reinforced concrete structures theory and design rules as well as building mechanics and materials strength.

**Limit liczby studentów:**

15

**Cel przedmiotu:**

Developing the skills of understanding the action and design of thin-walled coverings, storage tanks for liquids or loose materials and concrete arches.
Preparation of the project of a tank, consisting of thin-walled shell elements.

**Treści kształcenia:**

Lectures:
Thin-walled covers – types of shells, internal forces in shells, membrane state of stresses, membrane theory, calculation of forces in axially symmetrical loading case of rotational shells, moments theory, shell supported on ring-beams, cylindrical shells – structural components, internal forces distribution, simplified methods for calculation, reinforcement in shells.
Tanks for liquids – perpendicular tanks, distribution of internal forces, simplified methods of calculation of internal forces, detailing and construction of reinforcement.
Silos – types, actions on silos’ walls, calculations and reinforcement.
Arches – types, calculation and detailing, structural details, reinforcement.
Project:
Circular tanks for liquids - calculations and learning to understand the internal forces distribution. Elaboration of the project of reinforced concrete cylindrical tank with shell covering.

**Metody oceny:**

1. Exam in writing and oral, covering the lectures material.
2. Elaboration of a project. Final grade will be 50% exam grade and 50% project grade.

**Egzamin:**

tak

**Literatura:**

[1] EN-1992-1-1. Eurocode 2. Concrete Structures Design. Part I.
[2] EN-1992-3. Eurocode 2. Concrete Structures Design. Part 3 – silos and tanks for liquids.
Material from lectures.
[3] W. Stachurski, J. Kobiak “Konstrukcje żelbetowe, tom 4, (in polish).
[4] K. Grabiec „Żelbetowe konstrukcje cienkościenne” (in polish).
[5] A Halicka, D. Franczak „Projektowanie zbiorników żelbetowych” (in polish).

**Witryna www przedmiotu:**

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**Uwagi:**

## Charakterystyki przedmiotowe

### Profil ogólnoakademicki - wiedza

**Charakterystyka W1:**

The graduates know the basic standards and guidelines for the design of tank structures.
The graduates are aware of risks of failure associated with the designed building structure and have expertise needed to provide the required safety according to the standards.
The graduates know design principles of selected shell structures taking into account flexible connections.

Weryfikacja:

Exam, project

**Powiązane charakterystyki kierunkowe:** K2\_W13, K2\_W05, K2\_W09

**Powiązane charakterystyki obszarowe:** III.P7S\_WG, P7U\_W, I.P7S\_WG.o

### Profil ogólnoakademicki - umiejętności

**Charakterystyka U1:**

The graduates can prepare project drawing documentation, including calculations and technical description proper for the stage of the design process taking into consideration different levels of detail. They can prepare and interpret engineering drawings of construction structures to the extent consistent with the specialization profile.
The graduates can provide an adequate level of safety of the designed structure by applying standards for loads and design.
The graduates can classify structural systems.
The graduates can define and classify effects on structures. They can define the load and load combinations.
The graduates can analyse and design selected shell structures including connection flexibility.

Weryfikacja:

Exam, project work.

**Powiązane charakterystyki kierunkowe:** K2\_U04, K2\_U05, K2\_U10, K2\_U16\_KB, K2\_U17\_KB, K2\_U19\_KB, K2\_U20\_KB

**Powiązane charakterystyki obszarowe:** P7U\_U, I.P7S\_UO, I.P7S\_UW.o, III.P7S\_UW.o

### Profil ogólnoakademicki - kompetencje społeczne

**Charakterystyka K1:**

The graduates understand the importance of personal responsibility in engineering activity, including accuracy and reliability when presenting and interpreting the results of their own work.

Weryfikacja:

Exam, project work.

**Powiązane charakterystyki kierunkowe:** K2\_K07, K2\_K01, K2\_K02, K2\_K03, K2\_K04, K2\_K05, K2\_K06

**Powiązane charakterystyki obszarowe:** P7U\_K, I.P7S\_KO, I.P7S\_KR, I.P7S\_KK