## 1. Course number and name

RB-S1-19-S10-E, **Concrete Structures IV**

## 2. Credits and contact hours*

5 ECTS, lectures: 15 hours**, classes: 6 hours**, project: 22 hours**

## 3. Instructor's or course coordinator's name

Marek Węglorz PhD

## 4. Text book, title, author, and year

- Nawy E.G: Prestressed Concrete – Fundamental Approach. Prentice Hall, New Jersey, 2006
- Naaman A.: Prestressed Concrete – Analysis and Design. Ann Arbor, Michigan, 2005

a. other supplemental materials

- EN 1990:2002 Eurocode: Basis of Structural Design.
- EN 1991-1-1: 2001. Eurocode 1: Actions on structures. Part 1-1: General actions. Densities, self-weight, imposed loads for buildings.
- EN 1992-1-1: 2004. Eurocode 2: Design of Concrete Structures. Part 1-1: General Rules and Rules for Buildings.

## 5. Specific course information

a. brief description of the content of the course (catalog description)

Lectures:

(1) Concepts of prestressing. Development of general idea, (2) Materials and equipment. (3) Technical problems of modern solutions: post-tensioning and pre-tensioning, (4) Losses of prestressing force, (5) Methods of analysis: ultimate limit state (ULS), serviceability limit state (SLS), stress and strain control, (6) Flexural design of PC members: post-tensioned and pretensioned, web reinforcement design procedure for shear, (7) Examples of the precast, pretensioned concrete members and structures.

Classes:

Design rules of pretensioned concrete members according to Eurocodes.

Project:

Design of precast, pretensioned concrete member - static calculations and detailed drawing.

b. prerequisites or co-requisites

Concrete Structures I, II, III, sem. III, IV and V.

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program

Required.

## 6. Specific goals for the course

a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic

The student can:

- calculate loads acting on the pretensioned concrete members,
- calculate internal forces and evaluate the results of the pretensioned concrete members static analysis,
- design the precast, pretensioned concrete members,
- make calculations and technical drawings of pretensioned concrete members.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

K1A_U02, K1A_U04, K1A_W05, K1A_W06

## 7. Brief list of topics to be covered

1. Definition of prestressing of structures; development of the idea of prestressing from ancient time up to present; the methods of prestressing used today.
2. The most important properties of concrete for prestressing; stress-strain diagram at first loading of concrete and modules of elasticity; time-dependent strains of concrete affecting the prestressing; kinds of prestressing steels and the main types of tendons in present use; stress-strain relationship in prestressing steels.
3. Comparison of pre-tensioning vs. post-tensioning; features of reinforced-concrete vs. prestressed-concrete structures; classification of the intensity of prestressing affecting design. Production operation and methods for pre-tensioned elements; profiles of tendons in pre-tensioned members and description of long-line method;
4. Losses of prestressing force – instantaneous and time-dependent; methods for reduction of losses.
5. Failure modes considered in ULS.
6. Design criteria for ULS and SLS.
7. Typical applications of pre-tensioning and popular cross sections of elements.

*- Consultations were not included in the contact hours

**-per semester