1. Course number and name

RB-S1-18-W17-1C, **Special Structures I**

2. Credits and contact hours*

2 ECTS, lectures: 25 hours**, classes: 5 hours**, project: 6 hours**, laboratory 4 hours**

3. Instructor's or course coordinator's name

Marcin Kozłowski PhD, DSc/University Professor (course leader, Numerical modelling), Marcin Górski PhD (Composites), Szymon Dawczyński PhD (Mining)

4. Text book, title, author, and year

- 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

a. other supplemental materials

- Standards: EN 1990, EN 1991

5. Specific course information

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

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

b. prerequisites or co-requisites

Mechanics, Concrete Structures, Steel Structures, Masonry Structures, Engineering Geology and Soil Mechanics

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:

- 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

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

K1A_W05, K1A_W06, K1A_U02, K1A_U04

7. Brief list of topics to be covered

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.

1. Composites: composite materials in structural engineering, Fibre Reinforced Polymers, pre-cast composite elements, structures made out of composites
2. 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

*- Consultations were not included in the contact hours
**-per semester