# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Structural engineering [N1IŚrod2>BiKI]

## Course

Field of study
Environmental Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

## Number of hours

Lecture
20

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
20

## Number of credit points

4,00

## Coordinators

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## Lecturers

## Prerequisites

Basis of mathematics; basic knowledge of the Windows operating system and the EXCEL spreadsheet; ability to acquire information from designated sources; ability to cooperate in a team.

## Course objective

To acquire basic knowledge and skills to solve selected tasks in the field of mechanics and strength of materials. Knowledge of basic building materials and the rules of their use, getting to know the structural components and load-bearing systems of buildings, as well as the selected civil engineering structures, getting acquainted with the process of architectural and structural design.

## Course-related learning outcomes

Knowledge:
The student knows: 1) basic concepts of the strength of materials, 2) methods of determining internal forces in planar member systems, 3) basic structural, insulating and finishing building materials and the

rules of their use, 4) structural components and load-bearing systems of buildings, as well as the selected civil engineering structures, 5) basic technical and constructional requirements to be fulfilled by a properly designed, constructed and operated civil structure and/or its structural component.

Skills:
The student is able to: 1) obtain information from technical and construction regulations, 2) identify and name essential elements of buildings and other structures, 3) calculate geometrical characteristics of plane figures and calculate cross-sectional forces in statically determined plane bar systems, 4) protect a building against excessive heat and moisture losses.

Social competences:
The student is aware of: 1) the need to independently complement and broaden the knowledge on building materials and technologies, 2) the need to take care of one's own and society's health, 3) the need to reduce energy losses and protect the environment, 4) the need to ensure appropriate safety of the civil structure during its design, construction and operation.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures. Written test in two parts: the first part covering the issues of strength of materials and structural mechanics and the second part covering the issues of construction and civil engineering structures. The final mark is based on the points scored in both parts of the test. A minimum number of points is required for each part of the test.
The design exercises are divided into two thematic blocks: block one covering the issues of strength of materials and structural mechanics, block two covering the issues of construction and civil engineering structures. The performance of control works in the field of mechanics and strength of materials; the final mark is determined on the basis of the marks obtained from the control works. Performing a design exercise from the scope of general construction; continuous control of the acquired knowledge, during consultations of the design exercise; the mark is determined on the basis of the correctness of the performed design exercise and questions concerning the knowledge acquired during its performance. The final mark for the design exercises is determined as an average of marks for both parts.

## Programme content

Lecture topics (first part - A): Basic definitions and assumptions of construction theory. Calculation of internal forces in trusses, beams and frames. Geometric characteristics of the cross-section. Stress and strain analysis. Dimensioning of the section of a bending beam. Calculation of beam deflection. Eccentric force action. Rod stability.
Topics of control work carried out during design exercises in the field of mechanics and strength of materials: Calculation of internal forces in trusses, beams and frames. Geometric characteristics of the cross-section. Dimensioning of the section of a bending beam.

Lecture content (part two - B): Basic knowledge of building elements in various types of buildings in terms of design and construction.

## Course topics

Lecture topics (part A):

Topics of design exercises (part A):

Lecture topics (part B): Architectural and construction design process. Factors shaping the building. Building information modeling. Structural systems. Legal requirements. A detailed discussion of the building elements in terms of construction and materials: foundations, ground floors, floors on the ground, walls, including the ETICS system, ceilings, roofs, stairs. Principles of shaping passive and ecological buildings.

Topics of design exercises (part B): design of an external wall of a residential building, insulated using the ETICS system. Scope of the exercise: calculations of the wind impact on the external walls of the building,

calculations of the load-bearing capacity of the mechanical connectors system and the load-bearing capacity of the ETICS system, determination of the required number of mechanical connectors per 1 m2 of insulation in individual wall areas, calculations of the heat transfer coefficient of the external wall, calculations of the temperature factor on the internal surface of the wall , necessary to avoid critical surface humidity, calculate the dew point temperature and calculate the relative air humidity at the wall surface based on the analysis of the water vapor content in the air.

## Teaching methods

The lecture is conducted in the form of a multimedia presentation combined with the traditional teaching method.
Design exercises in the field of mechanics and strength of materials are carried out in a traditional form. The control works are issued to be carried out on their own during the design exercises.
Design exercises in the field of construction: explanation of the scope of the design, presentation of the use of the provided computer software to perform design calculations, checking the correctness of execution of individual stages of the design.

## Bibliography

Basic:
1. Przewłócki J., Górski J., Podstawy mechaniki budowli, Arkady, Warszawa 2008
2. Zielnica J., Wytrzymałość materiałów, Wyd. PP, 1996
3. Wytrzymałość materiałów. Zarys teorii, przykłady, zadania. (Pr. zbiorowa pod redakcją K. Wrześniowskiego), 1985
4. Rozporządzenie w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie
5. Siewczyńska Monika, Domy jednorodzinne. Przewodnik do ćwiczeń projektowych z Budownictwa Ogólnego, Wydawnictwo Naukowe PWN, 2017

Additional:
1. Orłowski W., Słowański L., Wytrzymałość materiałów. Przykłady obliczeń. Arkady, Warszawa 1978
2. Cywiński Z., Mechanika budowli w zadaniach, PWN 1997
3. Leyko J., Mechanika ogólna, PWN, Warszawa 2007
4. Jakubowicz A., Orłoś Z., Wytrzymałość materiałów, WNT, Warszawa 1997
5. Dyląg Z., Jakubowicz A. , Orłoś Z., Wytrzymałość materiałów, WNT 1999
6. Nowacki W., Mechanika budowli, PWN Warszawa 1975
7. Jastrzębski P., Mutermilch J., Orłowski W., Wytrzymałość materiałów, Arkady , Warszawa 1986
8. Michalak H., Pyrak S., Domy jednorodzinne - konstruowanie i obliczanie. Arkady, Warszawa 2005
9. Nowy poradnik majstra budowlanego, red. J. Panas. Arkady, Warszawa 2012
10. Budownictwo ogólne, t.1 - materiały i wyroby budowlane, red. B. Stefańczyk. Arkady, Warszawa 2005
11. Budownictwo ogólne, t.3 - elementy budynków, podstawy projektowania, red. L. Lichołai. Arkady, Warszawa 2008
12. Gaczek M., Jasiczak J., Kuiński M., Siewczyńska M., Izolacyjność termiczna i nośność murowanych ścian zewnętrznych - Rozwiązania i przykłady obliczeń. WPP, Poznań 2011
13. Rokiel M., Hydroizolacje w budownictwie - poradnik. Dom Wydawniczy Medium, Warszawa 2009
14. Mirski J.Z., Łącki K., Budownictwo z technologią, t.2. WSiP 2010
15. Izolacje styropianowe w budownictwie - poradnik. Stowarzyszenie Producentów Styropianu
16. Podstawy budownictwa dla inżynierów sanitarnych, kier. J. Kuczyński. Arkady, Warszawa 1984

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 100 | 4,00 |
| Classes requiring direct contact with the teacher | 40 | 1,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 60 | 2,50 |