



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Strength of materials [S1Bud1>WM1]

### Course

Field of study

Civil Engineering

Year/Semester

1/2

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

30

Projects/seminars

15

### Number of credit points

4,00

### Coordinators

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### Lecturers

### Prerequisites

Knowledge: Mathematics: algebra (including matrix calculus), mathematical analysis (including differential and integral calculus), geometry, planimetry, trigonometry. Theoretical mechanics: knowledge of the equilibrium equations and internal forces in rod elements of a structure. Skills: Mathematics: skills of calculation of derivatives and integrals of functions, the ability to use matrix calculus. Physics: ability to apply the principles of Newton. Theoretical mechanics: the ability to use the balance equations to determine the reactions and internal forces in statically determined bar systems. Social competences: Students can work in groups. The student follows the rules of ethics.

### Course objective

Acquiring knowledge, skills and competences in solving problems of stress, deformations and displacements in structural member elements and in the field of material strength.

### Course-related learning outcomes

### Knowledge:

The student has detailed knowledge in the field of mechanics, strength of materials and principles of general structural design, and knows the theories explaining the complex relationships between them (obtained during the lecture). The student knows at an advanced level the principles of structure theory and analysis of rod systems in the field of statics and stability (obtained during the lecture).

### Skills:

The student is able to make a list of loads acting on buildings and perform static analysis of statically determinate rod structures (obtained during exercises and projects).

### Social competences:

The student is responsible for the reliability of the results of their work and their interpretation. The student is ready to critically assess their knowledge and received content, as well as critically evaluate the results of their own work.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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#### Evaluation of lectures

Exam (written or oral form, one- or two-stage), duration: 90-120 minutes, on the date specified at the beginning of the semester. The basis for passing the exam is to obtain a sufficient minimum score (3.0). Rating scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), insufficient (2.0).

#### Evaluation of exercises

The classes are passed on the basis of positive grades (at least 3.0) from tests, dates given at the beginning of the semester.

Rating scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), insufficient (2.0).

#### Project evaluation

Project classes are passed on the basis of positive grades (at least 3.0) from project tasks. Project tasks are subjected to individual defense (oral or written form).

Rating scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), insufficient (2.0)

## Programme content

Program content includes geometric parameters of figures, axial and eccentric normal force, action of bending moments in straight and bidirectional bending, action of shear force, and torque. Stresses, strains and displacements are calculated.

## Course topics

### Lectures

1. Geometrical parameters of figures
2. Geometrical parameters of figures
3. Normal force
4. Bending moment (one-directional bending)
5. Shear force
6. Principal stresses
7. Simultaneous action of normal force and bending moment
8. Skew bending
9. Eccentric action of normal force
10. Normal stresses under the foundation
11. Torsion of circular and thin-walled closed sections
12. Torsion of rods with a thin-walled open section
13. Determination of beams displacements
14. Determination of beams displacements
15. Theory of experimental research methods

## Exercises

1. Determination of internal forces due to linearly variable loads in beams. Determination of internal forces in arches.
2. Determination of geometric parameters of figures
3. Determination of geometric parameters of figures
4. Analysis of axially loaded bars. Basics of bent beam design
5. Stresses in a rectangular cross-section
6. Test
7. Stresses in the I-section
8. Stresses in the box section
9. Principal stresses, stress cubes, equivalent stress
10. Skew bending
11. Eccentric action of normal force
12. Stress distribution under the foundation
13. Test
14. Resit test
15. Repetition

## Projects

1. Explanation of organizational principles, discussion of subject matter, projects No. 1 and 2 - determination of geometrical parameters of cross-sections commissioning.
2. Defense of project No. 1.
3. Defense of project No. 2. Projects No. 3 commissioning - determination of stresses in beams.
4. Project No. 3 - determination of stresses in beams
5. Project No. 3 - determination of stresses in beams - tensors and stress cubes.
6. Defense of project No. 3. Projects No. 4 commissioning - skew bending in beams.
7. Defense of project No. 4

## Teaching methods

Information lecture  
Practice method  
Project method

## Bibliography

### Basic

1. A. Gawęcki, Mechanika materiałów i konstrukcji prętowych, tomy 1 i 2, Wydawnictwo Politechniki. Poznańskiej 1998.
2. J. Dębiński, J. Grzymisławska, Ćwiczenia laboratoryjne z wytrzymałości materiałów, Wydawnictwo Politechniki Poznańskiej, 2016.
3. J. Dębiński, J. Grzymisławska, Wytrzymałość Materiałów cz.1-5, Wydawnictwo Politechniki Poznańskiej, 2019.

### Additional

1. S. Piechnik, Wytrzymałość materiałów, Politechnika Krakowska, Kraków 1999
2. A. Jakubowicz, Z. Orłoś, Wytrzymałość Materiałów, tomy 1 i 2, WNT, Warszawa, 1999 i 1997
3. Z. Cywiński, Mechanika budowli w zadaniach. Układy statycznie wyznaczalne, PWN Warszawa 1999
4. J. Grabowski, A. Iwanczewska, Zbiór zadań z wytrzymałości materiałów, Oficyna Wydawnicza Politechniki Warszawskiej, 1994.

### Additional resources

<https://www.youtube.com/watch?v=7D1XTquKhm0>

## Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,00
Classes requiring direct contact with the teacher	75	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50