# COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mechanics of Engineering Structures

## Course

Field of study

Civil Engineering

Year/Semester

1/1

Area of study (specialization)

Road, bridge and railway engineering

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

## Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

15

## Number of credit points

2

## Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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## Prerequisites

KNOWLEDGE: Student knows the analytical methods of calculating forces and displacements in statically determinate and indeterminate bar systems. Student has knowledge of the state of stresses and deformations in the sections of bars and in the ground.

SKILLS: Student can calculate forces and displacements in bar systems, statically determinate and indeterminate. He can calculate stresses and strains in the cross-sections of bars and in the ground and can perform numerical calculations using a spreadsheet.

SOCIAL COMPETENCE: Student is a responssible person willing to broaden her/his knowledge and to communicate and work in a team environment with her/his colleagues.

## Course objective

To teach the student the principles and understanding of the static analysis of rod and tension systems in terms of the finite element method using computer programs.

## Course-related learning outcomes

### Knowledge

The student knows the analytical and computer methods of calculating internal forces and displacements in beams on elastic ground.

The student knows the analytical and computer methods of calculating internal forces and displacements in bar structures, also taking into account the influence of large axial forces.

The student knows the specificity of the non-linear behavior of tension structures and the methods of their static analysis.

### Skills

The student is able to calculate analytically and using the finite element method internal forces and displacements in beams on elastic ground.

The student is able to calculate analytically and using the finite element method internal forces and displacements in bar structures.

The student is able to use the Newton's method to calculate geometrically nonlinear tension systems.

### Social competences

The student can work individually and in a team.

The student is aware of the responsibility resulting from the accuracy of the results obtained and is able to interpret.

The student is aware of the need for continuous training and expanding knowledge.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture – Final test at the last lecture (2 h)

Projects – Completion of 2 projects and their defence in the form of test (1,5 h) at the last meeting.

## Programme content

Static analysis of beams on elastic foundation. Problem formulation and analysis by the finite element method. Static analysis of bar structures (frames). Problem formulation and analysis by the finite element method. Static analysis of tension systems. Problem formulation, analysis with the analytical method and the finite element method.

## Teaching methods

Lecture – Traditional lectures ( "chalk-and-talk"), with computer-assisted presentations at times.

Projects – Two projects: beam on elastic foundation, and frame - solved by the FEM.

## Bibliography

Basic

1. W.K. Kaczurin: Teoria konstrukcji wiszących. Arkady, Warszawa 1965.

2. P. Litewka, R. Sygulski: Wybrane zagadnienia zaawansowanej mechaniki budowli. Wydawnictwo PP, Poznań 2012.

3. T. Łodygowski, W.Kąkol: Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich, dostępne na stronie internetowej Zakładu Komputerowego Wspomagania Projektowania PP

4. G. Rakowski, Z. Kacprzyk: Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza PW, Warszawa 2016.

Additional

1. J. Hajduk, J. Osiecki: Ustroje cięgnowe. Teoria i obliczanie. WNT, Warszawa 1970.

2. J.W. Leonard: Tension Structures - Behavior and Analysis. McGraw-Hill, 1987.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 60 | 2,0 |
| Classes requiring direct contact with the teacher | 30 | 1,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 30 | 1,0 |

[1] delete or add other activities as appropriate