COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced structural mechanics [N2Bud1>ZMB]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Structural Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
0

Other
0

Tutorials
10

Projects/seminars
10

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge. The student knows the analytical methods of calculating forces and displacements in statically determinate and indeterminate bar systems. The student has basic knowledge of buckling in compression and loss of stability of planar bar systems. The student has knowledge of the state of stresses and deformations in the cross-sections of bars. Skills. The student is able to calculate forces and displacements in statically determinate and indeterminate bar systems. He is able to calculate stresses and deformations in the sections of bars. Social competence. The student understands the need to constantly expand his knowledge, and can apply his skills in practice.

Course objective

Acquainting with matrix methods of analysis of statics, dynamics and stability of simple bar systems as well as statics of axisymmetric shells.

Course-related learning outcomes

Knowledge:
The student will learn analytical and numerical methods of calculating internal forces and displacements in bar systems, also taking into account the influence of large axial forces, and methods of analyzing the

initial stability of bar systems.

Skills:
The student is able to calculate the internal forces and displacements in bar systems using various methods, also taking into account the influence of large axial forces.
The student is able to calculate the critical load and the form of stability loss of bar systems.
The student is able to critically evaluate the results of the conducted analyzes.

Social competences:
The student is responsible for the correctness of the calculations made.
The student is able to describe the performed calculations and draw conclusions from their results.
The student is aware of the need to systematically supplement and expand his knowledge.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Written exam checking the knowledge and skills of the subject, including tasks for independent solution and theoretical basis.
One design exercise for an individual solution.
Scale for the evaluation of results for the test and exam:
> = 90% - 5.0 (very good)
> = 85% - 4.5 (good plus)
> = 75% - 4.0 (good)
> = 65% - 3.5 (sufficient plus)
> = 55% - 3.0 (satisfactory)

Programme content

1. The matrix approach to the displacement method.
2. Statics analysis of bar systems: lattice bars, beams and flat frames.
3. Initial frame stability in terms of the matrix.

Course topics

Class topics:
- formulation of the problem of mechanics (statics) of bar structures in displacements,
- derivation of the stiffness matrix for a two-node bar element working axially,
- derivation of the stiffness matrix for a two-node beam element working axially (Euler-Bernoulli beam),
- derivation of the stiffness matrix for a two-node frame element of a flat frame,
- derivation of the stiffness matrix for a two-node plane truss element,
- derivation of the transformation matrix,
- derivation of the system of governing equations for the entire structure using the principle of minimum potential energy,
- solving statics problems for axially operating bar systems, beams and flat frames.

Teaching methods

Monographic lectures covering theoretical foundations and simple numerical examples.
Auditorium exercises including numerical examples. The examples are solved by the teacher using the "chalk and blackboard" method.
Exercises for self-solution covering two design tasks. The tutor consults the tasks given to students and, as needed, solves similar tasks on the blackboard.

Bibliography

Basic
1. Mechanika konstrukcji prętowych w ujęciu macierzowym, M. Guminiak, J. Rakowski, Wydawnictwo Politechniki Poznańskiej, Poznań, 2012.
2. Wybrane zagadnienia zaawansowanej mechaniki budowli, P. Litewka, R. Sygulski, Wydawnictwo Politechniki Poznańskiej, Poznań, 2012.

Additional
1. Mechanika budowli - ujęcie komputerowe, t. 1, 2 i 3, Z. Waszczyszyn i in., Arkady, Warszawa, 1995.
2. Computer Analysis of Structural Systems, J. F. Fleming, Mc Graw - Hill, 1989.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00