COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced structural mechanics [S2Bud1>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
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

1. Student knows analytical methods of calculation of internal forces and displacements in statically determinate and indeterminate bar structures 2. Student has basic knowledge concerning buckling and stability loss of plane bar structures 3. Student has knowledge concerning stress and strain states in beam cross-sections 4. Student can calculate internal forces and displacements in statically determinate and indeterminate bar structures 5. Student can calculate stress and strain states in beam cross-sections 6. Student is responsible for the results of carried out computations

Course objective

1. Presentation of matrix methods of static and stability analysis of bar structures 2. Introduction of foundations of plane girders analysis by analytical methods, finite strip method and boundary element method.

Course-related learning outcomes

Knowledge:
1. Student knows analytical and numerical methods of calculation of internal forces and displacements in bar structures, also with the influence of large axial forces

2. Student knows methods of analysis of initial stability of bar structures.
3. Student knows the foundations of forming and non-linear behaviour of cable structures
4. Student knows the foundations foundations of forming and bahaviour of shells in membrane and bending state

Skills:
1. Student can use analytical and numerical methods of calculation of internal forces and displacements in bar structures, also with the influence of large axial forces
2. Student can compute the critical load and mode of the stability loss for bar structures
3. Student can apply the Newton method to analyze geometrically non-linear cable structures
4. Student can compute internal forces in axially symetric shells using the engineering approach
5. Student can critically assess the results of carried out calculations and draw appropriate conclusions
6. Student can desrcibe the carried out analyses and draw the general conclusions from the results

Social competences:
Student is responsible for the obtained results of computations

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
-Lecture - written examination with 5 questions checking the study outcomes. Satisfactory mark - for 3 correct answers, good mark - for 4 correct answers, very good mark - for 5 correct answers
- Example classes - the final mark is the mean value from three marks for three tests checking the knowledge from three individual exercises
1. Matrix version of stiffness method - 33%
2. Matrix method of analysis of frame stability and statics with large axial forces - 33%
3. Internal forces in axisymmetric shells - 33%
The tests take place on the deadline of particular exercises
- Exercise classes - the final mark is the mean value from three marks for each individual exercise. The particular mark for the exercise results from the mark for the particular test which may be:
a) decreased if the exercise deadline is not met (by 1 for each week of delay),
b) increased in the case of special activity of the student during classes

Programme content

Matrix version of stiffness method.
Matrix analysis of bending of plane frames with large axial forces.
Matrix approach to the initial stability analysis of frames.
Internal forces and displacements in cable structures.
Engineering approach to computation of internal forces in axially-symmetric shells.
Foundations of finite strip method and boundary element method.
Projects
Matrix version of stiffness method
Stability and statics with large axial forces for plane frames
Statics of axi-symmetric shells

Course topics

Matrix version of stiffness method.
Matrix analysis of bending of plane frames with large axial forces.
Matrix approach to the initial stability analysis of frames.
Internal forces and displacements in cable structures.
Engineering approach to computation of internal forces in axially-symmetric shells.
Foundations of finite strip method and boundary element method.
Projects
Matrix version of stiffness method
Stability and statics with large axial forces for plane frames
Statics of axi-symmetric shells

Teaching methods

lecture - informative, monographic, exercises - exercise and project methods

Bibliography

Basic
1. 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
3. Metoda przemieszczeń i podstawy MES, T. Chmielewski, H. Nowak, L. Sadecka, PWN, Warszawa, 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	3,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00