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)
Construction Engineering and Management

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
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

- Making acquaianted with theoretical background of matrix methods in statics and stability analysis of bar structures in the context of the safe design regarding the load capacity and stability. - Presentation of fundamentals of plane girder analysis - theory of plates and theory of axisymmetric shells in the context of their safe design regarding the load capacity.

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:

Lecture -written examination comprising 5 tasks veryfying the learning outcomes. Mark 3.0 for three correct solutions, 4.0 for four correct solutions, 5.0 for all correct solutions.
Example classes - the final mark results from the marks for two test veryfying the learning outcomes in the scope of three projects (see below). Each test comprises 3-5 tasks of computattional and/or theoretical nature. Positive mark fo more than 50% solutions.
Projects - the final mark results from the marks for three individual project tasks:
1 - Stiffness method in frames - matrix version - 33%; 2 - Stability and statics with large axial forces in frames - matrix version - 33%; 3 - Internal forces in shells of axisymmetric tanks - 33%
The mark for each project results from the level of correctness and completeness of its solutions.achieving the correct an complete solution is the students's only responsibility. During the consultiations in the classes the teacher clarifies doubts, verifies the correctness of applied methods but does not verify the numeric correctness of the solution.

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

Lecture and classes
Matrix version of the stiffness method. 10h
Matrix analysis of statisc of plane frames with large axial forces influence. 5h
Initial stability in the matrix version. 5h
Computation of internal forces and displacements in cable structures. 3h
Engineering method of computation of forces in axisymmetric shells.6h
Fundations of the plate theory. 1h
Projects
1 - Stiffness method in frames - matrix version
2 - Stability and statics with large axial forces in frames - matrix version
3 - Internal forces in shells of axisymmetric tanks

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