COURSE DESCRIPTION CARD - SYLLABUS

Course name
Structural mechanics [S1Bud1>MB2]

Course

Field of study
Civil Engineering

Year/Semester
2/4

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
15

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Student has basic knowledge of the following subjects: mathematics, theoretical mechanics, strength of materials in the scope from Civil Engineering or related, as well as the structural mechanics from the 3rd semester.

Course objective

Solution of frames and beams using the stiffness method. Calculation of critical loads for elastic frames. Fundamental knowledge in structural dynamics, computation of natural frequencies and dynamic coefficients.

Course-related learning outcomes

Knowledge:
1.Student knows the relations between displacements and loads in statics, stability and dynamics of straigh beams.
2. Student knows the methods to build computational models for structures with concentrated masses.
3. Student knows the influence of the large axial forces on plane bar structures.

Skills:
1. Student can compute the distributions of internal forces, displacements due to external loads, temperature change and imposed displacements in plane bar structures.
2. Student can formulate equilibrium conditions for plane frames according to the second order theory.
3. Student can compute natural frequencies and amplitudes of harmonically forced vibrations for bar structures with concentrated masses.

Social competences:
1. Student can work individually as well as in a team.
2. Student is aware of the responsibility for the correctness of the obtained solutions and can give their interpretation.
3. Student has the consciousness of necessity of continuous expansion of knowledge.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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1) lecture
written examination, the final mark yields from the total sum of points obtained, positive mark (3.0) is granted after obtaining at least 50% of the maximum amount of points
2) tutorial
two written tests during the semester
3) project
two individual projects for each student, form of checking: individual consultations, the final mark based on the verification of knowledge at the submission date

Programme content

During the course, the following topics are discussed: solving kinematically indeterminate systems using the stifffness method, the dynamics of bar systems, and the stability of bar systems.

Course topics

Lecture 1-2 - Slope-deflection formulae for straight beams. Solving kinematically indeterminate systems using the stiffness method.
Lecture 3 - Solving kinematically indeterminate beam using the matrix version of stiffness method.
Lecture 4 - Basics of dynamics of systems. Free and forced vibrations of undamped and damped systems with one degree of freedom.
Lecture 5 - Dynamics of systems with concentrated masses. Dynamics of systems with distributed mass.
Lecture 6 - Slope-deflection formulae for straight bars loaded with axial forces. The second order theory and computing the critical loads.
Lecture 7 - Initial stability of frames. Influence of large axial forces on bending of beams.
Tutorial 1-2 - Solving kinematically indeterminate frames using the classical stiffness method.
Tutorial 3 - Solving kinematically indeterminate beams using the matrix version of stiffness method.
Tutorial 4 - Test 1
Tutorial 5-6 - Dynamics of beams and frames with distributed mass.
Tutorial 7 - Test 2
Project 1-4 - Exercise 1 - Stiffness method.
Project 5-7 - Exercise 2 - Dynamics of bar structures with concentrated masses.

Teaching methods

Lecture - monographic, tutorials and projects - exercise and project method.

Bibliography

Basic
1. W. Nowacki, Mechanika budowli, PWN, Warszawa 1974
2. Z. Dyląg i in., Mechanika budowli (t.I+II), PWN, Warszawa 1989
3. M. Guminiak, J. Rakowski, Zbiór zadań z mechaniki budowli, Wydawnictwo PWSZ, Piła 2008
4. M. Guminiak, J. Rakowski, Mechanika budowli. Zbiór zadań z elementami ujęcia komputerowego,

Wydawnictwo PWSZ, Piła 2011
Additional
1. Z. Waszczyszyn, Cz. Cichoń, M. Radwańska, Metoda elementów skończonych w stateczności konstrukcji, Arkady, Warszawa 1990
2. R. Iewandowski, Dynamika konstrukcji budowlanych (t I +II), Wydawnictwo Politechniki Poznańskiej 2018
3. Skrypt internetowy, Mechanika budowli, https://sites.google.com/view/iak-put-poznan-pl/dydaktyka/almamater/materia%C5%82y-dydaktyczne

Breakdown of average student's workload

	Hours	ECTS
Total workload	107	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00