



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Structural mechanics [S1BZ1E>MB1]

Course

Field of study

Sustainable Building Engineering

Year/Semester

2/3

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

English

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

prof. dr hab. inż. Przemysław Litewka
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Lecturers

Prerequisites

Student has the basic knowledge in: mathematics, foundations of mechanics, strength of materials in the scope from the current course Student can use the possessed knowledge and gain new abilities from accessible literature. Student can apply the known theory to solve practical problems Student is aware of necessity to expand knowledge so that he can find the justification for its application to practical problems. Student understands the necessity of constant education.

Course objective

Knowledge of theoretical foundations and models in mechanics of plane bar structures. Ability to compute internal forces and displacements in statically determinate and indeterminate systems. Ability to compute influence lines of static and kinematic quantities in bar structures.

Course-related learning outcomes

Knowledge:

1. Student knows basic theorems and principles of linear structural mechanics
2. Student knows the relations between displacements and loading in statics of straight beams
3. Student knows the methods to build the computational models of plane bar structures.

Skills:

1. Student can find the distributions of internal forces and compute displacements due to external loading, temperature change and imposed displacements in plane bar structures.
2. Student can find the functions of static and kinematic quantities due to movable load.
3. Student can choose correct methods to solve plane bar structures

Social competences:

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

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. The examination is written. In the case of failed first attempt there is the right for second attempt. The dates for first and second attempts will be given in the beginning of the semester. Examination comprises three to four questions with equal weight. Solution to more than 50% of the questions is required to pass the examination.
2. The positive final mark for example classes is given after positive passing of both tests T1 and T2 scheduled during the semester. The final mark is the weighted mean of positive marks for the tests (T1 – weight 2.0, T2 – weight 3.0). In the case of a negative mark (2.0) for any of the tests – the first attempt mark is 2.0. An absence in any of the tests results in the absent mark in the first attempt. The second attempt test will take place during the examination session – the date will be given in January. The student has to retake the test(s) which were not passed during the semester. Every test comprises three questions with unequal weights (3, 1 and 1 points) – the answers for each question are assessed as null, half or full points. The positive mark is obtained for the total percentage of points higher than 50%, i.e. higher than 2.5.
3. Exercise classes (projects) – solution and submission of two individual exercises (projects) The exercises must be submitted at the latest on the deadline specified at the beginning of the semester. Delayed submissions are not accepted. In the case of no submission of any exercise the student is not classified. The mark for the particular exercise is given depending on the level of its correctness:
mark 5.0 – 95–100%
mark 4.5 – 90–94%
mark 4.0 – 85–89%
mark 3.5 – 80–84%
mark 3.0 – 75–79%
mark 2.0 – 0–74% (negative)
The final mark for the exercise classes is equal to the weighted mean (E1 – weight 2.0, E2 – weight 3.0) if both marks are positive. In the case of at least one negative mark 2.0 the final mark in the first attempt is 2.0. In such a case the student will get the repetition exercise(s) which has (have) to be submitted during the examination session. The final mark in the second attempt is equal to the weighted mean (E1 – weight 2.0, E2 – weight 3.0) if both marks are not negative. The mark(s) for the repetition exercise(s) replace(s) the mark(s) for the first date exercise(s). In the case of at least one negative mark the final mark in the second attempt is 2.0. Systematic work and reporting the progress during the exercise classes is obligatory. The lack of regular consulting will cause the negative mark and/or no-classification case. The presence in the exercise class is granted for the consultation, not just attending the class.

Programme content

Lecture

Mechanical models of civil engineering structures (1h)

Work of internal and external forces. Principle of virtual work (1h)

Calculation of displacements in statically determinate bar structures due to loading, temperature change and imposed displacements (2h)

Statically indeterminate structures. Flexibility method. Loading, temperature change, imposed

displacements (2h)
 Reciprocity theorems (2h)
 Reduction theorems - computation of displacements in statically indeterminate structures (2h)
 Influence lines of static and kinematic quantities in statically determinate and indeterminate structures (4h)
 Tutorials
 Calculation of displacements in statically determinate bar structures due to loading, temperature change and imposed displacements (4h)
 Statically indeterminate structures. Flexibility method. Loading, temperature change, imposed displacements (6h)
 Reduction theorems - computation of displacements in statically indeterminate structures (2h)
 Exercises (projects)
 1. Calculation of displacements in statically determinate bar structures due to loading, temperature change and imposed displacements (4h)
 2. Statically indeterminate structures. Flexibility method. Loading, temperature change, imposed displacements. Computation of displacements in statically indeterminate structures

Course topics

Lecture and classes

Derivation of the principle of virtual work

Application of PVW in computation of displacements (translations and rotations) in plane frames and trusses - under the action of loading, temperature change and support displacements

Plane frames statically indeterminate - flexibility method. Determination of DR, computation of plane frames under the action of loading, temperature change and support displacements

Influence lines of forces and displacements in statically determinate beams

Influence lines of forces in statically indeterminate beams

Projects

Application of PVW in computation of displacements (translations and rotations) in plane frames and trusses - under the action of loading, temperature change and support displacements

Plane frames statically indeterminate - flexibility method. Determination of DR, computation of plane frames under the action of loading, temperature change and support displacements

Teaching methods

Lecture - monographic lecture, tutorials, exercises - exercise and project method

Bibliography

Basic

1. Electronic textbook <http://www.ikb.poznan.pl/przemyslaw.litewka/str-me-w.html>

2. M. Guminiak, J. Rakowski, Zbiór zadań z mechaniki budowli, Wydawnictwo PWSZ, Piła 2008

3. M. Guminiak, J. Rakowski, Mechanika budowli. Zbiór zadań z elementami ujęcia komputerowego, Wydawnictwo PWSZ, Piła 2011

4. Z. Cywiński, Mechanika budowli w zadaniach (t.I+II), PWN, Warszawa 1976

5. J. Rakowski, Mechanika budowli, Zadania cz.1, Wydawnictwo PP, Poznań 2007

Additional

1. Internet textbook, Mechanika budowli, www.ikb.put.poznan.pl/node/49

2. W. Nowacki, Mechanika budowli, PWN, Warszawa 1974

3. Z. Dyląg i in., Mechanika budowli (t.I+II), PWN, Warszawa 1989

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	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)	30	1,00