STRUCTURAL MECHANICS

Subject code: **06.4-WILŚ- BUD- MBU1- IB07**

Subject type: Obligatory

Language of instruction: English

Responsible for the subject: Person currently conducting lectures

Providing education: Department of Structural Mechanics

Type of class	Number of classes per semester	Number of classes per week	Semester	Type of credit	ECTS points
Full time studies					5
Lecture	30	2	III	exam	
Project	30	2		credit with a grade	
Part time studies					
Lecture	18	2	III	exam	
Project	18	2		credit with a grade	

SUBJECT OBJECTIVE:

Presentation of basic problems of structural mechanics and methods for solving them. Developing skills in calculating impact lines, using the principles of virtual work, solving flat statically indeterminate systems using the force method. Familiarizing with the computer software available in this field.

INITIAL REQUIREMENTS:

Knowledge of mathematical analysis and matrix calculus, general mechanics, basics of strength of materials.

SUBJECT SCOPE:

Lecture

Statically determinate bar systems: determining the distribution of cross-sectional forces in beams, frames, arches and trusses; impact lines. The equation of virtual work and its application for calculating displacements. The Betti and Maxwell theorem. Displacement influence lines. Elastic energy and deformation work. The theorem of the minimum potential energy of the elastic system. Clapeyron systems. The susceptibility matrix. The Castigliano theorem. The Maxwell -Mohr designs.

Statically indeterminate systems. Determining the SSN. Properties of statically indeterminate systems in comparison with statically determinate systems.

The force method. Basic layout. Canonical equations of the force method. Super position patterns. Selection of the basic system. Checking the correctness of calculations. The reduction theorem and calculation of displacements in statically indeterminate systems. Impact lines in statically indeterminate systems. Continuous beams, trusses, arches, spatial systems.

Project

Project classes include:

Project 1: Determination of impact lines and internal forces in statically determinate bar systems.

Project 2: Calculation of displacements by means of virtual work rules in statically determinate bar systems.

Project 3: Solving statically indeterminate flat bar systems with the force method.

Educational methods:

Lecture - conventional lecture,

Project - individual and team work on a project.

EDUCATION RESULTS:

Results after completion of the course	Symbol	Verification method	Type of class
Knowledge			
The student has a basic knowledge of impact lines and internal forces in bar systems, knows methods and techniques for determining impact lines in beams and trusses. The student has knowledge of the equation of virtual work, the Betti and Maxwell theorems, the Castigliano theorem of the minimum energy potential of the elastic system. The student has basic knowledge of statically indeterminate systems and the force method	**K_W04**	exam	L
Abilities			
The student acquires skills for determining forces. The student is able to calculate and draw the impact lines of reactions and internal forces in bar systems. The student can use the equation of virtual work to determine displacements in statically determinate and indeterminate systems.	**K_U09**	test, a credit for classes	P
The student can determine internal forces in a multiply statically indeterminable bar system. The student	**K_U10**	test, a credit for classes	P

can use available computer software to check results obtained analytically			
Social competences			
The student is aware of responsibility for their own work and is ready to comply with the rules of teamwork	**K_K04**	conversation during lectures initiated by the teacher; checking competences during the introduction to classes	L, C, P

REQUIREMENTS TO OBTAIN A CREDIT:

Lecture — Full-time studies: exam based on a written test with points:

56% - 65% correct answers	satisfactory
66% - 75%	satisfactory plus
76% - 85%	good
86% - 93%	good plus
94% - 100%	very good

Project — The condition for a credit is a positive grade for all projects (3 projects)) and for written tests with points proving the student's knowledge and individual work on tasks with the same criteria as for the exams.

Credit for the subject:

The final grade is the average of the grades: G = (L+P)/2

STUDENT WORK:

Full time studies

Interaction with the teacher 30l+30p+5cons, total	65 h,
Preparation for the exam	10 h,
Projects – individual work – 3 proj x 15 h	45 h,
Total 65+10+45 120 h,	
ECTS for the subject 120/30	4 ECTS.

Part time studies

Interaction with the teacher 20l+10p+5kons, total	35 h,
Preparation for the exam	25 h,
Projects – individual work – 3 proj x 20 h	60 h,
Total 35+25+60 120 h,	
ECTS for the subject 120/30	4 ECTS.

BASIC LITERATURE:

1. Branicki C. i inni: Mechanika budowli – ujęcie komputerowe, tom 1, Arkady, Warsaw 1991
2. Ciesielski R. i inni: Mechanika budowli – ujęcie komputerowe, tom 2, Arkady, Warsaw 1992
3. Dyląg Z. i inni: Mechanika budowli, tom 1 i 2, PWN, Warsaw 1974
4. Nowacki W.: Mechanika budowli, PWN, Warsaw 1974

5. Cywiński Z.: Mechanika budowli w zadaniach, PWN, Warsaw 1997
6. Chmielewski T., Nowak H.: Mechanika budowli, WNT, Warsaw 1996

COMPLEMENTARY LITERATURE:

1. Jastrzębski P., Solecki R., Szymkiewicz J.: Kratownice – obliczenia statyczne, Arkady, Warszawa 1959
2. Gomuliński A., Witkowski M.: Mechanika budowli – kurs dla zaawansowanych, Oficyna Wyd. P.W., Warsaw 1993
3. Borkowski A.: Statyczna analiza układów prętowych w zakresach sprężystym i plastycznym, PWN, Warsaw – Poznań 1985

SYLLABUS PREPARED BY:

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