STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Strength of Materials		**1010601121010215111**

Field of study	Profile of study (general academic, practical)	Year /Semester
Aerospace Engineering	**general academic**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **2**	Classes: **1**	Laboratory: **-**	Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**100 4%**
Technical sciences	**100 4%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic in the field of mathematics, strength of materials, engineering graphics and other areas of education in the field of study. Ordered theoretical knowledge in the field of study.
2	**Skills**	Solving basic tasks from geometry and mathematical analysis. Solving basic issues of solid state mechanics. The ability to search for the necessary information in literature, databases and catalogs. Using information and communication techniques appropriate to the implementation of engineering tasks. Ability to learn independently.
3	**Social competencies**	Understanding the need for lifelong learning and acquiring new knowledge. Understanding the general social effects of engineering activities. Understanding the need for team collaboration. The student is aware of mutual dependencies between mathematical knowledge, physical knowledge and technical sciences.

Assumptions and objectives of the course:

Understanding the methods of testing the strength of materials and checking the strength of a structure. Mastering basic principles in the field of mechanics and strength analysis. Understanding the theoretical and practical problems related to strength analysis based on the mechanical properties of materials as the basis for the proper design of the structure. Passing in a simple form selected endurance issues, i.e. modeling statically indeterminate systems or solving complexity problems. Indication of limitations necessary in constructing due to safety and reliability, regulations, standards. Indication of the areas of acceptable solutions and effective solutions to the problem. Awareness of the complexity of construction: the need to build and test prototypes, formulate the conditions for safe operation, the need for a systematic approach to problems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. has knowledge in the field of physics, covering the basics of classical mechanics, solid state physics, necessary to understand specialized lectures in the theory of construction materials - [K1A_W02]

2. has basic knowledge in technical mechanics: statics and strength of materials, including the basis of the theory of elasticity and plasticity, performance hypotheses, methods for calculating beams, shafts, joints and other simple structural elements, as well as methods for testing the strength of materials and the state of deformation and stresses in structures - [K1A_W04]

3. has basic knowledge of metal, non-metallic and composite materials used in machine construction, in particular their structure, properties - [K1A_W06]

Skills:
1. can obtain information from literature, the Internet, databases and other sources. Can integrate the information obtained and interpret conclusions and create and justify opinions - [K1A_U04]
2. can use formulas and tables, technical and economic calculations using a spreadsheet and running a simple relational database - [K1A_U05]
Social competencies:
1. understands the need to learn throughout life; can inspire and organize the learning process of other people - [K1A_K01]
2. is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the related responsibility for decisions - [K1A_K02]
3. can interact and work in a group, taking on different roles in it - [K1A_K03]

Assessment methods of study outcomes
Passing lecture - 5 theoretical issues, 2 computational problems: <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb Passing the calculation exercises (3 tests): - <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb
Course description
Basic concepts from statics. Definition of strength, division of forces, systems of forces. Ties and reactions of bonds. Internal forces. One-axis state of stresses and strains. Stress- strains curve. Hooke's law. The conditions of the equilibrium of flat systems of forces. Statically determinate and indeterminable rod systems and rod-beam systems. Shear stresses, deformations. Generalized Hooke's law. Permissible stresses, safety factor of the structure and strength condition. Hypothesis of material effort. Moments of inertia of flat figures, center of gravity of the cross-section, main central axes of inertia. Steiner's theorem. Twisting of shafts and rods with a rectangular section, thin-walled open and closed. Bending of fixed and variable stiffness beams. Diagrams of bending moments and lateral forces in bending beams. Normal and shear stresses in bending beams. Beam deformation (deflection and angle of rotation): two-integral analytical method, Clebsch method. Solving statically indeterminate beams: analytical methods, Clebsch method. Composite strength: compression (tensile) with bending.
Basic bibliography:
1. Zielnica J., Wytrzymałość Materiałów, WPP, wyd. III, Poznań 2000.
2. Ostwald M., Podstawy wytrzymałości materiałów, Wydawnictwo PP, Poznań, 2007.
3. Magnucki K., Szyc W., Wytrzymałość materiałów w zadaniach: pręty, płyty i powłoki obrotowe, Wydawnictwo Naukowe PWN, 2000.
4. Leyko J., Mechanika ogólna t.1, PWN, Warszawa, 1997
5. Jakubowicz A., Orłoś Z., Wytrzymałość materiałów, WNT, Warszawa, 1984
Additional bibliography:
1. Banasik M., Grossman K., Trombski M., Zbiór zadań z wytrzymałości materiałów. PWN 1992
2. Osiński Z., Mechanika ogólna, PWN, Warszawa, 1994
3. Ostwald M., Wytrzymałość materiałów. Zbiór zadań. Wydawnictwo PP, Poznań, 2008
4. Dyląg Z., Jakubowicz A., Orłoś Z., Wytrzymałość materiałów t.1 i 2, WNT, Warszawa, 2000
5. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo-Techniczne Warszawa 2004.
6. Willems N., Easley T. J., Rolfe S. T., Strength of Materials, Mc GrawHill Book Company, 1981
7. Gere M., Timoshenko S., Mechanics of Materials, PWS-Kent Publishing Company, Boston, 1984.

Result of average student's workload

Activity	**Time (working hours)**
1. Lectures	30
2. Classes	15
3. Consultations	5
4. Preparation for classes	20
5. Preparation for tests	30
6. Preparation for passing the lecture	20

Student's workload

Source of workload	**hours**	**ECTS**

Total workload	120	4
Contact hours	50	2
Practical activities	70	2