COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength of Materials

Course

Field of study
Aerospace Engineering

Year/Semester
1/2

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials
15

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
Piotr Kędzia, PhD
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Faculty of Mechanical Engineering
ul. Jana Pawła II 24, 61-131 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic in the field of mathematics, engineering graphics and other areas of education in the field of study. Ordered theoretical knowledge in the field of study. 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. 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.

Course objective

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

Course-related learning outcomes

Knowledge

1. 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 - [P6S_WG](K_W02)
2. 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 - [P6S_WG](K_W03)
3. Basic knowledge of metal, non-metallic and composite materials used in machine construction, in particular their structure, properties - [P6S_WG](K_W08)

Skills

1. Searching information in literature, the Internet, databases and other sources. Integration the information obtained and interpret conclusions and create and justify opinions - [P6S_UW](K_U01)
2. Using formulas and tables, technical and economic calculations using a spreadsheet and running a simple relational database - [P6S_UW](K_U07)

Social competences

1. Understanding the need for self-education related to the development of technology. [P6S_KK] (K_K01)
2. Awareness of the importance of engineering activities. [P6S_KK] (K_K02)
3. Understand the importance of teamwork. [P6S_KO] (K_K03)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Passing the lecture: test during the last class in the semester:
rating 3.0 50.1% -60%
rating 3.5 60.1% -70%
rating 4.0 70.1% -80%
rating 4.5 80.1% -90%
rating 5.0 90.1% -100%

Passing the exercises: current verification of the learning results and the final test at the last class in the semester:
rating 3.0 50.1% -60%
rating 3.5 60.1% -70%

rating 4.0 70.1% -80%
rating 4.5 80.1% -90%
rating 5.0 90.1% -100%
Assessment of activity during lectures and involvement in classes included in the final grades.

Programme content

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

Teaching methods

Lecture with multimedia presentation.
Exercises conducted at the blackboard.

Bibliography

Basic

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

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests) [1]	50	2,0

[1] delete or add other activities as appropriate