POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength of materials and structures [S1MiBM2>WMiK2]

Course

Field of study	Year/Semester
Mechanical Engineering	2/4

Area of study (specialization)	Profile of study
–	general academic

Level of study	Course offered in
first-cycle	Polish

Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other
15	30	0

Tutorials	Projects/seminars
15	0

Number of credit points
4,00

Coordinators

Lecturers

Prerequisites
A student has basic knowledge about mathematics, strength of materials, engineering graphics and other areas of studies. A student has theoretical knowledge of areas of studies. A student can solve basic problems of geometry and mathematical analysis. A student can solve basic problems of solid mechanics. A student can search for necessary information and facts in literature, scientific databases and catalogues. A student can use information and communication techniques for realizing engineering tasks. A student has the ability to self-study. A student understands a need for lifelong learning and acquiring knowledge. A student understands general social results of engineering activities. A student understands a need for teamwork. A student is aware of connections between mathematics, physics and technical sciences.

Course objective
Familiarizing students with strength of materials and strength tests, teaching students basic concepts of mechanics and strength of materials. Presenting theoretical and practical engineering methods of analysing the strength of structures that are based on material properties. Delivering in understandable form selected strength of materials issues, i.e. modelling indeterminate systems or solving complex strength problems. Showing the restrictions imposed on structures due to their strength, safety and regulations (standards, law). Discussing the methods of solving strength problems in an effective and proper way, highlighting the importance of building and testing prototypes, showing a system approach to solving engineering problems.

Course-related learning outcomes

Knowledge:
1. The graduate knows and understands the basics of theoretical and experimental analysis of the strength of materials to the extent necessary for the field of study.
2. Graduate understands basic models and calculation methods used in the construction. He has ordered a basic knowledge of solid mechanics and the strength of materials.
3. The graduate has basic knowledge of computational methods in the mechanics and strength of materials and has knowledge of material properties tests

Skills:
1. Can obtain information from literature, databases and other properly selected sources (also in English) in the field of mechanical engineering and other engineering and technical areas in line with the studied field.
2. It has the ability to self-learning, including "improving" professional competence.
3. He can carry out basic tests of mechanical properties of materials and measurements of stress in structural elements and operate specialized equipment research.
4. Can use mathematical apparatus to describe concepts of mechanics, technological structures and processes, can apply known methods and mathematical models as well as computer simulations to analyze and evaluate the performance of components and systems in devices. Can formulate problems and knows how to use mathematical methods in engineering practice.
5. Can solve technical problems based on laws of mechanics and perform analysis of the strength of machines and mechanical.
6. Can evaluate the usefulness of routine methods and tools to solve simple practical engineering tasks and select and apply appropriate method and tools.

Social competences:
1. Understands the need for lifelong learning; can inspire and organize the learning process of others.
2. He/She realizes the importance of non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for making decisions.
3. Can cooperate and work in a group adopting different roles.
4. Can accurately identify priorities for implementation of tasks assigned by him/her or others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Passing the lecture (end of semester, last lecture - 10 theoretical issues from lectures):
- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

Assessment of tutorials (There are three tests in a semester and offer solutions to the exercises questions prepared by the teacher training):
- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

Self-semester work.
Assessment: activity at lectures and accounting exercises.
Laboratories:
A positive result is based on discussion led when doing tests (questions on the theory of those tests). Moreover, students need to conduct all tests and all their reports from tests must be approved.
In order to receive a positive grade and pass the course a student needs to achieve more than 50% of total points in each test. The final grade is based on the following rules:
very good - if the ratio of sums of achieved and total points is bigger than 91%,
good plus - if the ratio of sums of achieved and total points is between 81-90%,
good - if the ratio of sums of achieved and total points is between 71-80%,
sufficient plus - if the ratio of sums of achieved and total points is between 61-70%,
sufficient - if the ratio of sums of achieved and total points is between 51-60%.

Programme content

Lectures and tutorials
Deformation of beams bent (deflection and angle of rotation): direct integration of the differential equation of the elastic line, the generalized equation of the elastic line a beam (Clebsch's method), the moment-area method and analysis of deflections by superposition method. Solving statically indeterminate beams: the analytical method, application of the universal of integration of the elastic line equation, method of superposition, three-moment method (three-moment equation). Eccentric

compression. Equation of neutral axis. Compound stresses: compression (tension) and bending, bending and torsion.
Laboratories
Static tensile strength test, Static torsion strength test, Hardness measurement methods: Brinell, Vickers and Poldi, Rockwell hardness measurement method and the measurement method of the Vickers microhardness, Fatigue of materials (Locati method), Finite element method (shape factor flat bar with notch), Static measurement of strain gauges: measurement of stresses in the bending I-beam and measurement of stresses in the thin-walled tank, Dynamic measurement of strain gauges (coefficient of dynamic surpluses), Photo-elasticity, Elastic buckling slender bar, Characteristics of springs, Impact bending test and Ultrasonic defectoscopy.

Course topics

none

Teaching methods

1. Lecture: presentation illustrated with examples administered on the blackboard, solving tasks, didactic materials for E-Courses: films, presentations, etc.
2. Exercises: solving tasks on the board (problem solving), discussion, didactic materials for E-Courses: films, presentations.
3. Laboratory exercises: conducting experiments, solving tasks, discussion, didactic materials for E-Courses: films, presentations.

Bibliography

Basic:
1. Zielnica J., Wytrzymałość Materiałów, WPP 1996.
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.
6. Badania eksperymentalne w wytrzymałości materiałów. Pod redakcją S. Joniaka, WPP. 2006.

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. Polskie Normy.
6. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo-Techniczne Warszawa 2004.
7. Willems N., Easley T. J., Rolfe S. T., Strength of Materials, Mc GrawHill Book Company, 1981.
8. Gere M., Timoshenko S., Mechanics of Materials, PWS-Kent Publishing Company, Boston, 1984.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50