POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength of materials [S1IMat1>WM]

Course

Field of study
Materials Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
45

Laboratory classes
15

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

5,00

Coordinators

dr hab. inż. Piotr Paczos prof. PP
piotr.paczos@put.poznan.pl

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, technical sciences, biology and medicine.

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. 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. a student has basic knowledge about mathematics, physics, chemistry and about other fields of science useful for formulating and solving simple biomedical engineering problems.
2. a student knows the basic concepts of mechanics: statics, dynamics and kinematics, knows and understands the principles of statics and conditions for the equilibrium of a rigid body subjected to coplanar forces.
3. a student can describe basic strength tests of materials and structures.
4. a student can calculate external and internal forces and moments, knows how to determine stresses and displacements in bars and trusses, can solve problems of torsion of cylindrical shafts.
5. a student can determine normal stresses in beams subjected to bending. a student has theoretical and practical knowledge about basic strength tests.

Skills:
1. a student can acquire necessary information from literature, scientific databases and catalogues (also english ones).
2. a student can think logically and self-study.
3 .a student can plan and make basic strength experiments.
4. a student can formulate and solve problems of strength of materials considering axial, torsional and bending loads. a student can easily convert between different si units.
5. a student can assess and make a critical analysis of existing technical solutions in the area of biomedical engineering. basing of those analyses a student can propose improvements in their strength.

Social competences:
1. a student can understand the need for lifelong learning, can inspire others to do this and can organise learning for others.
2. a student can cooperate with others and take on a different role in a group.
3. a student can set priorities when realizing his own and other people tasks.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures and classes: There are three or four tests in a semester. They consist of five theoretical questions and three computational tasks. 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%,
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.

Programme content

Lectures and classes:
Fundamentals of statics. Definitions of force, system of forces. Constraints and reaction forces / moments. Internal forces. Uniaxial stress state. Stress-strain curve. Hooke’s law.Conditions for the

equilibrium of a rigid body subjected to coplanar forces. Statically determinate and indeterminate trusses. Shear stresses and non-dilatational strain. Generalized Hooke’s law. Feasible stresses and factor of safety. Mohr"s circle. Moments of inertia of plane figures, centre of gravity of plane figures, principal axes of inertia. Steiner’s theorem. Torsion of rectangular, open and closed section beams. Bending moment and shear force diagrams. Normal and shear stresses in beams. Deflection of beams. Statically indeterminate beams ¬– Clebsch"s method, method of superposition, three-moment equations. Strength criteria. Eccentric compression. Combined loads.
Laboratories:
Tensile strength test. Brinell, Vickers, Poldi, Rockwell hardness tests. Vickers microhardness test. Fatigue of materials. Impact test. Characteristic of springs. Strain gauge measurements.

Teaching methods

1. Lecture: presentation illustrated with examples administered on the blackboard, solving tasks.
2. Exercises: solving tasks on the board (problem solving), discussion.
3. Laboratory exercises: conducting experiments, solving tasks, discussion.

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. 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.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	5,00
Classes requiring direct contact with the teacher	90	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00