



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Strength of materials

### Course

Field of study

Mechatronics

Area of study (specialization)

-

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

dr inż. Mikołaj Jan Smoczyński

Responsible for the course/lecturer:

### 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

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.

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.

The graduate has basic knowledge of computational methods in the mechanics and strength of materials and has knowledge of material properties tests.

#### Skills

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.

It has the ability to self-learning, including "improving" professional competence.

He can carry out basic tests of mechanical properties of materials and measurements of stress in structural elements and operate specialized equipment research.

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.

Can solve technical problems based on laws of mechanics and perform analysis of the strength of machines and mechanical.

#### Social competences

Understands the need for lifelong learning; can inspire and organize the learning process of others

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.

Can cooperate and work in a group adopting different roles.

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:

Knowledge acquired during the lecture is verified during the test, which consists of 10 theoretical issues:



- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

Knowledge and skills acquired during the exercises are verified on the basis of 2 tests written during the semester:

- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

### Programme content

Lectures and tutorials:

Basic concepts of statics. Definition of force, division of forces, systems of forces. Constrains and constrains reactions. Internal forces. One-dimensional stresses and deformations state. Stress-strain diagrams. Hooke's Law. Equilibrium conditions of plane force systems. Statically determinate and indeterminate bar systems and bar-beam systems. Shearing stresses, non-dilatational strain (deviatoric strain). Generalized Hooke's law. Allowable stress, factor of safety structural and strength condition. Mohr's circle of stress. Material failure theories. Moments of inertia of plane areas, centroids of cross section, main principal axes (principal moment of inertia). Steiner's theorem (parallel axis theorem). Twisting of shafts and rods with rectangular cross section.

### Teaching methods

Lecture: multimedia presentation illustrated with examples given on a board, problem solving.

Tutorials: problem solving, discussion.

### Bibliography

Basic

1. Zielnica J., Wytrzymałość Materiałów, WPP, wyd. III, Poznań 2000, str. 554.
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., Orłóś 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., Orłóś 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	75	3,0
Classes requiring direct contact with the teacher	35	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	40	2,0

<sup>1</sup> delete or add other activities as appropriate