



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Statics and strength of materials [S1MNT1>A-SiWM]

Course

Field of study

Mathematics of Modern Technologies

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

elective

Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

30

Projects/seminars

0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

A basic knowledge from the fields of mathematics, physics and mechanics. The ability to solve basic problems of mechanics. The ability to work alone, self-study and broaden the knowledge based on available literature.

Course objective

Gaining a basic knowledge of mechanics and strength of materials within the scope specified in the study program. The ability to solve basic problems from the field of mechanics and strength of materials.

Course-related learning outcomes

Knowledge:

- in-depth knowledge of statics and strength of materials [K_W06(P6S_WG)].

Skills:

- solving of the problems of statics and strength of materials with analytical methods [K_U 07(P 6S_U W), K_U08(P6S_UW), K_U16(P6S_UO)];
- the use of acquired knowledge in modeling of mechanical problems [K_U07(P6S_UW), K_U08(P6S_UW),

K_U16(P6S_UO)];

- acquiring information from literature, databases and other available sources of knowledge [K_U08(P6S_UW)];
- the ability to work individually and in a team. The ability to estimate the time needed for the implementation of the task ordered [K_U16(P6S_UO)];
- the ability to self-study, including to improve professional and social competences [K_U07(P6S_UW), K_U08(P6S_UW), K_U16(P6S_UO)].

Social competences:

- awareness of the limits of one's own knowledge and understanding the need for further education [K_K01(P6S_KK)];
- precise formulation of questions used to deepen one's own understanding of a given topic or finding missing elements of reasoning [K_K02(P6S_KK)];
- preparation to perform their social role as a graduate of a technical university, including providing the public with popular science content and identifying and resolving basic problems regarding the field of study and promoting mathematics as a basis for analytical reasoning and precise formulation of correct conclusions [K_K05(P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Written exam verifying a knowledge and a proper understanding of the concepts of mechanics.

Tutorials:

Written exams verifying proper solving of the mechanical problems with analytical methods.

Programme content

The subjects of the module includes an overview of the scope of classical mechanics, a characteristics of its basic concepts and a discussion of issues that belong to such branches of mechanics as statics and strength of materials.

Course topics

Lectures:

1. Introduction

- Overview of the scope of classical mechanics and the basis of the strength of materials.
- Introduction to kinematics and dynamics (statics and kinetics).
- Characteristics of basic concepts such as: models of real bodies (material point, perfectly rigid body), forces and types of forces depending on their nature and origin, a balance of forces.
- The principles of statics with examples.

2. Statics

- A definition of a degree of freedom (numbers of degrees of freedom for a material point and a rigid body in a plane and a space), a concept of external and internal forces, constraints (classification and types) and supports.
- Introduction to systems of forces in a plane and in a space.
- Finding a resultant of forces.
- Varignon's theorem.
- The concept of a moment of a force about a point, a couple of forces and a moment of a couple.
- Equilibrium conditions and equations of a planar and a space force system.
- Planar trusses.
- Spatial system of parallel forces.
- Force of gravity. The center of gravity.
- Friction. Static and kinetic friction.

3. Strength of materials

- Stress, deformation of an elastic body.
- Hooke's Law. Poisson's ratio. Young's modulus.
- De Saint-Venant's principle.
- Tensile and compression structures.
- Determinate and indeterminate structure.

- One-dimensional stress state - bar tension.
- Two-dimensional stress state - rectangular shield.
- Mohr's diagram.
- Bending of bars.
- Bending moments and shear forces in straight beams.
- Normal stresses in pure bending of straight beams.
- Torsion of bars with circular cross-sections.
- Multidimensional state of stress.

Tutorials:

1. Statics

- Convergent planar system of forces.
- Moments of a force. Parallel force system.
- Arbitrary plane system of forces.
- Convergent spatial force system.
- Arbitrary spatial force system.
- Planar trusses.
- Spatial system of parallel forces. Gravity forces. Center of gravity.
- Static and kinetic friction.

2. Strength of materials

- Tensile and compression structures.
- Determinate and indeterminate structure.
- One-dimensional stress state - bar tension.
- Two-dimensional stress state - rectangular shield.
- Bending of bars.
- Torsion of bars with circular cross-sections.

Teaching methods

Lectures:

Multimedia presentation illustrated with examples solved on the board.

Tutorials:

Solving of the mechanical problems analytically on the board, performing the tasks proposed by the lecturer.

Bibliography

Basic:

1. J. Leyko. Mechanika ogólna. Część 1. Statyka i kinematyka. Wydawnictwo naukowe PWN, Warszawa 2002.
2. J. Misiak. Mechanika techniczna. Statyka i wytrzymałość materiałów. Tom 1. Wydawnictwa Naukowo-Techniczne, Warszawa 2006.
3. M.E. Niezgodziński., T. Niezgodziński. Wytrzymałość materiałów, Wydawnictwo naukowe PWN, Warszawa 1984.
4. T. Niezgodziński, M.E. Niezgodziński. Zadania z wytrzymałości materiałów, Wydawnictwo naukowe PWN, Warszawa 2020.
5. W. Biały. Metodyczny zbiór zadań z mechaniki. Wydawnictwa Naukowo-Techniczne, Warszawa 2004.

Additional:

1. J. Misiak. Zadania z mechaniki ogólnej. Część 1. Statyka. Wydawnictwa Naukowo-Techniczne, Warszawa 1994.
2. J. Nizioł. Metodyka rozwiązywania zadań z mechaniki, Wydawnictwa Naukowo-Techniczne, Warszawa 1978.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
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)	63	2,50