



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mechanics of Materials II [N1MiBP1>WM2]

Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

2/4

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

18

Laboratory classes

9

Other

0

Tutorials

9

Projects/seminars

0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Student starting the course should have fundamental knowledge in the field of mechanics, especially statics, mathematics (geometry, trigonometry, calculus) and material science (mechanical properties, structure of materials), measurements techniques.

Course objective

Presenting the rules and methods of modelling of structural elements and the rules of structural analysis.
Presenting the methods of solving of problems related to the strength and stiffness of the structure.
Presenting the combined states of loads as well as the limit loads.

Course-related learning outcomes

Knowledge:

1. Has knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probability, analytical geometry necessary to: describe the operation of discrete mechanical systems, understand computer graphics methods, describe the operation of electrical and mechatronic systems.
2. Has basic, ordered knowledge of metal materials used in mechanical engineering, such as iron,

aluminum, copper, etc. alloys used in machine building, and in particular about their structure, properties, methods of production, heat and thermo-chemical treatment, and the influence of plastic working on their endurance.

3. Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, membranes, shafts, joints and other simple structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in mechanical structures.

Skills:

1. Can assess material, environmental and labor costs for making a simple machine.
2. Can perform basic functional and strength calculations of machine elements such as traction, gear, friction, bearings, rolling and sliding gears, clutches, brakes.
3. Can perform strength calculations of simple frames and load-bearing structures of machines using elementary strength theories.

Social competences:

1. Is ready to critically assess his knowledge and received content.
2. Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on his own.
3. Is willing to think and act in an entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:

- a 45 min. exam containing about 20 questions answering which requires understanding of basic notions, making simple calculations and completing the drawings; students receive a list of issues covering the whole material in advance; at least 60 % of points are required to pass the exam

Tutorials:

- two colloquiums during the semester, 90 min. each, containing 1 or 2 problems; the problems cover the knowledge presented during the tutorials; the condition to get credit are positive grades from both colloquiums (at least 60 % of points).

Laboratory:

- oral verification of knowledge at the beginning of classes; preparation of the correct report from all 6 exercises

Programme content

Lecture:

1. Bending

- determining the normal and shear stress in beams

- design of beams

- determining the deflection of beams

- bending under inclined load

- composite beams

2. Analysis of stress and strains - plain state of stress

3. Combined load

- three dimensional trusses

4. Stability of bars

- basic knowledge in stability of structures

- Euler equation

- stability of bars in an elastic-plastic range

5. Introduction to the behaviour of structures in an elastic-plastic range

Tutorials:

- solving of statically determinate and indeterminate problems related to determining internal forces, displacements and stress in beams; determining the deflection of beams, solving the problems concerning the structures under combined load - three dimensional problems

Laboratory:

- static tensile test; hardness tests; toughness test; determining the stiffness of springs; determining the

fatigue limit; static gauge measurements

Course topics

The course covers issues related to the analysis of stresses, deformations, and load-carrying capacity of structural elements subjected mainly to bending and combined loading. The lectures discuss methods for determining normal and shear stresses in beams, beam design principles, determination of deflection curves, oblique bending, composite beams, plane stress analysis, combined strength problems in spatial bar systems, as well as the fundamentals of member stability and introductory elastic-plastic topics.

Classes are aimed at developing practical skills in solving problems related to the determination of internal forces, stresses, and displacements in statically determinate and indeterminate beams, as well as in analysing combined strength problems in spatial bar systems. An important part of the course is also the determination of beam deflection curves and the interpretation of structural behaviour under various loading schemes.

Laboratory classes are intended to develop practical skills in testing the mechanical properties of materials and verifying the phenomena discussed in lectures. Students perform, among others, a static tensile test, hardness measurements, an impact bending test, determination of the spring constant, fatigue strength testing, and static strain gauge measurements.

Teaching methods

Lecture:

- lecture with multimedia presentation containing figures and pictures supported with examples presented on the blackboard
- application of theoretical knowledge presented on the lecture to solve simple engineering problems
- during the lecture the discussion with students is initiated

Tutorials:

- examples of engineering problems solving on the blackboard
- discussion with students concerning the solutions and the obtained results

Laboratory:

- presentation of theoretical knowledge concerning each exercise; getting acquainted with the equipment at the test stand; performing the exercise by students

Bibliography

Basic

1. Ostwald M. Podstawy wytrzymałości materiałów i konstrukcji, WPP, Poznań, 2017
2. Ostwald M. Wytrzymałość materiałów i konstrukcji - zbiór zadań, WPP, Poznań, 2018
3. Dyląg Z., Jakubowicz A., Orłoś Z. Wytrzymałość materiałów Tom I, WNT, Warszawa, 1997
4. Goodno BJ, Gere JM. Mechanics of materials, Cengage Learning, Boston, MA, 2018
5. Joniak S. Badania eksperymentalne w wytrzymałości materiałów, WPP, Poznań, 2006

Additional

1. Steif PS. Mechanics of materials, Pearson, Boston, 2012
2. Banasiak M., Grossman K, Trombski M. Zbiór zadań z wytrzymałości materiałów, PWN, Warszawa, 1998

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	36	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	89	3,00