POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mechanics with theory of elasticity

Course

Field of study

Materials Engineering

Year/Semester

1/1

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr Agnieszka Fraska

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tel. 61 665 2177

Instytut Mechaniki Stosowanej

Wydział Inżynierii Mechanicznej

ul. Jana Pawła II 24, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of general mechanics, material strength, algebra and vector calculus. Can think logically and learn with understanding, use textbooks. Is aware of the need to expand his competences. Understanding the need to learn and acquire new knowledge.

Course objective

Getting to know and understanding the main concepts, laws and equations of theory of elasticity. - [K_W05]

The ability to apply the acquired knowledge to modeling engineering problems, analysis of numerical simulation results and inference. - [K_W05]

Course-related learning outcomes

Knowledge

1. The student who completed the course can define and explain the basic concepts, laws and equations of the theory of elasticity.

2. The student is able to define and explain the basic concepts, laws and equations of the theory of elasticity.

Skills

1. Student has the ability to solve problems in the theory of elasticity. - [K_U11]

2. Student has the ability to analyze and interpret the obtained result. - [K_U11]

Social competences

1. The student is aware of the need for lifelong learning. The student understands the need to improve their competences and continue learning. Can independently deepen his knowledge of the subject - [K_K01]

2. The student is able to work in a group. - [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: grade issued on the basis of a written test and points obtained during the exercises. The pass mark is 50% of the sum of the planned points, the grading scale is linear.

Classes: written credit - tests. Passing the grade after obtaining at least 50% of the total points, linear grading scale

Programme content

Lecture

The index notation principles and the abbreviated summation convention. Elements of algebra and analysis of Cartesian tensors.

Vector and tensor transformation rules within Cartesian coordinate systems.

Modeling of external and internal forces exerting on solid bodies. Stress state analysis - the stress vector, the Cauchy stress tensor, the Cauchy stress formula.

The principal stresses and the eigenvectors, maximum normal and shear stress.The principal stresses and the eigenvectors.

The Langrange (material) and the Euler (spatial) descriptions. The displacement vector, the deformation gradient and the gradient of the dispacement vector.

Strain tensor; geometric interpretation of its components. The infinitesimal strain tensor. Interpretation of the infinitesimal strain tensor components. .

The constitutive relation of linear elasticity. The governing equations of linear elasticity for isotropic material - the stress formulation and the displacement formulation. Initial and boundary conditions. Basic constitutive models of elastic materials.

Exercises:

Improvement of accounting skills concerning the use of the summation convention and index notation. Chosen elements of vectors and tensors algebra and analysis

Stress vector and stress tensor. Cauchy's law. Accounting examples.

Geometric and physical interpretation of problems leading to the formulation of the eigenvalues for strain and stress tensors. Solving examples.

Continuous medium deformation - material and spatial description. Relationships between deformation gradient, displacement gradient, deformation tensor and deformation tensor. Accounting examples.

The infinitesimal strain tensor - solving examples.

Teaching methods

Lectures: multimedia presentations supported by comentary and solving examples.

Classes: problem solving, practical exercises and analysis of solutions, discussion.

Bibliography

Basic

1. W. Nowacki, Teoria sprężystości, PWN, Warszawa 1970.

2. Y.C. Fung, Podstawy mechaniki ciała stałego, PWN, Warszawa, 1969.

3. 2. T. Chmielewski, S. Imiełowski, Wybrane zagadnienia teorii sprężystości i plastyczności, OWPW

4. 2018.4.G. E. Mase: Theory and problems of continuum mechanics. McGraw Hil 1970

Additional

1. S. Timoshenko, J.N. Goodier, Teoria sprężystości, Arkady, Warszawa 1962.

2. B. Skalmierski, Mechanika, rozdz. IV, PWN, Warszawa 1994.

Breakdown of average student's workload

	Hours	ECTS
Total workload	68	3,0
Classes requiring direct contact with the teacher	33	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests, self-study with the employing of the online course, solving the proposed tasks) [1]	35	1,0

[1] delete or add other activities as appropriate