COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength of materials II [S2MwT1-MT>WM2]

Course

Field of study
Mathematics in Technology

Year/Semester
2/3

Area of study (specialization)
Modelling in Technology

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student starting this subject should have basic knowledge in mathematics, strength of materials, engineering graphics and other areas of education in the field of study. Should also have the ability to solve basic problems of geometry and mathematical analysis, solve the basic problems of solid mechanics. He should also be able to search for necessary information in literature, databases, catalogs and use information and communication techniques appropriate to carry out engineering tasks.

Course objective

Understanding theoretical and practical problems associated with strength analysis based on the mechanical properties of materials as the basis for the proper design of various structures. Acquainting with advanced issues of strength of materials II in theoretical and practical applications, including: stability of rod systems, elastic beams and Clapeyron systems. Transmission in a comprehensible form of selected strength problems using energy methods, i.e. the principle of reciprocity of work and reciprocity of shifts, Castigliano"s theorem and the principle of Castigliano-Menabre"s least work. Transfer of selected calculation issues from the strength of materials and structural elements under the influence of basic loads and complex loads. Designing of technological connections and analysis of deformations and displacements in various types of constructions or parts of the structure, e.g. rods, shafts, beams and flat frames.

Course-related learning outcomes

Knowledge:
1. The graduate has extended and in-depth knowledge of mathematics and has ordered, theoretically founded general knowledge of analytical mechanics.
2. The graduate has extended and in-depth knowledge of material strength, understands the basic models and calculation methods used in construction.
3. The graduate has knowledge of the theory of elasticity and plasticity, knows the basics of the theory of elasticity and plasticity. Knows what phenomena in nature and technology relate to the theory of elasticity and plasticity.
4. The graduate has knowledge in the field of modeling supporting machine design including simplifying assumptions used in modeling, creating a model of the physical mechanical system.
5. The graduate has knowledge of the rules of safety and risks in the industry.

Skills:
1. The graduate is able to work individually and in a team, is able to use information and communication techniques appropriate to carry out tasks, is able to prepare a study in Polish presenting the results of his own research; can prepare and present an oral presentation on specific issues in the field of mechanics and machine construction.
2. Is able to inspire and organize the learning process of others. He can make the right decisions in the field of acceptable solutions and make the right choice.
3. Can formulate criteria for the selection of an appropriate mathematical method to solve a given technical problem. Is able to use selected mathematical methods to solve a technical problem.
4. Is able to perform strength analyzes of machine elements and mechanical systems by basic methods of advanced structure strength analysis, stability, and energy methods in structure strength analysis.
5. Is able to apply the basic laws of analytical mechanics and simplified models in solving simple problems in the field of mechanics and machine construction, and choose modeling methods in design, carry out basic calculations in modeling.

Social competences:
1. Awareness of the need for self-education.
2. Awareness of social and systemic effects of engineering activities.
3. Awareness of the importance of teamwork.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Exam (3 scored calculation tasks and 5 theoretical issues):
- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb
Completing the exercises (3 tests or developing and presenting solutions to the exercises prepared by the teacher during the exercises):
- <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb
Laboratories:
Credits based on oral answer from the theory of the exercise during laboratory exercises. We get credit on condition that all the exercises are completed and the teacher accepts all test reports.

Programme content

Lecture and exercises:
Beams on an elastic foundation, differential equation of the beam deflection line, boundary conditions and the expected solution. Compression of bending beams. Loss of stability of compressed bars: buckling in the elastic and elastic-plastic range. Generalized forces and generalized displacements. Clapeyron systems. Energy methods. Displacement and susceptible description of deformation of elastic structures. Castigliano"s theorem and the principle of Castigliano-Menabre"s least work. Application of these methods to calculate displacements of bar structures.

Teaching methods

a) Lectures:
- lecture with multimedia presentation (including drawings, photos, animations, sound, films) supplemented with examples given on the board,
- lecture conducted in an interactive way with the formulation of questions to a group of students or to specific students indicated,
- initiating discussions during the lecture,
- theory presented in close connection with practice,
- presenting a new topic preceded by a reminder of related content known to students in other subjects.

b) Exercise:
- solving sample tasks on boards,
- detailed reviewing of task solutions by the tutor of the exercises and discussions on comments,
- initiating discussions on solutions.

c) Laboratory:
- detailed review of reports by the laboratory leader and discussions on comments,
- demonstrations,
- teamwork.

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., Orłoś 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., Orłoś 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.
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Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,00