POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Solid mechanics [S2EJ1>MCS]

Course

Field of study
Nuclear Power Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Mathematics: algebra (including matrix calculus), mathematical analysis (including differential and integral calculus), geometry, planimetry, trigonometry. Theoretical mechanics: knowledge of equilibrium equations and internal forces in rod elements of astructure. Skills: Mathematics: skills of calculation of derivatives and integrals of functions, the ability to use matrix calculus. Physics: ability to apply the principles of Newton. Theoretical mechanics: the ability to use the balance equations to determine the reactions and internal forces in statically determined bar systems. Social competences: The student can work in groups and is sensitive to the needs of colleagues when carrying out joint design exercises in groups. The student follows the rules of ethics.

Course objective

Acquiring knowledge, skills and competences in solving problems of stress, deformations and displacements in structural member elements and in the field of material strength.

Course-related learning outcomes

Knowledge:
1. The student knows the conditions of equilibrium of plane and spatial systems of forces.

2. The student knows methods of determining internal forces in statically determinate systems.
3. The student knows the principle of virtual work.
4. The student has knowledge of mechanics, strength of materials and principles of general design of structures, and knows theories explaining the complex relationships between them.
5. The student knows the principles of structural theory and analysis of bar systems in the field of statics and stability.

Skills:
1. The student is able to determine the reactions of constraints in plane and spatial systems.
2. The student is able to collect the loads acting on building structures.
3. The student is able to perform static analysis of statically determinate rod structures.
4. The student is able to assess the usefulness and select a computational method, use or implement appropriate software to solve a specific class of problems, taking into account the achievements of technique and technology.

Social competences:
1. The student understands the need for teamwork in solving theoretical and practical problems related to the strength of structures.
2. The student is responsible for the reliability of the results obtained and their interpretation.
3. The student is ready to critically evaluate the knowledge he has and the content he receives, as well as critically evaluate the results of his own work.
4. The student understands the need to systematically deepen and expand his knowledge and skills.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures
Written assessment (duration 60-90 minutes) on the date given at the beginning of the semester. The basis for passing the course is obtaining a minimum satisfactory grade (3.0).
Grading scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), unsatisfactory (2.0)
Exercise auditorium
Continuous assessment in each class (rewarding activity). A 60-minute written final test at the end of the semester. The colloquium aims to test your skills and involves solving 4 tasks.
Grading scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), unsatisfactory (2.0)
Laboratory classes
Passing on the basis of positive grades (at least 3.0) from the reports of laboratory exercises and the final test. The reports must be defended by the team carrying out the exercise (oral or written).
Grading scale: very good (5.0), good plus (4.5), good (4.0), satisfactory plus (3.5), satisfactory (3.0), unsatisfactory (2.0)

Programme content

Principles of statics. Newton's laws. Balance conditions of any system of forces. Statically determinate systems. The principle of virtual work and its applications. Internal forces in rod systems. Differential relations in bending. Geometric parameters of plane figures. State of stress. Strength hypotheses. Displacements of rod systems. Stability of rod systems. Experimental research methods.

Course topics

Lectures
Principles of statics. Newton's laws. Balance conditions of any system of forces. Constraints and reaction forces. Statically determinate systems. The principle of virtual work and its applications. Internal forces in rod systems (beams, frames, lattices). Differential relations in bending. Geometric parameters of plane figures. Pure bending. Skew bending. Eccentric action of normal force. Stresses under the foundation. Complex state of stress. Strength hypotheses. Displacements of rod systems. Stability of rod systems. Experimental research methods.
Auditorium exercises
Determining the degree of static indeterminacy. Calculating the reaction of constraints and determining

internal forces in rod systems (beams, lattice, frames). Determining geometric parameters of complex plane figures. Checking the state of stress in tensile/compressed elements. Determination of normal and shear stresses in bending elements. Determination of normal stresses under the foundation. Calculation of reduced stresses. Determination of the critical force in compression bars.
Laboratories
Providing health and safety rules in laboratory halls. Metals - tensile test. Analysis of a flat truss loaded with concentrated force. Bending beam analysis. Skew bending of the beam. Elastooptics. Determining the critical force.

Teaching methods

Lecture: multimedia presentation supplemented with explanations provided on the board.
Auditory exercises: solving sample tasks, initiating discussions on the consequences of the applied model assumptions/simplifications.
Laboratories: teamwork of students during experiments, comparative analyzes of experimental and theoretical results.

Bibliography

Basic:
1. J. Kubik, J. Mielniczuk, Mechanika techniczna dla inżynierów, wyd. UKW, Bydgoszcz 2017
2. J. Misiak, Mechanika ogólna. T. 1, Statyka i kinematyka, WNT Warszawa 2016
3. J. Dębiński, J. Grzymisławska, Podstawy mechaniki płaskich układów prętowych. Cz. 1-3, Wydawnictwo PP, Poznań 2019
4. J. Dębiński, J. Grzymisławska, Wytrzymałość Materiałów cz.1-3, Wydawnictwo Politechniki Poznańskiej, 2019.
5. J. Dębiński, J. Grzymisławska, Ćwiczenia laboratoryjne z wytrzymałości materiałów, Wydawnictwo Politechniki Poznańskiej, 2016.

Additional:
1. A. Jakubowicz, Z. Orłoś, Wytrzymałość Materiałów, tomy 1 i 2, WNT, Warszawa, 1999 i 1997
2. Z. Cywiński, Mechanika budowli w zadaniach. Układy statycznie wyznaczalne, PWN Warszawa 1999
3. J. Grabowski, A. Iwanczewska, Zbiór zadań z wytrzymałości materiałów, Oficyna Wydawnicza Politechniki Warszawskiej, 1994.

Breakdown of average student's workload

	Hours	ECTS
Total workload	135	5,00
Classes requiring direct contact with the teacher	75	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00