COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strenght of Mechanical Structures [S2EPiO1>WKE]

Course

Field of study
Industrial and Renewable Energy Systems

Year/Semester
1/2

Area of study (specialization)
Thermal and Renewable Energy

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
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in mathematics, strength of materials, engineering graphics and other areas of education in the field of study. Ordered theoretical knowledge in the field of study. The ability to search for necessary information in literature, databases, catalogues. Using information and communication techniques appropriate to carry out engineering tasks. The student is aware of the interplay between mathematical, physical and technical sciences.

Course objective

To acquaint students with theoretical and practical problems related to strength analysis based on the mechanical properties of materials as the basis for the proper design of various structures in the energy industry. Acquaintance with advanced problems of theoretical strength of materials and practical applications, including issues related to heat load and high pressure.

Course-related learning outcomes

Knowledge:
1. has expanded knowledge necessary to understand profile subjects and specialist knowledge about construction, methods of designing, manufacturing, operating, security systems, and impact on the

economy, society and the environment in the field of industrial and renewable energetic sectors in the area of calculation methods of mechanical strength of components of energetic systems.
2. has extended and in-depth knowledge in the field of mathematics, optimization methods, including numerical methods used in the modern calculation methods of mechanical strength of energy devices elements.
3. knows the principles of industrial property protection (including intellectual property) as well as economic, legal and ethical conditions of activities related to construction of energetic systems elements with special emphasis to their mechanical strength.

Skills:
1. is able to formulate and test hypotheses related to simple research problems concerning mechanical strength of element sf energetic systems.
2. is able to critically analyse the functioning of existing technical solutions in the energy industry and evaluate these solutions for mechanical strength.
3. is able to solve research and engineering tasks requiring the use of engineering standards and norms and the use of technologies appropriate for industrial and renewable energy, using experience gained in an environment professionally engaged in engineering activities with special attention to mechanical strength.

Social competences:
1. is ready to critically assess knowledge and received content.
2. is ready to recognize the importance of knowledge in solving cognitive and practical problems and to seek expert opinions in the event of difficulties in solving the problem yourself .
3. is ready to perform responsible professional roles, taking into account changing social needs, including: developing the profession"s achievements, maintaining the ethos of the profession, compliance with and development of the principles of professional ethics and actions to comply with these principles.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: written and oral test (3 calculation tasks and 5 theoretical issues + conversation with the teacher on issues related to the strength of power structures): <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb
Completion of exercises (3 tests or development and presentation of solutions for tasks prepared by the teacher), assessment of continuous activity during lectures and calculations: <50% - ndst, >51-60% - dst, >61-70% - dst plus, >71-80% - db, >81-90% - db plus, >91% - bdb

Programme content

Beams on an elastic foundation, differential equation of the beam deflection line, boundary conditions and the expected solution. Clapeyron systems. Energy methods. The principle of reciprocity of Betty"s work and reciprocity of Maxwell"s shifts. Calculation examples. Castigliano"s theorem and the principle of Castigliano-Menabrea"s least work. Application of these methods to calculate structure displacements. Maxwell-Mohr method of calculating displacements. Strength calculations for pipelines and arches.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.
2. Exercises: solving tasks on the board, multimedia presentation.

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. Willems N., Easley T. J., Rolfe S. T., Strength of Materials, Mc GrawHill Book Company, 1981.
2. Gere M., Timoshenko S., Mechanics of Materials, PWS-Kent Publishing Company, Boston, 1984.
2. Magnucki K. Wytrzymałość i optymalizacja zbiorników cienkościennych. Wyd. Naukowe PWN, Warszawa, Poznań 1990.
3. Niezgodziński M. E., Niezgodziński T., Wzory, wykresy i tablice wytrzymałościowe, Wydawnictwo Naukowo-Techniczne Warszawa 2004.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00