COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength of mechanical structures [N2MiBP1>WKM]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/1

Area of study (specialization)
Hybrid Powertrain Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
9

Laboratory classes
0

Other
0

Tutorials
9

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr inż. Iwona Wstawska
iwona.wstawska@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of mathematics, mechanics, strength of materials, engineering graphics and other areas of education in the field of study.

Course objective

The aim of the course is to provide the tools necessary to construct machines, with particular emphasis on their strength and stability. Indication of the limitations of the applied mathematical models of structures. Presenting in an understandable form the principles of carrying out strength calculations in complex load states with the use of energy methods. Acquainting with the basics of strength analysis of thin-walled structures with particular emphasis on circular-symmetric plates and shells of revolution.

Course-related learning outcomes

Knowledge:
Has a basic knowledge of the mechanics of solids and discrete systems with many degrees of freedom, mathematical modeling of physical and mechanical systems based on d"Alembert"s principle and Lagrange"s equations, mathematical description of materials using constitutive equations.
Has extended knowledge of material strength in the field of nonlinear models, fracture and fatigue

strength, calculations of statically indeterminate structures, structure stability.
He has in-depth knowledge of the construction, principles of operation and classification of machines from a selected group.

Skills:
He can estimate the potential threats to the environment and people from the designed working machine and vehicle from a selected group.
He can develop a technical description, offer and design documentation for a complex machine from a selected group of machines.
Can use a popular numerical system to program a simple system simulation task with a small number of degrees of freedom.

Social competences:
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 its own.
He is ready to critically assess his knowledge and received content.
Is ready to fulfill professional roles responsibly, taking into account changing social needs, including:
- developing the professional achievements,
- maintaining the ethos of the profession,
- observing and developing the rules of professional ethics and acting towards the observance of these rules.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Written test and assessment of activity in the classroom:
3 50.1% -70.00%
4 70.1% -90.0%
5 from 90.1%

Programme content

The introduction emphasizes the need to generalize the mathematical models used in the strength of materials.
Stability of bars in compression: internal forces of a deformed structure, integral of the uniform and inhomogeneous equation of the beam deflection line, generalization of the Euler formula for various support methods, limiting slenderness, radius of inertia of the cross-section, compression of bars with the participation of transverse forces, the scope of the Euler"s formula applicability.
Energy methods of strength of structures: linear elastic system, generalized force, generalized displacement, potential energy of elastic forces. Castigliano theorem, Menabre theorem, force method, integration by multiplying graphs.
Strength of circular-symmetric plates: the concept of a plate, internal forces in plates, plate equilibrium equations, boundary conditions, integral of the differential equation of plate deflection, assessment of plate strength.
Membrane theory of shells of revolution.

Course topics

none

Teaching methods

Live lecture with multimedia illustrations, tutorials with problems solved on the board.

Bibliography

Basic
Dyląg Z., Jakubowicz A., Orłoś Z., Wytrzymałość Materiałów Tom 1–2, Wydawnictwa Naukowo-Techniczne, Warszawa 2010.
Zielnica J., Wytrzymałość materiałów, Wydawnictwo Politechniki Poznańskiej, Poznań 2001.

Niezgodziński M., Niezgodziński T., Wytrzymałość materiałów, Wydawnictwo Naukowe PWN, Warszawa 2009.
Additional
Magnucki K., Szyc W., Wytrzymałość materiałów w zadaniach. Pręty, płyty i powłoki obrotowe., Wydawnictwo Naukowe PWN, Warszawa 2012.
Banasiak M., Grossman K., Trombski M., Zbiór zadań z wytrzymałości materiałów, Wydawnictwo Naukowe PWN, Warszawa 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	30	2,00
Classes requiring direct contact with the teacher	18	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	12	1,00