COURSE DESCRIPTION CARD - SYLLABUS

Course name
Strength analyzes of rail vehicle components [S2MiBP1-PSz>AWPSz]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/2

Area of study (specialization)
Railway Vehicles

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
0

Projects/seminars
30

Number of credit points

3,00

Coordinators

dr hab. inż. Bartosz Firlik prof. PP
bartosz.firlik@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, shafts, joints and other structural elements He can perform strength calculations of simple frames and load-bearing structures of machines using elementary strength theories Is aware of responsibility for their own work and is ready to comply with the rules of teamwork and responsibility for jointly performed tasks

Course objective

Getting to know the methods of designing and testing a vehicle with the use of functional models of vehicle assemblies, solved analytically and using numerical methods. Strength analyzes of rail vehicle components based on applicable standards and regulations. Verification and validation of calculation results.

Course-related learning outcomes

Knowledge:
Has extensive knowledge of modern machine manufacturing technologies in the field of designing the production process of machine parts and their assembly using computer CAM tools
Has extended knowledge of material strength in the field of nonlinear models, fracture and fatigue

strength, calculations of statically indeterminate structures, structure stability.
Has a general knowledge of the principles and methods of constructing working machines, in particular the methods of functional and strength calculations, mathematical optimization of mechanical structures and modeling of machine structures in 3D systems.

Skills:
He can design the technology of exploitation of a selected machine with a high degree of complexity.
Can use a popular numerical system to program a simple system simulation task with a small number of degrees of freedom.
Can perform a medium complex design of a working machine or its assembly using modern CAD tools, including tools for spatial modeling of machines and calculations using the finite element method.

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.
Is willing to think and act in an entrepreneurial manner.
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:
Credit with the use of a computer. The final grade includes both the final grade as well as the student"s activity during the classes and preparation for them.

Programme content

Using the ANSYS and SolidWorks Simulation interface for strength calculations
Development and reading of system topology based on technical documentation and real photos of vehicles,
Preparation of a program of strength tests
Principles of defining boundary conditions and their influence on calculation results
FEM mesh creation, mesh quality criteria
Analysis of simulation results

Teaching methods

Multimedia presentation, independent work with computers (ANSYS and SolidWorks Simulation software), assessment in the form of a project. Students can also use the software on private computers, using it for other projects during their studies.

Bibliography

Basic
1. T. Zagrajek, G. Krzesiński, P. Marek: Metoda elementów skończonych w mechanice konstrukcji. Ćwiczenia z zastosowaniem systemu ANSYS, ISBN: 83-7207-573-5,
2. O.C. Zienkiewicz: Metoda Elementów Skończonych. Arkady Warszawa 1972 r.
Additional
1. R. Bąk, T. Burczyński: Wytrzymałość materiałów z elementami ujęcia komputerowego. WNT Warszawa 2001, ISBN 83-204-2577-8
2. O.C. Zienkiewicz, R.L. Taylor: The Finite Element Method Set. Sixth Edition .Wydawnictwo Elsevier 2005.
3. M. Daćko, W. Borkowski, ST. Dobrociński, T. Niezgoda, M. Wieczorek: Metoda Elementów Skończonych w mechanice konstrukcji. Arkady, Warszawa 1994.
4. K.J.Bathe : Finite Element Procedures. Prentice-Hall, Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey, 1996.
5. M. Kleiber: Metoda Elementów Skończonych w nieliniowej mechanice kontinuum. Biblioteka

Mechaniki Stosowanej IPPT PAN. PWN, Warszawa-Poznań 1985
6. T. Łodygowski, W. Kąkol: Metoda Elementów Skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich. Politechnika Poznańska 2003r.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00