



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Strength analyzes of rail vehicle components

### Course

Field of study

Year/Semester

Construction and Exploitation of Means of Transport

1/2

Area of study (specialization)

Profile of study

Railway Vehicles

general academic

Level of study

Course offered in

Second-cycle studies

polish/english

Form of study

Requirements

full-time

compulsory

### Number of hours

Lecture

Laboratory classes

Other (e.g. online)

15

0

0

Tutorials

Projects/seminars

0

30

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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### 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

The student has detailed knowledge of computer methods in vehicle design, including creating numerical models of rail vehicle components, creating a FEM mesh, defining boundary conditions.

#### Skills

Can use analytical, simulation and experimental methods to formulate and solve engineering tasks and simple research problems.

Can perform an experiment in the process of creating and verifying functional models of vehicle assemblies, interpret the obtained results and draw conclusions.

#### Social competences

Is aware of the importance of non-technical effects of engineering activities, including its impact on the environment.

He can interact and work in a group.

Can think and act in a creative and entrepreneurial manner. Is able to properly define priorities for the implementation of a task set by himself or others.

### Methods for verifying learning outcomes and assessment criteria

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	65	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	20	1,0

<sup>1</sup> delete or add other activities as appropriate