COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of vehicle dynamics

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/1

Area of study (specialization)
Rail vehicles

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish/english

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Faculty of Civil and Transport Engineering

ul. Piotrowo 3, pok. 722, 60-965 Poznań

Responsible for the course/lecturer:
mgr inż. Tomasz Staśkiewicz (exercise)

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Prerequisites

Basic information on vehicle construction, dynamics and strength of materials.

Course objective

Understanding the principles of vehicle design, mainly concerning vehicle dynamics, aimed at meeting given operational requirements, also based on durability, ergonomics and cost analysis.

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 extensive knowledge of selected departments of technical mechanics related to the selected specialization.

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

Can use a popular numerical system to program a simple system simulation task with a small number of degrees of freedom.

Is able to use the acquired knowledge in the field of thermodynamics and fluid mechanics to simulate thermodynamic processes in technological systems of machines, using specialized computer programs.

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

It is ready to initiate actions for the public interest.

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:

The final grade takes into account both the grade from the written exam as well as the student's activity during the classes and preparation for them.

Programme content

Criteria for assessing the dynamic properties of the vehicle. Methods of measuring dynamic properties. Kinematic parameters of the track and operational parameters influencing the design of the vehicle. Forces affecting the vehicle.

Dynamics of vehicle and drive systems, equations of motion and methods of their solution. Methods of computer modeling of dynamic properties and vehicle strength analyzes, their use in vehicle design. The problem of the contact of a wheel with a rail or a tire with the road. Track handling, stability, vibration damping, wear of vehicle components. Driving comfort issues.

Selection of vehicle structures according to functional properties: safety and ride quality, durability, passenger comfort, reduction of wear and damage to vehicles, vehicle life costs. Modern utility solutions for vehicles.

Teaching methods

1. Lecture with multimedia presentation

2. Tutorials - selected analyzes and calculations of vehicle dynamics

Bibliography

Basic

1. Iwnicki S. (red.), Handbook of Railway vehicle dynamics. Taylor & Francis, 2006

2. Anderson E., Berg M., Stichel S.: Rail Vehicle Dynamics, Railway Group KTH, Stockholm 2014

3. Kisilowski J. (red.), Dynamika układu mechanicznego pojazd szynowy-tor. PWN, Warszawa 1991.

4. Kisilowski J.,, K. Knothe K. (red.), Advanced railway vehicle system dynamics. WNT, Warszawa 1991.

Additional

1. Gąsowski W., Marciniak Z., Konstrukcje oraz modele wózków i układów zawieszeń wagonów i lokomotyw. Wyd. Politechniki Poznańskiej, Poznań 1993.

2. Pacejka H., Tyre and vehicle dynamics. Butterworth-Heinemann, Oxford 2005.

3. International and local standards

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	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) [1]	30	1,0

[1] delete or add other activities as appropriate