COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of vehicle dynamics [S1MiBP1>PDS]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr inż. Marek Maciejewski
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Lecturers

Prerequisites

Basic knowledge of mechanics, in particular the kinematics and dynamics of discrete systems. Knowledge of the basic principles of formulating dynamic problems. The ability to adapt the solution to the formulated problem. Spreadsheet support. Ability to define the computational process to achieve a problem solution. The ability to identify problems and solve dilemmas in the computational process. Independence.

Course objective

Providing students with information on the basic relations between the construction parameters of vehicles, road conditions and the requirements of traffic dynamics, while maintaining safety and driving comfort.

Course-related learning outcomes

Knowledge:
M1_W04 Has ordered basic knowledge of the main divisions of technical mechanics: statics, kinematics and dynamics of a material point and a rigid body.

Skills:
M1_U6 Can use learned mathematical theories to create and analyze simple mathematical models of

machines and their elements, and simple technical systems.
M1_U26 Can interact with other people as part of teamwork (also of an interdisciplinary nature).

Social competences:
M1_K01 Is ready to critically assess his knowledge and received content

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 exam on the lecture material, completion of laboratory classes based on the documentation of the tasks performed.

Programme content

Classification of dynamics for vehicle movement. Interaction between vehicle and road. Construction and kinematic and dynamic properties of the tire. The importance of the tire for the trajectory of motion and vibration of the vehicle. Force interactions and kinematic excitations on a moving vehicle.
Longitudinal dynamics of the car. Drag forces and power of resistance forces to motion - references to the driving force on wheels. The size of the gear ratios in the car drive system as a result of the equilibrium of interactions, taking into account the adhesion of the wheels. Selection of gears: the smallest and the largest. Determination of the number of gears. Methods of selecting intermediate gears. Car traction and dynamic characteristics, and the power balance.
Car braking and the balance of forces during braking. Determination of the braking forces and their limitations resulting from adhesion conditions. Distribution of braking forces on the vehicle axles drive. Braking time and distance.
Lateral dynamics of the car - movement stability. Lateral forces and balance of the car in a curve. Tire deformation and car side drift. Lateral skid problem. Longitudinal stability of the car movement in a curve - the car understeers and oversteers. Importance of vehicle stability in rectilinear motion. Lateral stability - balance of the car in a curve.
Vehicle vertical dynamics and suspension system tasks. Discrete approach (a system of related masses) in defining vehicle models. Vehicle models: one-, two-, and three-dimensional. Basic relations between vertical dynamics, frequency and damping factors. Influence of vibrations on humans - driving comfort. Suspension models: passive, active, adjustable and semi-active. Sky-hook controlled suspensions. Research and evaluation criteria for suspensions.

Teaching methods

1. Lecture: multimedia presentation. 2. Laboratory classes: formulation and solution of given problems in the field of car dynamics.

Bibliography

Basic
1. Prochowski L. .: Pojazdy samochodowe mechanika ruchu. Wydawnictwa Komunikacji i Łączności, Warszawa 2008.
2. Arczyński S.: Mechanika ruchu samochodu, WNT, Warszawa, 1994.
3. Siłka W.: Teoria ruchu samochodu, WNT, Warszawa 2002
Additional
1. Andrzejewski R.: Stabilność ruchu pojazdów samochodowych. WNT, Warszawa 1997.
2. Gillespie T.D.: Fundamentals of Vehicle Dynamics. SAE Warrendale 1992
3. Wong J.Y.: Theory of Ground Vehicles, J.Whiley&Sons, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	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)	20	1,00