



## Subject card

Subject name and code	Vehicle Dynamics, PG_00052230						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2024/2025		
Education level	first-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		English		
Semester of study	6		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ryszard Woźniak				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	15.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		0.0		0.0	60
Subject objectives	Issues presentation related to the kinematics and dynamics of car movement with particular emphasis of the drag movement, and overcoming them by the drive system equipped with an internal combustion engine.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W12] possesses basic knowledge necessary to understand the ex-technical conditions of engineering activity, possesses basic knowledge on management, including quality management and running commercial enterprise, within the range of protection of intellectual property and patent law; knows general principles of creating and developing forms of individual entrepreneurship and basic HSE rules applicable to machine industry	The student gains knowledge about the resistance to motion of the vehicle. He acquaints himself with the selection of an engine for a car and the selection of gear ratios in the vehicle drive system. He gets acquainted with the problems related to the braking of the vehicle and with selected issues related to the construction of the car.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	K6_U07	The student gains knowledge about the resistance to motion of the vehicle. He acquaints himself with the selection of an engine for a car and the selection of gear ratios in the vehicle drive system. He gets acquainted with the problems related to the braking of the vehicle and with selected issues related to the construction of the car.	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
	K6_U01	The student gains knowledge about the resistance to motion of the vehicle. He acquaints himself with the selection of an engine for a car and the selection of gear ratios in the vehicle drive system. He gets acquainted with the problems related to the braking of the vehicle and with selected issues related to the construction of the car.	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
	K6_W08	The student gains knowledge about the resistance to motion of the vehicle. He acquaints himself with the selection of an engine for a car and the selection of gear ratios in the vehicle drive system. He gets acquainted with the problems related to the braking of the vehicle and with selected issues related to the construction of the car.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
Subject contents	<p><b>Lecture:</b> Throttle by tyred wheel: slip rolling, rolling with tyre strain, vertical and lateral surface reactions, traction, energetic losses, forces in contact path. Drugs of movement: rolling, air, gradient, inertia, cornering and towing. Forces and torques acting to vehicle in straight movement. Limiting values of reaction forces. Different power trains - comparison of possibilities. Engine cooperation with power train of traction vehicle. Efficiency of power train. Vehicle traction possibilities: power balance, force balance, dynamic ratio and dynamic figures, distance and time of acceleration. Vehicle braking.</p> <p><b>Classes:</b> Drugs of movement: calculations of: rolling drug, air drug, gradient drug, inertia drug, cornering drug, towing drug, forces and torques acting to the vehicle going straight or cornering. Calculations of limiting values of reaction forces. Calculations of efficiency of power train. Calculations of: power balance, forces balance, dynamic ratios, distance and time of acceleration. Calculations of transmission ratios in power train. Calculations of braking force balance on each vehicle wheel during braking.</p> <p><b>Laboratory:</b> Determination of rolling tyre radius. Determination of dynamic tyre radius. Determination of vertical tyre stiffness. Balancing car wheels with tyres. Determination of wheels with tyres inertia moments. Determination of rolling resistance coefficient of the car. Determination of air drag coefficient of the car.</p> <p><b>Project:</b> Design of a dry, friction clutch for a passenger car (including calculations and technical drawings).</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tests during the semester	50.0%	50.0%
	Project evaluation	80.0%	50.0%

Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Vehicle Dynamics. Theory and Application. Reza N. Jazar, Springer (all editions).</li> <li>2. Fundamentals of Vehicle Dynamics. Thomas D. Gillespie. SAE International; 1 edition (October 17, 2019).</li> <li>3. Race Car Vehicle Dynamics - Problems, Answers and Experiments. William F. Miliken, Douglas L. Miliken, Edward M Kasprzak, L. Daniel Metz. SAE International; Pap/Cdr edition (May 30, 2003).</li> <li>4. Dynamik der Kraftfahrzeuge. Zweite, völlig neubearbeitete Auflage. Band A: Antrieb und Bremsung. Manfred Mitschke. Springer-Verlag, Berlin Heidelberg New York 1982.</li> </ol>
	Supplementary literature	Absence
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Drive train efficiency coefficients</li> <li>2. Drags of vehicle movement</li> <li>3. The choice of engine for vehicle</li> <li>4. Selection of gear in the drive train of the car on the lowest gears</li> <li>5. Selection of gear in the drive train of the car on the highest gear</li> <li>6. Design of a dry, friction clutch for a passenger car</li> </ol>	
Work placement	Not applicable	

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