GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Vehicle dynamics, PG_00064926						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2027		Academic year of realisation of subject	2027/2028			
Education level	second-cycle studies		Subject group	Specialty subject group Subject group related to scientific research in the field of study			
Mode of study	Part-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Machine Design and Vehicles -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Sławomir Sommer				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	9.0	9.0	9.0	0.0	0.0	27
	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	27		9.0	64.0		100
Subject objectives	Gaining basic knowledge of braking and cornering of vehicles.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U02] formulates and solves technical problems specific to Mechanics and Mechanical Engineering using appropriate tools including CAD and MES systems, and prepares technical documentation	The student is able to formulate and solve technical problems related to vehicle motion mechanics, using appropriate computational tools, including CAD and MES systems. Analyzes dynamic and kinematic aspects of vehicle motion and their impact on design and operation. Assesses the impact of design, material and environmental factors on vehicle traction properties and safety. Creates technical documentation and analytical reports on vehicle motion mechanics issues.	[SU4] Assessment of ability to use methods and tools
	[K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice	The student interprets the social, economic and legal aspects related to engineering activities, including those related to the protection of industrial property and copyright, and takes them into account in engineering practice. Analyses the impact of legal regulations and technical standards on the design, operation and safety of engineering systems. Identifies the economic and social consequences of engineering decisions and assesses their impact on the development of technology and innovation. Applies the principles of engineering ethics and professional responsibility in the context of implemented projects.	[SW1] Assessment of factual knowledge
	[K7_U04] creatively designs or modifies devices, processes or systems specific to Mechanics and Mechanical Engineering, using computer-aided design systems in the form of technical documentation, taking into account aspects of economic analysis, using appropriate tools and techniques	The student designs and modifies devices, processes or engineering systems in the area of Mechanics and Machine Design, using computer-aided design tools (CAD, MES). Prepares technical documentation in accordance with applicable norms and standards, taking into account aspects of economic analysis. Uses advanced computational tools and techniques to assess the efficiency and optimize the designed solutions. Takes into account economic, technological and environmental aspects in the process of designing and modifying engineering systems.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K7_W02] demonstrates a structured and theoretically grounded knowledge of the key topics in Mechanical Engineering enabling the analysis and modelling of mechanical systems, processes and devices	The student has structured and theoretically based knowledge in the field of Mechanics and Machine Design, enabling the analysis and modeling of systems, processes and mechanical devices. Understands the basic principles of mechanics and their application in the design and operation of machines and devices. Analyzes and interprets physical phenomena and mathematical models used in technical mechanics. Uses computational methods and simulation tools to analyze the dynamic and static properties of mechanical systems.	[SW1] Assessment of factual knowledge
Subject contents	Course content – lecture LECTURE Friction coefficient. Two axle vehicle braking. Front axle braking. Rear axle braking. Braking forces distribution. Braking on gradiend (up and down). Braking deceleration. Side slipping of tyres. Vehicle cornering without side slipping of tyres. Vehicle cornering taking side slipping of tyres into account. LABORATORY Braking forces measurement. Braking distance measurement. Vehicle rolling radius measurement. Vehicle rolling resistance coefficient measurement. Vehicle air drug coefficient measurement.		
Prerequisites and co-requisites	Knowledge from subjects: mathematics I i II i III (07000W0 i 07000C0) and physics I i II (07001W0 i 07001C0).		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	50.0%
	Practical exercise	75.0%	50.0%
Recommended reading	Basic literature	1. Prochowski L.: Mechanika ruchu. WKiŁ, Warszawa, 2005. 2. Arczyński S.: Mechanika ruchu samochodu. WNT, Warszawa, 1993. 3. Lanzendoerfer J., Szczepaniak C.: Teoria ruchu samochodu. WKiŁ, Warszawa, 1980. 4. Mitschke M.: Dynamika samochodu. WKiŁ, Warszawa, 1977.	
	Supplementary literature	No requirements	
	eResources addresses		

Example issues/ example questions/ tasks being completed	**Lecture:** **Coefficient of Adhesion** - What factors influence the value of the coefficient of adhesion? - How is the coefficient of adhesion of a surface measured? - What are the differences in adhesion on dry, wet, and icy surfaces? **Braking of a Two-Axle Vehicle** - What are the main forces acting on a vehicle during braking? - How does weight distribution affect braking efficiency? **Front-Axle vs. Rear-Axle Braking** - What are the dynamic differences between braking with the front and rear axles? - What are the consequences of applying brakes only on one axle? **Brake Force Distribution** - How is the optimal brake force distribution calculated? - How do ABS and EBD systems function in the context of brake force distribution? **Braking on an Incline and a Decline** - How does terrain slope affect braking efficiency? - What braking techniques are used on steep descents? **Braking Deceleration** - How is braking deceleration defined, and what factors influence it? - What are typical values of braking deceleration for different types of vehicles? **Lateral Tire Skid Phenomenon** - What are the causes of lateral tire skidding? - How can lateral skidding be minimized? **Vehicle Motion in a Curve With and Without Lateral Skid** - What forces act on a vehicle when cornering?

	- What are the effects of oversteer and understeer? **Laboratory:** **Measurement of Braking Forces** - What methods are used to measure vehicle braking forces? - What devices are utilized in braking force measurements? **Measurement of Braking Distance** - What factors affect braking distance? - What measurement errors may occur when determining braking distance? **Determination of Rolling Radius of a Vehicle** - What is the significance of the rolling radius in vehicle motion analysis? - How is the rolling radius measured? **Determination of Rolling Resistance Coefficient of a Vehicle** - How is the rolling resistance coefficient defined and measured? - How do materials and surfaces affect rolling resistance? **Determination of Vehicle Aerodynamic Drag Coefficient** - What methods are used to determine the aerodynamic drag coefficient? - How does vehicle shape influence aerodynamics?
Practical activites within the subject	Not applicable

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