

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Theory of Cars Movement</b>		Code <b>1010614151010612531</b>
Field of study <b>Mechanical Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>3 / 5</b>
Elective path/specialty <b>Motor Vehicles and Tractors</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>part-time</b>	
No. of hours Lecture: <b>14</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>		No. of credits <b>1</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>1 100%</b>
<b>Responsible for subject / lecturer:</b>  Grzegorz Ślaski, dr hab inż. email: Grzegorz.Slaski@put.poznan.pl tel. 61 6652 222 Faculty of Machines and Transport 3 Piotrowo street, 60-965 Poznan, Poland		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	The student has academic level knowledge in area of vehicle systems design, applied mechanics and mathematics
2	<b>Skills</b>	The student can make assumptions and simplifications of real vehicle and its mechanical structure loads. The student has skills of using mathematical formulations of physical laws, its manipulation and mathematical equations solving. The student can interpret physical meaning of obtained numerical results
3	<b>Social competencies</b>	The student can interpret and communicate meaning and limitations of obtained calculation results and estimates in society aspects. Is able to set priorities for realization of undertaken tasks. The student has ability to self-solving problems and self-studying and improving new knowledge.
<b>Assumptions and objectives of the course:</b> Understanding the fundamental relations between design parameters of motor vehicles, such as tire stiffness, gravity center location, engine torque, vehicle mass and suspension geometry and kinematics, external excitations like roads irregularities and slopes, aerodynamics forces and vehicle behavior (acceleration, braking, maneuverability, stability and ride comfort and safety).		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. Has knowledge of vehicle external excitations in form of forces and kinematic - [K1A-W24]		
2. Has knowledge of physical limitations of vehicle performance - [K1A_W24, K1A_W04]		
3. Has knowledge of static and dynamic properties of vehicle and its subsystem influencing vehicle behavior in different conditions - [K1A_W24, K1A_W04]		
4. Has knowledge of interactions between tire and road and the influence of various vehicle properties on these interactions. - [K1A_W24]		
5. Has knowledge of an influence of vehicle properties on type and safety of vehicle dynamics - [K1A_W24]		
<b>Skills:</b>		
1. Is able to interpret phenomenon accompanying vehicle motion in aspect of its physical fundamentals and limitations - [K1A-U03]		
2. Is able to estimate values of forces, performance indexes and limits of vehicle motion - [K1A-U07]		
3. Is able to interpret the influence of vehicle dynamics aspects on its design aspects - [K1A-U25]		
<b>Social competencies:</b>		

1. Is aware of physical limitations of vehicle motion and its influence on road traffic safety - [K1A-K02]  
 2. Is aware of the need of improving vehicle design and educate of wide group of vehicles users in area of vehicle performance physical limitations and their influence on people health and safety - [K1A-K02]

**Assessment methods of study outcomes**

Written test, which is based on answers related to the selection of given answers and open questions. Credits will be given after achieving at least 50% of points. Answers are scores from 0 to 1 point.

**Course description**

Static and dynamic axle loads.

Longitudinal dynamics - vehicle acceleration: power and traction limited acceleration, tractive effort ? speed characteristics.

Longitudinal dynamics - vehicle braking: fundamental relations of braking process, (maximum braking forces, braking distance, time and deceleration, braking power), tire longitudinal slip control, vehicle motion stability during braking, braking forces distribution.

Lateral dynamics - vehicle maneuverability and stability, tire sideslip, fundamental tire characteristics, vehicle handling characteristics ? understeer and oversteer, estimating vehicle response during steady state cornering at low and higher speed, design parameters influencing vehicle handling characteristics.

Lateral dynamics - vehicle response at transient lateral dynamics tests, analysis of 2DOF (bicycle) model of vehicle lateral dynamics, methods of experimental testing of transient handling characteristics

Vertical dynamics - ride comfort and safety (ISO 2631 standard), criteria of ride comfort and safety evaluating, evaluation of comfort and safety indexes, suspension elements characteristics and their influence on comfort and safety,

Relation between vertical and longitudinal and lateral dynamics. Problem of models accuracy.

**Basic bibliography:**

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 bibliography:**

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.Wiley&#38;Sons, 2001

**Result of average student's workload**

Activity	Time (working hours)
1. Participation in lectures	15
2. Literature studies	5
3. Consultation	1
4. Preparation for written credits (based on lectures)	5
5. Participation in written test solving.	2

**Student's workload**

Source of workload	hours	ECTS
Total workload	28	1
Contact hours	18	1
Practical activities	0	0