COURSE SYLLABUS

1. Programme information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automotive Vehicles, Mechatronics and Mechanics
1.3 Department	Automotive Vehicles and Transportation
1.4 Field of study	Automotive Engineering
1.5 Cycle of studies	Master's degree
1.6 Study programme / Qualification	Advanced Techniques in Automotive Engineering
1.7 Form of education	FT - full-time education

2. Course information

2.1 Course title	Vehicle Dynamics			Course code	10.00
2.2 Course lecturer	Assoc. Prof. Dr. Eng. Nicolae Cordos - nicolae.cordos@auto.utcluj.ro				
2.3 Seminar / laboratory / project / practical activities coordinator	Assoc. Prof. Dr. Eng. Nicolae Cordos - nicolae.cordos@auto.utcluj.ro				
2.4 Year of study	1	2.5 Semester	2	2.6 Type of assessment	C
2.7 Course status	Formative category				DF
	Optionality				DOB

3. Estimated total time

3.1 Hours per week	3	of which:	3.2 Lecture	1	3.3 Seminar		3.3 Laboratory	1	3.3 Project	1	3.3 Practice	
3.4 Hours per semester	42	of which:	3.5 Lecture	14	3.6 Seminar		3.6 Laboratory	14	3.6 Project	14	3.3 Practice	

3.7 Distribution of time allocation (hours per semester) for individual study and assessment:	
(a) Assessment	2
(b) Study using the textbook, course materials, bibliography and notes	40
(c) Additional documentation in the library, on specialized electronic platforms and in the field	31
(d) Preparation of seminars / laboratories, assignments, reports, portfolios and essays	10
(e) Tutoring	
(f) Other activities	

3.8 Total hours for individual study and assessment (sum of 3.7(a)...3.7(f))	83
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5

4. Prerequisites (where applicable)

4.1 Curriculum prerequisites	General knowledge of: mathematics, physics, mechanics
4.2 Competence prerequisites	Computer literacy

5. Conditions (where applicable)

5.1. Course delivery conditions	Room with board, video projector and screen
5.2. Seminar / laboratory / project delivery conditions	Attendance (100% attendance) and completion (finalization / passing) of practical activities are required for admission to the final form of course assessment

6. Specific competences acquired

Professional competences	● Identifying, defining and using concepts specific to vehicle dynamics; ● Using study principles and graphical tools to describe the dynamic behaviour of vehicles; ● Describing the dynamic phenomena specific to the rational operation of vehicles; ● Developing models in the field of automotive engineering; ● Developing technical solutions and study methodologies in the field of automotive engineering; ● Implementing strategies for studying vehicle dynamics according to their operating conditions.

Transversal competences	• Responsible execution of complex professional tasks under conditions of limited autonomy and qualified assistance - Autonomy and responsibility • Awareness of the need for continuous training; efficient use of learning resources and techniques for personal and professional development - Personal and professional development

7. Expected learning outcomes

Knowledge	• The student/graduate identifies and explains the basic concepts, theories and methods specific to the study of vehicle dynamics; • The student/graduate analyses and substantiates the theoretical and experimental results obtained from the study of vehicle dynamics.
Skills	• The student/graduate uses basic principles and fundamental notions specific to vehicle dynamics; • The student/graduate uses study principles and graphical and digital tools to describe the kinematic and dynamic behaviour of the vehicle; • The student/graduate describes the kinematic and dynamic phenomena specific to the vehicle; • The student/graduate develops physical-mathematical models applicable in the field of vehicle dynamics; • The student/graduate implements strategies for studying vehicle dynamics according to operating conditions, design characteristics and interaction with the roadway; • The student/graduate analyses and interprets the results obtained by applying study methodologies specific to vehicle dynamics; • The student/graduate selects and uses concepts, theories, models and methods for assessing the dynamic behaviour, safety and performance of the vehicle.
Responsibility and autonomy	• The student/graduate selects and analyses bibliographic sources specific to the field of vehicle dynamics; • The student/graduate demonstrates autonomy in learning by solving issues specific to vehicle dynamics; • The student/graduate demonstrates responsibility in solving issues specific to vehicle dynamics, both individually and within teams.

8. Course objectives (derived from the specific competences grid)

8.1 General course objective	• Development of professional competences in the field of automotive engineering.
8.2 Specific objectives	• Knowledge and understanding of the basic concepts, theories and methods of vehicle dynamics; their appropriate use in professional communication - Knowledge, understanding and use of language • Use of basic knowledge to explain and interpret various types of concepts, situations, processes, etc. (in broader contexts) associated with vehicle dynamics - Explanation and interpretation • Development of professional projects with the innovative use of established quantitative and qualitative principles and methods in the field of automotive engineering - Creativity and innovation

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Notes**
Fundamentals of vehicle dynamics. Modelling concepts in Matlab / Simulink. Modelling elements of dynamic systems	2 hours	Presentation (explanation, description), constructivist methods (presentation, analyses, advantages, disadvantages, applicability),	
Vehicle wheels with tyres. Vehicle suspensions. System modelling	2 hours		
Modelling the vehicle running gear. Modelling the vehicle in motion (engine speed characteristic, power transmitted to the drive wheels; final drive transmission ratio; gearbox transmission ratios, torques at the drive wheels, power at the drive wheels; vehicle wheel adhesion to the road)	2 hours		
Modelling the longitudinal dynamics of the vehicle. Modelling the dynamic loads of the vehicle	2 hours		

Modelling the acceleration capability of vehicles. Modelling the braking capability of vehicles.	2 hours	conversation, demonstration, exemplification, guidance, etc.	
Modelling vehicle manoeuvrability. Modelling vehicle stability	2 hours		
Modelling the motion resistances of vehicles	2 hours		

Bibliography

1]. Abe, M., Vehicle Handling Dynamics, Theory and Application. Oxford, Butterworth-Heinemann, Published by Elsevier Ltd., 2009.
[2] Splettstoessr, Jonah M. Developing a Simulation Tool for Vehicle Dynamics and Rollover of the Baja Buggy and Formula Hybrid Car. Milwaukee School of Engineering, Fachhochschule Luebeck, 2010. Diplomarbeit.
[3] Haugg, Armin. Analysis and Simulation of the Dynamic Steering Response for an SAE Baja-Car.
[4] Milwaukee School of Engineering, Fachhochschule Luebeck, 2008. Diplomarbeit.
[5]. Todorut, A., Fundamentals of Vehicle Dynamics. Calculation Algorithms, Tests, Applications. Cluj-Napoca, Sincron Publishing House, 2005.
[6]. Automotive System Dynamics, Yu Fan and Lin Yi, China Machine Press, 2005.
[7]. Vehicle System Dynamics and Control, Yu Fan, China Machine Press, 2010.
[8]. Automotive System Dynamics and Control, Masato Abe, Yu Fan, China Machine Press, 2012.

9.2 Laboratory	**No. of hours**	**Teaching methods**	**Notes**
Simulation of vehicle wheels	2 hours	Problem-based learning, exercises, algorithmization, conversation, explanation, description, modelling, demonstration, exemplification, guidance, etc. Visual technical	
Simulation of the vehicle suspension system			
Design and simulation of the running gear	2 hours		
Simulation of vehicle acceleration capability	2 hours		
Simulation of vehicle braking capability.	2 hours		
Simulation of vehicle stability	2 hours		
Simulation of motion resistances	2 hours		

Bibliography

1]. Abe, M., Vehicle Handling Dynamics, Theory and Application. Oxford, Butterworth-Heinemann, Published by Elsevier Ltd., 2009.
[2] Splettstoessr, Jonah M. Developing a Simulation Tool for Vehicle Dynamics and Rollover of the Baja Buggy and Formula Hybrid Car. Milwaukee School of Engineering, Fachhochschule Luebeck, 2010. Diplomarbeit.
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[5]. Todorut, A., Fundamentals of Vehicle Dynamics. Calculation Algorithms, Tests, Applications. Cluj-Napoca, Sincron Publishing House, 2005.
[6]. Automotive System Dynamics, Yu Fan and Lin Yi, China Machine Press, 2005.
[7]. Vehicle System Dynamics and Control, Yu Fan, China Machine Press, 2010.
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9.3 Project	No. of hours	Teaching methods	Notes
1. Definition of functions based on the main parameters of the studied vehicle	2 hours	Problem-based learning, exercises, algorithmization, conversation, explanation, description, modelling, demonstration, exemplification,	
2. Evaluation of the forces and torques acting on the wheels	2 hours		
3. Identification of the vehicle driving conditions	2 hours		
4. Determination of the vehicle dynamic performance	2 hours		
5. Determination of vehicle resistance	2 hours		
6. Determination of longitudinal stability parameters	2 hours		
7. Evaluation of activity during project classes	2 hours		

Bibliography

1]. Abe, M., Vehicle Handling Dynamics, Theory and Application. Oxford, Butterworth-Heinemann, Published by Elsevier Ltd., 2009.
[2] Splettstoessr, Jonah M. Developing a Simulation Tool for Vehicle Dynamics and Rollover of the Baja Buggy and Formula Hybrid Car. Milwaukee School of Engineering, Fachhochschule Luebeck, 2010. Diplomarbeit.
[3] Haugg, Armin. Analysis and Simulation of the Dynamic Steering Response for an SAE Baja-Car.
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[5]. Todorut, A., Fundamentals of Vehicle Dynamics. Calculation Algorithms, Tests, Applications. Cluj-Napoca, Sincron Publishing House, 2005.
[6]. Automotive System Dynamics, Yu Fan and Lin Yi, China Machine Press, 2005.
[7]. Vehicle System Dynamics and Control, Yu Fan, China Machine Press, 2010.
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10. Correlation of course contents with the expectations of the epistemic community, professional associations and representative employers in the programme field

The competences acquired will be necessary for employees working in the field of automotive engineering. In developing these competences, account is taken of employers' recommendations to higher education institutions for graduate training (ability to use time efficiently, ability to work in a team, ability to learn quickly, ability to coordinate teams, new opportunities in the company's interest, ability to use computers and the Internet, capacity to adapt to new situations, etc.) and of employers' recommended priorities in graduate training (creativity and innovation capacity, negotiation skills, capacity for critical analysis and self-analysis, ability to learn quickly, knowledge from other fields).

11. Assessment

Type of activity	11.1 Assessment criteria	11.2 Assessment methods (and assessment form: continuous/summative)	11.3 Weight in final grade
11.4 Lecture	Grades obtained in partial tests, attendance and conduct during activities, grade awarded at the final examination,	Written assessment	60%
11.5 Laboratory	- ability to operate with the knowledge acquired; - ability to apply knowledge in practice;	Active participation in laboratory.	30%
11.6 Project	- ability to operate with the knowledge acquired; - ability to apply knowledge in practice;	Active participation in project research activity.	20%
11.7 Minimum performance standard Knowledge of the fundamental elements of theory and practice; solving a simple application.			

Completion date:	Course staff	academic rank, title First name LAST NAME	Signature
10.07.2026	Lecture	Assoc. Prof. Dr. Eng. Nicolae Cordos	
	Applications	Assoc. Prof. Dr. Eng. Nicolae Cordos	

Date of approval in the ART Department Council 24.07.2026 _____	ART Department Director Prof.dr.ing. Barabás István
Date of approval in the ARMM Faculty Council 16.09.2026 _____	Dean, Prof.dr.ing. Filip Nicolae