

Transilvania University of Brașov, Romania

Study program: Command and control systems for motor vehicles

Faculty: Automotive Engineering

Study period: 2 years (master)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Vehicle dynamics complements	CDA	5	2	-	1	-

Course description (Syllabus): This course offers an advanced understanding of Vehicle Dynamics. In the first part, students will explore core concepts such as vehicle behavior, stability, and control principles, crucial in engineering sciences. The second part focuses on the application of these principles, analyzing complex vehicle systems, modern technologies in dynamics, and performance optimization strategies. This structure ensures a comprehensive grasp of both theoretical and practical aspects of vehicle dynamics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Programming and simulation languages	LPS	5	1	-	2	-

Course description (Syllabus): This course introduces students to the fundamental concepts and applications of Programming and Simulation Languages. The first part of the course covers essential programming constructs, algorithmic thinking, and the basics of simulation models, laying a strong foundation in computational sciences. The second part delves into the application of these programming and simulation principles, focusing on problem-solving, advanced simulation techniques, and the development of robust models for various real-world scenarios. Students will gain hands-on experience and practical skills essential for proficiency in this dynamic field.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Propulsion of electric and hybrid vehicles	PAEH	5	2	-	2	-

Course description (Syllabus): This course is designed to equip students with a comprehensive understanding of the propulsion systems in electric and hybrid vehicles. The first part of the course introduces the fundamental concepts of electric and hybrid propulsion, including energy sources, power electronics, and motor technologies. The second part emphasizes the integration and optimization of these systems within vehicles, exploring advanced topics such as energy management, control strategies, and the impact of propulsion technology on vehicle performance and environmental sustainability. Students will gain both theoretical knowledge and practical insights into the future of vehicular propulsion.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Sensors and actuators	SA	5	1	-	1	-

Course description (Syllabus): This course offers a deep dive into the world of Sensors and Actuators, key components in modern engineering and technology systems. Initially, the course presents the fundamental principles and types of sensors and actuators, exploring their roles in measuring and controlling physical environments. The latter part of the course focuses on the application and integration of these devices in various systems, discussing signal processing, feedback control, and the challenges of real-world implementation. Students will emerge with a thorough understanding of how sensors and actuators are designed, operated, and applied across multiple industries.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Automatic hydraulic and pneumatic systems for vehicles	SHPA	5	2	-	2	-

Course description (Syllabus): This course is structured to provide students with a detailed understanding of Automatic Hydraulic and Pneumatic Systems, essential components in vehicle mechanics and automation. The first part of the course introduces the fundamental principles, components, and operations of hydraulic and pneumatic systems, focusing on their roles in power transmission and control within vehicles. The second part delves deeper into the integration, automation, and troubleshooting of these systems in various types of vehicles, emphasizing efficiency, reliability, and the latest technological advancements. Through this course, students will gain both theoretical and practical insights, preparing them for challenges in designing and maintaining sophisticated vehicular systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Professional practice I	PP1	5	-	-	-	12

Course description (Syllabus): This course is designed to bridge the gap between academic knowledge and real-world professional practice. The first part of the course introduces students to the core principles of professional ethics, communication, and project management, essential for a successful career in any field. The second part emphasizes practical aspects of professional life, including teamwork, problem-solving in a professional setting, and navigating the complexities of the workplace. Students will engage in interactive workshops and case studies, equipping them with the skills and insights needed to excel in their future careers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Integrated electronic control units	UCI	5	2	-	1	-

Course description (Syllabus): This course offers an in-depth exploration into Integrated Electronic Control Units (ECUs), pivotal components in modern vehicle electronics and automation systems. In the first part, students will learn about the architecture, functionality, and programming of ECUs, emphasizing their role in vehicle dynamics, safety, and performance. The second part focuses on the advanced integration of ECUs with various vehicular subsystems, covering topics such as network communication protocols, diagnostics, and the challenges of real-time control and system optimization. This course aims to provide students with comprehensive knowledge and practical skills in the design, implementation, and troubleshooting of ECU-based systems.

Course title	Code	No. of credits	Number of hours per week			
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Energy storage and energy management	SEME	5	2	-	2	-

Course description (Syllabus): This course delves into the critical aspects of Energy Storage and Energy Management, essential components in the evolving landscape of energy systems. The first part introduces students to various energy storage technologies, including battery systems, supercapacitors, and thermal storage, highlighting their principles, design, and applications. The second part focuses on energy management strategies, exploring efficient utilization, energy conversion, and optimization techniques in different contexts such as renewable energy systems, electric vehicles, and smart grids. Students will gain a deep understanding of how to effectively store, manage, and optimize energy in various applications, preparing them for challenges and innovations in the energy sector.

Course title	Code	No. of credits	Number of hours per week			
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Networks and communication protocols in vehicles	RPCA	5	2	-	1	-

Course description (Syllabus): This course provides a comprehensive overview of the networks and communication protocols integral to modern vehicle systems. The first part of the course introduces the foundational concepts of in-vehicle networks, covering standard protocols such as CAN, LIN, and FlexRay, along with their operational principles and roles in vehicle architecture. The second part delves into the complexities of communication protocols, focusing on data transmission, network management, and the integration of emerging technologies like IoT and V2X (Vehicle-to-Everything) communication. Students will emerge with a thorough understanding of how sophisticated network and communication protocols enhance vehicle functionality, safety, and performance.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Driver assistance systems	SCA	5	1	-	2	-

Course description (Syllabus): This course provides a detailed examination of Driver Assistance Systems, a pivotal element in the advancement of vehicle safety and automation. The first part of the course covers the basics of various driver assistance technologies such as Adaptive Cruise Control, Lane Keeping Assistance, and Collision Avoidance Systems, focusing on their design, functionality, and underlying technologies. The second part explores the integration of these systems into vehicle architecture, discussing sensor fusion, decision-making algorithms, and the challenges of ensuring reliability and safety. Students will gain insight into the current state and future trends of driver assistance systems, preparing them for roles in developing the next generation of intelligent vehicles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Professional practice II	PP2	5	-	-	-	12

Course description (Syllabus): This course is designed to bridge the gap between academic knowledge and real-world professional practice. The first part of the course introduces students to the core principles of professional ethics, communication, and project management, essential for a successful career in any field. The second part emphasizes practical aspects of professional life, including teamwork, problem-solving in a professional setting, and navigating the

complexities of the workplace. Students will engage in interactive workshops and case studies, equipping them with the skills and insights needed to excel in their future careers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced testing and diagnostics	TDA	5	1	-	2	-

Course description (Syllabus): This course is tailored to impart in-depth knowledge and skills in Advanced Testing and Diagnostics, critical for maintaining high performance and reliability in various systems. The first part of the course introduces students to advanced diagnostic techniques and testing methodologies, covering aspects such as fault detection, system monitoring, and predictive maintenance. The second part focuses on the practical application of these methods in real-world scenarios, including the use of diagnostic software, interpretation of test results, and the development of comprehensive maintenance strategies. Students will learn to effectively diagnose and resolve complex issues, ensuring the optimal operation of sophisticated systems in diverse fields.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Autonomous and connected vehicles	AAC	5	2	-	1	-

Course description (Syllabus): This course offers an extensive exploration into the rapidly evolving fields of Autonomous and Connected Vehicles. The first part of the course introduces the fundamental principles and technologies behind vehicle autonomy, including sensor systems, machine learning, and decision-making algorithms, establishing a solid foundation in the concepts of self-driving vehicles. The second part delves into the realm of connected vehicles, focusing on communication technologies, network infrastructure, and the integration of vehicles into the broader transportation ecosystem. Students will engage with the ethical, legal, and social implications of these technologies, preparing them for the multifaceted challenges and opportunities in the future of transportation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Automotive software development	DSA	5	1	-	-	2

Course description (Syllabus): This course is designed to provide a comprehensive understanding of Automotive Software Development, a critical component in modern vehicle systems. The first part of the course focuses on the fundamentals of automotive software architecture, including real-time operating systems, middleware, and application development, laying the groundwork for robust software design. The second part emphasizes the development lifecycle, from requirement analysis and design to testing, validation, and deployment, incorporating industry standards and best practices. Students will gain practical experience through hands-on projects, equipping them with the skills to develop, implement, and maintain sophisticated automotive software solutions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modeling and simulation in Virtual Reality	MSRV	5	2	-	2	-

Course description (Syllabus): This course delves into the innovative realm of Modeling and Simulation within the context of Virtual Reality (VR), an increasingly pivotal technology in various industries. The first part of the course introduces students to the fundamentals of VR, including 3D modeling, immersive environments, and user interaction. The second part focuses on the application of VR for simulation purposes, covering topics such as scenario creation, physics-based modeling, and the use of VR for training, design, and analysis. Students will learn how to effectively use VR technologies to create and simulate complex real-world situations, gaining hands-on experience that prepares them for the future of digital interaction and simulation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Integrated vehicle control	CVI	5	2	-	1	0

Course description (Syllabus): This course handles Modeling and Simulation within the context of Virtual Reality (VR), an increasingly pivotal technology in various industries. The first part of the course introduces students to the fundamentals of VR, including 3D modeling, immersive environments, and user interaction. The second part focuses on the application of VR for simulation purposes, covering topics such as scenario creation, physics-based modeling, and the use of VR for training, design, and analysis. Students will learn how to effectively use VR technologies to create and simulate complex real-world situations, gaining hands-on experience that prepares them for the future of digital interaction and simulation.

Course title	Code	No. of credits	Number of hours per week			
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Vibrations and noises in electric vehicles	AVZA	5	1	-	2	-

Course description (Syllabus): This course offers an in-depth study of Vibrations and Noises specific to Electric Vehicles (EVs), critical factors affecting vehicle performance and passenger comfort. The first part of the course introduces the fundamental concepts of vibration and noise generation in vehicles, focusing on the unique characteristics and challenges presented by electric powertrains. The second part emphasizes the analysis, measurement, and control of these phenomena, covering topics such as isolation techniques, soundproofing materials, and noise reduction strategies. Students will gain a comprehensive understanding of how to diagnose, quantify, and mitigate vibrations and noises in EVs, equipping them with the skills to enhance the overall quality and performance of electric vehicles.

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Professional practice III	PP3	5	-	-	-	12

Course description (Syllabus): This course is designed to bridge the gap between academic knowledge and real-world professional practice. The first part of the course introduces students to the core principles of professional ethics, communication, and project management, essential for a successful career in any field. The second part emphasizes practical aspects of professional life, including teamwork, problem-solving in a professional setting, and navigating the complexities of the workplace. Students will engage in interactive workshops and case studies, equipping them with the skills and insights needed to excel in their future careers.

Course title	Code	No. of credits	Number of hours per week			
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University Ethics	EU	2	1	-	-	-

Course description (Syllabus): This course introduces students to the field of: academic writing; rules for reader capturing; academic drafting rules; identifying the sources of a scientific paper, extracting information; rules for writing bibliographic references; drafting of technical / scientific texts (technical reports, instructions, procedures, user manuals); choosing the academic vocabulary.

Course title	Code	No. of credits	Number of hours per week			
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Practical activity and/or scientific research	APCS	13	0	-	10	-

Course description (Syllabus): This course is structured to offer a blend of hands-on practical experience and an introduction to scientific research methodologies, tailored to prepare students for real-world applications and academic pursuits. The first part of the course focuses on practical skills development in a chosen field, involving workshops, lab sessions, and industry projects where students apply theoretical knowledge to practical scenarios. The second part introduces the fundamentals of scientific research, covering topic selection, literature review, hypothesis formulation, experimental design, data analysis, and report writing. Students will engage in a capstone project or research study, fostering critical thinking, problem-solving skills, and a scientific approach to professional and academic challenges.

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Elaboration of the dissertation	ELD	10	-	-	5	-

Course description (Syllabus): This course is meticulously crafted to guide students through the process of developing a high-quality dissertation, an essential component of advanced academic achievement. The first part of the course covers the foundational elements of dissertation writing, including topic selection, research question formulation, literature review, and methodological design. The second part focuses on the execution of the research, data collection, analysis, and the synthesis of findings. Students will also learn the intricacies of academic writing, argument construction, and effective communication of results. Throughout the course, students will receive personalized mentorship and feedback, ensuring a scholarly, well-structured, and impactful dissertation.

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Professional practice IV	PP4	5	-	-	-	12

Course description (Syllabus): This course is designed to bridge the gap between academic knowledge and real-world professional practice. The first part of the course introduces students to the core principles of professional ethics, communication, and project management, essential for a successful career in any field. The second part emphasizes practical aspects of professional life, including teamwork, problem-solving in a professional setting, and navigating the complexities of the workplace. Students will engage in interactive workshops and case studies, equipping them with the skills and insights needed to excel in their future careers.