Transilvania University of Braşov, Romania

Study program: Motor vehicles and future technologies

Faculty: Mechanical engineering
Study period: 2 years (master)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical methods applied in engineering	MNAI	5	2	-	1	-

Course description (Syllabus): applied optimization methods; tire parametrized model; vehicle brake parametrized models – implementation and simulation; gear and propulsion systems parametrized modeling issues; vehicle-road interaction modelling issues – different scenarios; vehicle impact simulation issues.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Project management	MP	5	1	1	-	1

Course description (Syllabus): This course presents the main aspects regarding the environment of industrial and research projects, as well as the theoretical and practical aspects of project management, its main areas. The students will be able to identify and use the specific elements, tools and techniques for elaborating, implementing and monitoring an industrial and research project.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Materials and technologies in the automotive industry	MTNIA	5	2	-	2	-

Course description (Syllabus): Designing constructive solutions to ensure the fulfillment of the functional requirements of motor vehicles; Operation with fundamental concepts in the field of engineering sciences; Design and application of maintenance technologies for road vehicles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modeling and finite element analysis	MAEF	5	1	-	-	2

Course description (Syllabus): The discipline of the Modeling and Finite Element Analysis aims at advanced geometric modeling, finite element modeling and the analysis of the behavior of machine components and mechanical systems under various operating conditions.The principle of the finite element method, the steps to solve a problem using the finite element method, general considerations on the choice of elemental elements, meshing domain analysis for continuous structures, obtaining finite element numerical model. Calculation methods of engineering structures. Using finite element method in engineering. Physical and Engineering Opportunities limits. Basis of the theory of elasticity: tension, displacement fields and strain states; Laws of behavior / criteria limits of elasticity: Tresca criterion, Von Mises criterion. Mechanical Fundamentals of finite element method. Equilibrium equations. Laws of behavior. Approximation by finite elements. The finite element method in elasticity, led by displacement calculation, deformation tensor, vector efforts, the element stiffness matrix. Types of finite elements and criteria of their choice. Practical problems using the finite element method. Interpretation of finite element analysis results.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The life cycle of automotive systems	CVSA	5	1	-	2	-

Course description (Syllabus): Familiarity with the methods of establishing and simulating the life cycle of motor vehicle systems; To know the statistical distributions used in the calculation of the life cycle of the vehicle systems; Problem analysis, realization of structural reliability schemes, calculation of life cycle specific indicators; Basic concepts; Life cycle distributions; Methods for estimating parameters; Limits of trust; Results and charts.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Automotive CAD-CAE-CAM	DFCI	5	1	-	2	-

Course description (Syllabus): Design of manufacturing technologies for road vehicles; Designing constructive solutions to ensure the fulfillment of the functional requirements of motor vehicles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
System simulation in automotive engineering	SSIA	5	2	-	-	1

Course description (Syllabus): Introduction (the process of product development, virtual prototyping, computer assisted engineering, software tools), The kinematic model (the position of an object in the plane, modifying the coordinate system, absolute/ relative coordinates, generalized coordinates, degrees of freedom, constraints, restrictions, speed and acceleration, solving nonlinear equations of the kinematic model, multi-body algorithm for kinematics), The dynamic model (dynamic model of rigid body systems, mass and mass distribution, elastic forces and damping, the dynamic model, the equation of motion of body systems, Lagrange's multipliers, numerical integration of motion equations, inverse dynamics, equilibrium), Commercial software such as MSC ADAMS (automatically generate and solve equations by commercial MBS programs).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
New solutions for internal combustion engines	SNMAI	5	2	-	1	-

Course description (Syllabus): reduction of gas-dynamic losses; increasing the efficiency of the motor cycle; reducing mechanical losses; minimizing the power required for the operation of the auxiliary systems; reducing the masses of the components of the engine mechanism; automation of the engine systems; designing the auxiliary systems that perform efficiently, ensuring the efficient use of future fuels.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The modern conception of vehicles	CMA	5	2	-	1	-

Course description (Syllabus): In-depth training of students for the use of modern methods of analysis, synthesis and validation of motor vehicles, especially special vehicles. Modeling and simulation of the subassemblies and the vehicle; Design of the reliability of the subsystems and of the vehicle assembly; Validation of solutions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optimizing the processes of forming the fuel mixture and of combustion	OPFAA	5	1	-	1	1

Course description (Syllabus): Analysis of the intake process in the internal combustion engine. Carrying out the swirl of the fresh charge upon intake process. Engineering design of the intake manifold. Intake process analysis. High-performance injection solutions. Injection modulation. Modeling of injection equipment components. Analysis of the interaction fuel jet - air vortex. Flow characteristics through the inlet valve. Analysis of the combustion chamber surface / volume ratio. Formation of the fuel mixture in the engines with unitary or divided chamber. Engines with stratified mixtures and with homogeneous mixtures. The peculiarities of combustion processes into CI and SI engines. Analysis of the factors that influence the mixing and combustion processes. Design of combustion chambers of internal combustion engines. Analysis of the combustion process and emissions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Procedures for design and testing of vehicles and mobile equipment	PTVSA	5	1	-	1	1

Course description (Syllabus): The main objective of the course is to deepen the methods of testing the systems of motor vehicles and mobile equipment. Students will become familiar with the use of sensors, translators and measuring equipment, with the acquisition and processing of experimental data; Various methods, equipment and stands for testing and validation of different vehicle systems will be developed; Some functional models will be made and various components of the vehicles will be tested.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermal management and energy recovery in internal combustion engines	MTREM	5	2	-	2	-

Course description (Syllabus): 1. Description of thermal energy transfer, mixture formation and burning within internal combustion engines; 2. Method assimilation for simulating and experimental research of the combustion processes within CIE and SIE; 3. Particularities presentation of combustion engine processes of the 4 stroke and supercharged engines; 4. Modern supercharger systems; 5. Energy recovery systems; 6. Studying how to optimize the energy recovery in order to increase performance of the internal combustion engines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Active and passive safety systems	SSAP	5	2	-	2	-

Course description (Syllabus): It aims to present the special problems related to the operation of the safety equipment of the vehicles. They are studied the ways of obtaining the active and passive safety, the limits of use the equipment and control mode. The correlations between the subsystems, the design aspects, the functional optimization and the operating performances are monitored.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Future fuels	CombV	5	2	-	1	-

Course description (Syllabus): The course has as main objective the students' knowledge of the current tendencies regarding the evolution of motor fuels, the correlation of their properties with the modifications made to the internal combustion engines, especially with the complex systems for reducing the chemical pollution. Knowing of the interdependencies between fuel type and consumption, pollutant emissions, operating conditions of the vehicles.

Course title	Code	No. of credits	Number of hours per week			
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Environment protection and recycling of vehicle components	PMRCA	5	2	1	-	-

Course description (Syllabus): Strategies applied to the sustainable development of vehicles; Sources of air, water and soil pollution; Strategies for reducing greenhouse gas emissions (CO2, CH4, etc.); Concepts of energy and environmental assessment of fuel use (WTT, WTW analysis, etc). Propulsion systems alternative; Regulations regarding the recycling of complex industrial products (Hybrid-electric, electric. Etc.); Management of recycling car components.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Auxiliary systems of internal combustion engines	SAMAI	5	2	-	-	2

Course description (Syllabus): The auxiliary systems of the current internal combustion engines have a decisive role in: reduction of gas-dynamic losses; increasing the efficiency of the motor cycle; reducing mechanical losses; reducing the masses of the components of the engine mechanism; automation of engine systems; reducing vibration and noise during the powertrain operation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Utility vehicles and tractors	ACT	5	2	-	-	2

Course description (Syllabus): Construction calculus and design principles of communal vehicles; Construction calculus and design principles of tractors transmission and equipment (three-point hitch lift, PTO); Determining economical and traction performance for tractors; Particular items regarding test methods for tractors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engine testing and homologation	TOM	5	2	-	1	-

Course description (Syllabus): Testing rigs and equipment for internal combustion engine's measurements. Measuring displacements using inductive and capacitive potentiometric transducers Measuring speeds with various technical solutions of speedometers.Transducers for measuring pressure, fluid speeds and temperatures. Equipment for measuring fluid flow and fuel consumption. Equipment for assessing emissions, particulates and smoke fumes. Measurement of the air rotation motion in the cylinder and of the pressure drop within the inlet manifold. Homologation of internal combustion engines for motor vehicles: definitions, classification, regulations. Homologation certificates for vehicles. Romanian standards, European regulations and SAE regulations for the internal combustion engine's homologation.

Course title	Code	No. of credits	Number of hours per week			
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Special vehicles	ASPEC	5	2	-	1	-

Course description (Syllabus): Acquiring the knowledge and training on special vehicles; calculation, construction, modeling and evaluation of the performance of special vehicles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Vehicles with alternative propulsion systems	ASPA	5	1	-	1	1

Course description (Syllabus): This course gives an overview of state of the art on cars alternative propulsion systems. It covers a description of components, system architectures and operation. The course also considers the modeling and simulation of these system sand at the end of the course, students should be able: to know the basics principles, components and operation of alternative propulsion systems to model and simulate the performance of these systems.

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Intelligent systems in motor vehicles	SIA	5	1	-	1	1

Course description (Syllabus): The goal of the course is to introduce students to the various technologies and systems used to implement advanced driver assistance systems. The basics of automotive electronics, fundamentals of electronic control systems, and the evolution of these systems is also introduced.
The course learning outcomes are that the students: Understand the rational for and evolution of automotive electronics; Understand which automotive systems have been replaced by electronic control systems and the advantage of doing so; Understand the fundamental theory of operation of electronic control systems; Understand the basics of sensors and transducers; Become familiar with the various types of advanced driver assistance systems; Understand the concept of remote sensing and the types of sensor technology needed to implement remote sensing; Understand the fundamentals of on-board vehicle networks.

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Academic ethics	EU	52	-	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.