

Transilvania University of Braşov, Romania

Study program: Automotive Engineering (in English)

Faculty: Mechanical Engineering

Study period: 4 years (bachelor)

1st YEAR

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Descriptive Geometry	GDe	4	2	-	2	-

Course description (Syllabus): Introduction; Projecting a point on two and three planes of projection; Projecting a straight line; Graphic representation of the plane; The methods of the descriptive geometry; Polyhedrons; Solids of revolution; The sphere; Intersections of solids.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	ANAMe	5	3	2	-	-

Course description (Syllabus): SEQUENCES OF REAL NUMBERS (sequences of real numbers, limits, properties); SERIES OF REAL NUMBERS (series of real numbers, convergence/divergence of series, Cauchy's theorem, Cauchy's condensation theorem, series with non-negative terms, Leibniz's alternating series theorem, convergence criteria); CONTINUOUS FUNCTIONS (limits of functions $f : E \subset \mathbb{R} \rightarrow \mathbb{R}$, properties of limits, the continuity of functions of one real variable; properties of continuous functions. Extensions to the case of functions $f : E \subset \mathbb{R} \rightarrow \mathbb{R}^m$, $f : E \subset \mathbb{R}^n \rightarrow \mathbb{R}$ and $f : E \subset \mathbb{R}^n \rightarrow \mathbb{R}^m$); DIFFERENTIABLE FUNCTIONS (differentiability of functions $f : E \subset \mathbb{R} \rightarrow \mathbb{R}$, properties of differentiable functions, Rolle's, Lagrange's and Cauchy's theorems. Higher order derivatives, Taylor's formula and applications. Extension to the case of functions $f : E \subset \mathbb{R}^n \rightarrow \mathbb{R}^m$: partial derivatives, Schwarz's theorem, higher order partial derivatives, Taylor's formula and applications); INTEGRABLE FUNCTIONS (Riemann integral: definition, computation methods, properties. Antiderivatives, the fundamental theorem of Calculus. Line integrals: definitions, properties, applications. The double integral: definition, properties, its relationship to the line integral (Green's theorem), applications. The surface integral: definitions, properties, applications. The triple integral: definitions, properties, its relationship to the surface integral (Gauss's divergence theorem and Stokes's theorem), applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied Computer Science	INFAe	5	2	-	2	-

Course description (Syllabus): Introduction: computer system architecture and operating system concepts; Word Processor: Microsoft Word, desktop publishing concepts, basic commands and operations, working with tables, working with long documents; Microsoft Excel, working with cells, normal operations in spreadsheet, formulas and functions, using graphs and diagrams; The Microsoft PowerPoint, creating presentations, formatting text, tables and images, graphs and organizational charts drawing objects.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical Drawing and Infographics - I	DTIe	4	2	-	2	-

Course description (Syllabus): Introduction. Drawing standards; Graphic representations used in technical drawing; Sectional views and sections; Dimensioning; Representation of the machine parts and components. Designation of surface characteristics. Limits of size. Assembly drawing

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physics	FIZIe	4	2	-	1	-

Course description (Syllabus): Introduction; Kinematics and dynamics of the material point; Mechanical oscillations; Mechanics of continuum medium; Thermodynamics and statistical physics; Electricity and magnetism; Optics; Structure of matter. Elements of quantum physics

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Programming and Programming Languages	PCLPe	5	2	-	1	-

Course description (Syllabus): Introduction; Programming languages and GUI; Buttons, Menu, Tools bar (simple controls); Advanced controls; Design and 2D animation; Data bases; Debugging programs; Complex programming; Project management

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Communication	COMe	3	1	1	-	-

Course description (Syllabus): Documentary informing in the library within the university; Introduction to communication; Communication within the group; Verbal communication; Non-verbal communication; Written communication; Expression skills

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics – I	MEC1e	5	3	1	1	-

Course description (Syllabus): Introduction, principles of mechanics, fundamental notions, history; Statics of the Material Point; System of Forces, Screw; Gravity (Mass) Center; Statics of the Rigid Body; Friction; Statics of Mechanical Systems. Truss Systems; Technical Applications of the Statics; Analytical Mechanics

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical drawing & Infographics– II	DT2e	4	2	-	2	-

Course description (Syllabus): Introduction in AutoCAD: About drawing in AutoCAD. Screen Layout. Drawing visualization. Creating views and slides; Creating drawings. Type of coordinates. Drawing aids. Fixing the limits and units. Interrogations; Object properties. Changing properties; Layer functionality. Creating layer structure. Associating objects to a layer; Drawing items. Drawing simple items. Drawing complex items; Modifying items. Selection modes. Modifying simple items. Modifying complex items; Block creation and editing. Defining attributes. Block and attributes inserting. Attributes editing; Hatch creation and editing. Text creation and editing. Text Style. Annotations; Dimensioning. Dimension Styles; 3D visualization. Systems of coordinates WCS and UCS. Elevation and Thickness. Surfaces and Objects

2nd YEAR

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics – II	MEC2e	6	2	2	2	-

Course description (Syllabus): Particle Kinematics; Rigid Body Kinematics; Relative Motion of a Particle; Basic Concepts in Dynamics; Main Theorems in Dynamics; Forces of Inertia; Rigid Body Dynamics

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Engineering		4	3		2	

Course description (Syllabus): Introduction; Direct-Current Circuits: Elements, symbols, electric diagrams, Ohm's Law, Kirchhoff's Laws, Work, Energy and Power in DC, series-parallel connections, Superposition theorem; Sinusoidal AC Circuits; Three Phase Circuits; Magnetic Circuits; Transformers; Signals, Analog and Digital. Modulation and Demodulation. A/D, D/A Converters; Semiconductors, Diodes and Power Supplies. Transistor Fundamentals. FET-MOSFET fundamentals. Logic gate. Common Source Amplifiers. BJT fundamentals. The NOT logic gate. The common Emitter Amplifiers; Small signal amplifiers. Integrated circuits; Power Electronics. Rectification. Single phase bridge inverter. 3 ph bridge inverters: PAM, PWM.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Industrial Management	MNGIe	4	2	1	-	-

Course description (Syllabus): Management functions; Conflicts; The variables for success; Working with executives; Planning; Pricing and estimating; Cost control; Risk management; Quality management; Managing crisis projects.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of Materials – II	RM2e	4	3	1	1	-

Course description (Syllabus): Failures Theories; Deflections of Beams under Transverse Loading; Stress under Compound Loads; Curved Beams; Energy Methods for Linear-Elastic Displacements Calculus; Indeterminate structures; Stability of Structures; Dynamic Loads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine Elements – I	OM1e	4	2	-	1	1

Course description (Syllabus): Introduction (object; place in development of mechanical engineer; history of calculation and construction of machine elements; evaluation; references, general consideration on design of machine elements). Joints (screw joints and screw transmissions; feather and key joints; spline joints; pins and bolts, safety rings; profiled joints; fit joints). Springs (elastic characteristics, helical cylindrical compression spring; helical cylindrical traction spring; helical

cylindrical torsion spring; torsion bar spring; plane spiral spring, leaf springs, disc spring, rubber spring). Gears (materials; tooth failure; spur gear; helical and gears; straight and curved bevel gears; permissible stress; gear forces). Gear transmissions (gear ratios, forces in speed reducers).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tolerances and Dimensional Control	TCDDe	3	2	-	1	-

Course description (Syllabus): Mechanical instruments for measurements. Optical instruments for measurements. Limits and fits for cylindrical smooth parts. Surface texture measurements. Geometric dimensioning and tolerancing. Tolerances and fits for part threads. Tolerances and fits for gear pairs. Tolerances and fits for keys and splines. Angle measurements. Pneumatic gauging. Measuring machines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special Mathematics and Statistics	MSSMe	4	2	2	-	-

Course description (Syllabus): Differential equations. Differential systems. First-order partial differential equations. Vector field theory. Theory of complex functions. Applications. Laplace transformation. Applications. Fourier series. Equations of mathematical physics. Probability and statistics.

3rd YEAR

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermodynamics and Heat Engines	TMTe	5	2	1	2	-

Course description (Syllabus): Thermodynamics. Fundamental measures. First principle of thermodynamics. Ideal gas. Mixture of ideal gases. Ideal gas state transformations. Second principle of thermodynamics. Thermodynamic cycles. Entropy. Fuel combustion. Internal combustion engines. Reciprocating compressors. Gas turbine installations. Heat transfer. Conduction, convection, radiation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Vibrations	VIBRe	5	2	1	1	-

Course description (Syllabus): Elastic elements and damping elements. System representation (mathematical model). Systems with one degree of freedom. Systems with two degrees of freedom. Systems with multiple degrees of freedom. Approximate methods used to study discrete systems. Introduction to finite element method used for vibrations study. Continuous systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine Elements – II	OM2e	5	2	-	1	1

Course description (Syllabus): Shafts (stresses and cycles; forces; calculations). Couplings and clutches (classification; permanent rigid couplings; mobile couplings; elastic couplings; clutches). Tribology and sleeve bearings (friction; usage; lubricants; constructions – body, sleeves; hydrodynamic bearings; bearings with limit friction). Ball and roller bearings (kinds of bearings; failures; calculation; ball and roller bearing mountings). Sealing devices. Chain drives (constructive types; geometric calculation, kinematic elements; contact calculation; maintenance). Belt drives (constructive types; geometric calculation, kinematic elements; forces and stresses; traction diagram, strength calculation, maintenance). Friction drives. Variable speed drives (failures, calculation).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Vehicle Dynamics – I	DA1e	5	3	-	2	-

Course description (Syllabus): Introduction. Vehicle – environment interaction. Rolling system. Wheel – ground interaction. Road loads (rolling, grade and aerodynamic resistances). Ground reactions. Tractive performances of motor vehicles. Braking requirements and performances. Fuel efficiency and pollution. Electric and hybrid vehicles principles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Processes and Characteristics of Internal Combustion Engines - I	PCM1e	5	2	-	2	1

Course description (Syllabus): Engine Types and their Operation. Operating parameters and Engine Design. Ideal engine cycles. Gas Exchange Processes. Charge Motion within the Cylinder. Combustion in Spark Ignition Engines. Combustion in Compression Ignition Engines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Vehicle Dynamics – II	DA2e	4	2	-	-	2

Course description (Syllabus): Ride (vibration - sources, vehicle response, human perception; oscillations and noises; suspension models; transmissibility; influence of springs and dampers; passive, semi-active and active suspensions).

Cornering (lateral guiding force; pneumatic trail; cornering methods; steering kinematic conditions; steering corridor and off tracking; vehicle cornering attitude). Stability (transversal ground reactions; longitudinal and transversal stability; models for transient steering; suspension influences). Handling (rectilinear motion stability; driver behavior; handling influences generated by traction, braking, suspension, steering and aerodynamics). Dynamics particularities of two-wheeled, off-road and competition vehicles.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Construction and Calculus of Automotive Vehicles - I	CCA1e	5	2	-	1	1

Course description (Syllabus): Transmission and driveline layout and functions. Couplings (friction, visco, hydrodynamic). Gearboxes. Axle's final drives and hub-mounted drives. Cardan and constant velocity joints. Shafts. Differentials (open, locking, limited-slip, active and torque-vectoring). Transfer cases. Rigid axles. Wheel hubs. Wheels. Hydrodynamic and friction transmissions. Transmission and driveline automation. Hybrid propulsion systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Construction and Calculus of Internal Combustion Engines - I	CCM1e	4	2	-	2	-

Course description (Syllabus): Calculus of engine kinematics and dynamics. Engine balance. Design of cylinder block and cylinder head. Design of piston. Design of rings. Design of piston pin. Design of connecting rod. Design of crankshaft and bearings.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Aided Design	PACe	3	2	-	2	-

Course description (Syllabus): Framing aided design in engineering assisted. Current vehicle design requirements. Computer hardware and software features used in the design. Types of CAD models. Architecture and common features of CAD programs. Notions - CAE, Rapid Prototyping. Introduction to Pro / Engineer, graphical user interface, menus. Module drawings (sketcher): drawings, dimensioning, constraints. Solid modeling module (part modeling) work plan, defining selection and orientation of planes, model tree, extruded shapes, form of revolution, sweep, blend, shapes placed, copying forms, advanced forms. Module assembly, foundations, types of constraints

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Automatic Systems Bases	BSAe	3	2	1	1	

Course description (Syllabus): General theory of an automatic systems; block representations, conditions, time / frequency responses. Signals analysis, governors, tuning the command / execution systems. Automatic governors, characteristics, their response at different excitations. Management of the internal combustion engines. Chassis control.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Quality Assurance Methods	MACe	2	1	1	-	-

Course description (Syllabus): Contributing approach to quality. The ISO 9000:2006 specific terminology. The concept of quality products. Development of concept "quality" and related industrial practices. ISO 9000 family of standards. Requirements of the quality management system according to ISO 9001: 2008 standard. Audit in quality engineering. Specific development of quality management system, ISO / TS 1694

4th YEAR

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Construction and Calculus of Internal Combustion Engines - II	CCM2e	5	2	-	1	1

Course description (Syllabus): Design of gas exchange system. Design of fuelling system. Design of cooling system. Design of lubricating system. Design of supercharging system. Design of exhaust gas treatment device.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Processes and Characteristics of Internal Combustion Engines - II	PCM2e	5	2	-	1	1

Course description (Syllabus): Air pollution. Regulatory test procedures and limits of emission. Test equipment. Mechanisms of pollutant formation in engines. Influence factors of pollutant formation. Active methods of pollutant reduction. Passive methods of pollutants reduction.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Construction and Calculus of Automotive Vehicles - II	CCA2e	5	2	-	1	1

Course description (Syllabus): Suspension system (steering geometry; suspension linkages for independent, dependent and semi-dependent wheels; elastic elements; dampers; semiactive and active suspensions). Steering system (cornering methods; steering angles correlation mechanisms; actuation mechanisms; assistance modalities; active steering). Braking system (requirements; brakes; actuation subsystems). Bodyworks for cars and buses. Frames, cabins and bodyworks for trucks. Fundamentals of passive and active safety systems. By-wire driving systems. Special vehicles particularities.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite Element Method	MEFe	5	2	-	2	-

Course description (Syllabus): Introduction. The principle of the finite element method. The steps to solve a problem using the finite element method, shape functions, general considerations on the choice of elemental elements, meshing domain analysis for continuous structures, obtaining finite element numerical model. Using finite element method in engineering. Physical and Engineering Opportunities limits. Laws of behavior / criteria limits of elasticity. 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. Influence of mesh, test case. Steps finite element analysis and flowchart solving process. Interpretation of finite element analysis results.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Marketing	MARe	2	1	1	-	-

Course description (Syllabus): Definition of marketing. Development and specialization. Marketing concept. Characteristics of contemporary marketing. Emergence and evolution of marketing. The marketing environment. Market segmentation. Product positioning. Product strategies. Product concept. Product life cycle. Product portfolio (B.C.G.). Price policy. Pricing strategies. Distribution strategies. Distribution channels. Promotion strategies. Types of promotion.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electric and Electronic Systems for Automotive Vehicles	SEEAe	3	2	-	2	-

Course description (Syllabus): Introduction. Electricity Supply System (alternators and charging circuits; batteries). The Starting System. Electronic Engine Management of the Otto Engine (ignition systems; electronic devices for fuel control). Electronic Engine Management of the Diesel Engine. Active Safety Systems. Passive Safety Systems. Other Electronics Systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Road Traffic Management	TRAFe	3	2	-	1	1

Course description (Syllabus): Traffic management principles. Mathematical instruments for traffic flows. Human factor in the road traffic system. Geometric design of roads. Describing the motion of the individual vehicle. Basic parameters of road traffic. Intersection design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fuels	COMBe	3	2	-	2	-

Course description (Syllabus): Fuels –Definitions, classification. Characteristics of automotive fuels. Conventional automotive fuels. Main refinery processes. Petrol fuel. Characteristics. Diesel fuel. Characteristics. Gaseous fuels. Natural gas. Liquefied petroleum gas. Hydrogen. Reformulated fuels. Renewable fuels.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Manufacturing and Assembling Technologies for Automotive Vehicles	TFAe	3	2	-	1	1

Course description (Syllabus): Fundamentals in cutting. Turning. Drilling. Reaming and threading. Grinding. Milling. Broaching. Finishing operations. Planning, shaping and sawing. Gear manufacturing. Non-traditional machining processes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special Automotive Vehicles	ASe	3	2	-	1	1

Course description (Syllabus): Classification of special destination vehicles. Generalities. Determination of tractors traction performances. Traction characteristics of tractors. Applications on tractors with wheels and tracks. Construction

and calculation of tractors power take offs and suspension mechanisms. Industrial tractors. Construction and calculation elements of working equipment: bulldozers, graders, scarifiers, scrapers, excavators.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hybrid-Electric Vehicles	AHEe	3	2	-	2	-

Course description (Syllabus): Introduction. Hybrid Systems, Fuels, Engines and Power Units. Fuel Efficiency, Economy and Distribution. Development of Batteries and Battery Electric Vehicles. Hybrid Electric Vehicles. Plug-in Hybrid Electric Vehicles (PHEVs). Life Cycle Analysis. Emissions. Environmental and Health Effects. Regulatory and Policy Frameworks Promoting Electric and Hybrid-Electric Vehicles. Short- and Long-term Development.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Life Cycle Analysis of Vehicle Components	ACVAe	2	2	-	1	-

Course description (Syllabus): Introduction. Product lifecycle. Lifecycle stages. PLM – Goal and Scope. Lifecycle inventory. Lifecycle impact assessment. Lifecycle Interpretation. Results Interpretation. LCA studies and usage. Environmental impact.