Transilvania University of Braşov, Romania

Study program: Mechanical Engineering (in English)

Faculty: Mechanical Engineering
Study period: 4 years (bachelor)

1stYear

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

Course description (Syllabus): Theory of real numbers; Theory of number series and power series; Derivatives and differentials of a functions of several variables (partial derivatives of a function of several variables, the differentiability of a function of several variables); Line integrals (the line integrals of the first kind and the line integrals of second kind); Double and triple integrals (the double integral in rectangular cartesian coordinates, expending a double integral in polar coordinates, the Green formula, the Stokes formula, The Gauss – Ostrogradsky formula).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Descriptive Geometry	GD	5	2	-	2	-

Course description (Syllabus): Topics include: Basic Concepts of 3-Dimensional Descriptive Geometry Points; Projection Planes; Orthographic Projection; Views; Auxiliary View, Lines in 3-Dimensional Geometry, Intersecting lines; Skewed lines; Parallel lines; Perpendicular lines; True Length of a line, Planes in 3-Dimensional Geometry, Representation; Points and lines on a plane; Dip of a plane, Spatial Relations of Lines and Planes, Examples—line parallel to plane; distances between lines, between planes; piercing point of line and plane; line of intersection; dihedral angle; visibility, The methods of the descriptive geometry. Method of replacing projection planes; method of revolution; Solids and Surfaces; Basic techniques for locating points, piercing points, and tangent planes for common solids —prisms, pyramid, cone, cylinder, sphere; Development of surfaces; Planar unfolding of common solids, and solids with warped surfaces; Intersection of geometric surfaces and solids.

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

Course description (Syllabus): Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest for Traffic and Transport Engineering: Understand the molecular structure and properties of chemical substances in describing and solving real technological problems; Demonstrate quantitative problem solving skills in many aspects of chemistry, including solutions and properties of solutions, metals and corrosion, electrochemistry, polymers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Materials Science and Technology I+II	STM	6	4	-	2	-

Course description (Syllabus): Structure and properties of metallic materials; Theory of alloys, the main types of equilibrium diagrams; Fe-C alloys - structure, properties, fields of use, symbolizing principles; Steel applied thermophysical and thermochemical treatments; Alloyed steels - symbols, specific heat treatments, fields of use; Heavy, semi-light and light alloys - structure, properties, fields of use, symbolism principles; Extractive metallurgy,

ferrous and nonferrous alloys preparation; Execution of parts by casting processes; Elaboration of metals and alloys through plastic deformation; Metal materials welding and unconventional processes related to welding.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied informatics	INFA	5	2	-	2	-

Course description (Syllabus): 1. Introduction. Motivational course. 2. Presentation of MS Office - Excel. 3.Presentation of MS Office - Word. 4.Presentation of MS Office - PowerPoint, Outlook, Access, OneNote. 5.Matlab. Introduction. Interface. Generalities. 6.Type of variables. Arithmetic operations with Matlab. Built-in function. 7.Arrays – Creating, Addressing, managing data. Built-in function. 8.Mathematical operations. Built-in function. Random numbers. 9.Script Files. The interaction of the user with Matlab trough command window. 10.Bidimensional and tridimensional plots. 11.Curve fit, Interpolation. 12.User-defined functions. 13.Numerical solving of integrals and differential equations

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Communication and ethics	COM	3	2	1	-	-

Course description (Syllabus): Communication - the basic instrument of social dialogue. Communication features. Communication and language. Verbal and nonverbal communication. Postural and gestural communication. Barriers in communication. The instruments of looking for a job approach. Curriculum Vitae (resume) – Overview. The instruments of looking for a job approach. Cover letter – Overview. Interview. Communication and negotiation. Rules of communication using e-mail services. Anatomy of the scientific article - types of studies and articles, and their components. Critical analysis of scientific articles. Bibliography. Scientific poster and oral presentation. Scientific writing for the general public: blog articles, newspaper / magazine articles. How to avoid plagiarism. Methods of research and identification of steps in writing a scientific paper.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language English I	LE01	2	1	1	-	-

Course description (Syllabus): This course introduces students to the main issues of English grammar. The main aspects are verb tenses, nouns, adjectives, pronouns, articles, adverbs but also the development of the vocabulary. Moreover, this course also deals with articles, reports and all sorts of essays in the field of transport engineering.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language English II	LE02	2	1	1	-	-

Course description (Syllabus): This course continues the course in the first semester and bases itself on it. The second semester deals with more focused issues, like Working in Industry, A Tour of the Workplace, Tools and Equipment, Suppliers and Sub-contractors, Buildings and Installations and Troubleshooting.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language French I	LF01	2	1	1	-	-

Course description (Syllabus): The noun, the article, the adjective, the pronoun, the numeral, the verb, the adverb. At the seminars, students work on French vocabulary and grammar, and on incorporating new items into their speech and writing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language French II	LE02	2	1	1	-	-

Course description (Syllabus): Oral presentations of the French mentalities; history and heritage; cross-cultural communication; traveling the world; meetings and discussions; French culture and traditions; listening and writing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linear Algebra, Analytical and Differential Geometry	AGAD	5	2	3	-	-

Course description (Syllabus): 1. Linear algebra and free vectors; 2. Analytic geometry in space; 3. Conics and quadrics; 4. Generated surfaces (cylindrical, conical and of rotation); 5. Plane curves and curves in space; 6. Surfaces.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical Drawing and Infographics I	DT01	5	2	-	2	-

Course description (Syllabus): General standards used in technical drawing: lines, scales, technical writing, layouts formats used in technical drawing; orthographic projection, orthographic projections and pictorial views, sections and sectional views, dimensioning, screw threads, screw fasteners and locking devices; keys; conventional representation of common features: flats and squares on shafts, gears, machining and surface texture symbols; isometric drawing; representation of assembly drawing of machine parts and components.

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

Course description (Syllabus): Principles and fundamental laws of mechanics; Oscillatory motion and elastic waves; Postulates and fundamental principles of thermodynamics; Electromagnetic field, Maxwell–Lorentz equations and electromagnetic waves; Optics. Photometry and wave optical phenomena; Fundamentals of quantum mechanics with application to atomic physics; Lattice and crystalline structures, state of electrons in crystalline structure and physical properties of solids; Structure of nucleus, nuclear radioactivity, nuclear energy and protection against nuclear radiation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics I	MEC1	5	3	1	1	-

Course description (Syllabus): Mechanics and especially the part dedicated to Statics is for an outstanding importance, both due to its practical applications – that have been approached during the seminar and lab – and through the contribuition at the understanding of some essential notions in the study of the systems evolution in time. Within this part, they will study Sistems of forces, Centres of mass, Equilibrium of a rigid body, Equilibrium of a rigid multibody system, System of trusses, Statics of a rigid body subjected to friction, Simple machines and applications.

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

Course description (Syllabus): Knowledge of specific programming structures within Matlab: 1. Introduction. 2. Matlab basics – revision. 3. Arithmetical, logical and relational operators Order of precedence. 4. Conditional statements: if-end; if-else-end; if-elseif-else-end. 5. Loops: for-end; while-end. Nested Loops. 6. Graphical User Interface. Types of objects and their corresponding properties. Design phase. Script, Callback functions. 7. Dialog boxes. 8. Compiling an application. Generate the executable file.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electrical Engineering and Electrical Machines	ELME	4	2	-	1	-

Course description (Syllabus): Introduction. Direct-Current Circuits: Elements, Symbols, Electric Diagram, Ohm's Law, Kirchhoff's Laws, Work, Energy and Power in DC, Series-Parallel Connections. Sinusoidal AC Circuits. Complex Numbers. DC and AC Applications Circuits. Single-Phase Transformers. Three-Phase Transformers. Autotransformer. Asynchronous Machines: Components, Operating mode, Characteristics. Synchronous Machines: Components, Operating mode, Characteristics.

2ndYear

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
General Economics	ECON	3	1	1	-	-

Course description (Syllabus): The market economy. Supply and demand model and the role of prices. 2. Competition and the invisible hand. 3. Monopoly and other forms of imperfect competition. 4. The economics of public policy. 5. Measuring economic activity: GDP and unemployment. 6. Measuring the price level and inflation. 7. International trade and capital flows.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical Drawing and Infographics II	DT2	5	1	-	3	-

Course description (Syllabus): AutoCAD fundamentals; Introduction and basic commands; AutoCAD environment; create objects commands; view objects; drawing aids; graphical screen administration; objects selection; edit/modify objects; Cartesian coordinate system; layers, line-type, properties; text writing and editing; blocks and attributes; hatch generation and editing; dimensioning; advanced editing techniques in AutoCAD.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics II	MEC2	6	3	2	1	-

Course description (Syllabus): Kinetics is a part of mechanics that describe the motion of the bodies without reference to the forces which either modify the motion or are generated as a result of the motion. Within this part, they will study Kinematics of particles, Kinematics of a Rigid Body , Complex motion. Mobile Coordinate Systems, Work, Energy, Momentum and Moment Momentum, Dynamics of a Particle, Dynamics of Rigid Multibody Systems, Selected Topics in Analitical Mechanics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of materials I	RM1	6	2	2	2	-

Course description (Syllabus): 1.Introduction. Fundamental concepts. 2.Internal Forces. 3. Moments of inertia. 4.Strength of Materials Basic Assumptions. 5. Fundamental Concepts of the Theory of Elasticity. Displacements, stresses and strains. 6. Axial loading. 7. Conventional Shear Calculus. 8. Torsion. 9.Bending of the beams.

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

Course description (Syllabus): Differential Equations with constant coefficients. Fields theory. The theory of complex functions. Fourier series. Laplace Transform. Elements of mathematical statistics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Electronics Applied	ELEA	4	2	-	1	-

Course description (Syllabus): 1.Passive circuit components: R,C,L; 2.Semiconductor devices: Diodes, Transistors, Thyristors; 3. Power supplies, rectifiers, stabilizers; 4.Electronic amplifiers and operational amplifiers; 5.Logic circuits and digital circuits; 6.Microprocessors and microprocessor systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language English III	LE03	2	1	1	-	-

Course description (Syllabus): This course focuses upon the tenses that are frequently used in English, like Present Simple and Present Continuous, Past Simple and Past Continuous, Past Perfect, Future and also on the sequence of tenses. Also, the seminar deals with issues like vehicle safety, resistance, dealing with clients and statics and dynamics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language English IV	LE04	2	1	1	-	-

Course description (Syllabus): This course uses all knowledge previously acquired in order to tackle upon issues like Electrotechnology, Automatic Systems, Gear Systems, Fluid Mechanics, Pneumatics, Hydraulics and Power Generation. Moreover, the course also focuses on Engineering Design, Corrosion, Motor Selection, Computer Aided Design, Technical Plant and Applying for a Job.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language French III	LE03	2	1	1	-	-

Course description (Syllabus): The course aims to improve the students` ability to understand and reproduce relevant linguistic structures; the ability to express themselves effectively in writing and in speech, the ability to apply creatively the knowledge acquired in college in different professional situations (the use of specialized terminology).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign Language French IV	LE04	2	1	1	-	-

Course description (Syllabus): The course aims to improve the students` ability to understand and reproduce relevant linguistic structures; the ability to express themselves effectively in writing and in speech, the ability to apply creatively the knowledge acquired in college in different professional situations (the use of specialized terminology).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical Methods	MNUM	3	2	-	2	-

Course description (Syllabus): Introduction to Numerical Methods. Numerical Methods for non-linear equations. Numerical Methods for systems of linear equations (analytical methods, Gauss's method, Jacobi's and and Gauss-Seidel's methods, LU factorization). Interpolation, regression, approximation of functions. Numerical differentiation and integration. Numerical Methods for differential equations and systems of differential equations (ODE's)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fluids Mechanics and Hydraulic Machines	MFMH	4	2	-	2	-

Course description (Syllabus): 1. Introduction. 2. Parameters and properties that define the state of a fluid. 3. Dynamics of perfect fluids. 4. Turbulent flow of fluids. 5. Elements of dimensional analysis and similitude theory.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of materials II	RM2	5	3	1	1	-

Course description (Syllabus): 1. Failures Theories. 2. Deflections of Beams under Transverse Loading. 3. Stress under Compound Loads. 4. Curved Beams. 5. Energy Methods for Linear-Elastic Displacements Calculus. 6. Indeterminate structures. 7. Stability of Structures. 8. Dynamic Loads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanisms	MECS	5	3	-	1	1

Course description (Syllabus): Analysis and synthesis of mechanisms; Structure of mechanisms: elements, joint, degrees of freedom; Kinematic analysis of mechanism; Dynamic analysis of mechanisms; Synthesis of linkages; Gear: type, gear mechanisms, tooth parameters.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine Elements I	OM1	4	2	-	1	1

Course description (Syllabus): Developing fundamental knowledge of tribology and strength calculation of machine elements; Calculation of machine elements and specialized assemblies (bolts, wedges, grooves, studs, springs, couplings, shafts, bearings, plain bearings, gears, etc.); Develop knowledge of identification and recognition of machine elements; Using computing package for design; Developing the overall design and execution; Development of written documentation.

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

Course description (Syllabus): Mechanical instruments for measurement. 1.1 Direct length measurement with mechanical appliance. 1.2 The principles of comparative length measuremenmt. 1.3 High sensitivity indicators. Optical instruments for measurement. 2.1 Engineering microscopes. 2.2 Goniometric measuremenmts with the microscope. 2.3 Optical projectors. Limits and fits for cylindrical smooth parts. 3.1 International tolerance system for limits and fits (ISO 20286-1:1997). 3.2 General tolerances for dimensions. Surface texture measurements. 4.1 Surface roughness parameters. 4.2 Roughness and waviness. 4.3 Instruments for surface texture measurements. Geometric dimensioning and tolerancing. 5.1 Symbols for tolerances of position and form. 5.2 The concept of roundness. 5.3 Associated parameters. Tolerances and fits for part threads. 6.1 Tolerances and fits for general thread parts. Tolerances and fits for gear pairs. 7.1 Tolerances for gears and gears pairs. 7.2 Deviations and tolerances for gears and gear pairs. Angle measurements. 8.1 Angle measuring system and techniques. 8.2 Measurement of cone shaped technical parts. Pneumatic gaging. 9.1 Principal elements and operations of pneumatic gaging systems. 9.2 Pneumatic instruments for measurement. Measuring machines. 10.1 Definition and general evaluation. 10.2 Industrial measuring technology applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technological Practical Placement	PT1	4	90 hours / semester			

Course description (Syllabus): The practical work proposes to familiarize the students with the real problematic from companies and to stimulate the appliance of the knowledge gained in faculty in the practical activity.

3rdYear

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermotechnics and Heat Machines	TMT	5	2	1	2	-

Course description (Syllabus): 1.Termodynamics. Fundamental measures. Thermodynamic systems. 2.First principle of thermodynamics for open and closed systems. Caloric equations of state. 3Ideal gas. Ideal gas state equation. Specific heat capacities. 4.Second principle of thermodynamics. Thermodynamic cycles. Enouncements of second principle of thermodynamics. Entropy. Carnot cycle. Entropy variation for ideal gas transformations. Irreversible transformations. 5.Thermodynamics of combustion . Combustion of the fuels defined through elemental composition. Combustion of the fuels defined through chemical formula. Heating values of the fuels. 6.Heat Engines. Internal combustion engines. Classification. Theoretical cycles of internal combustion engines. Reciprocating compressors. Ideal compressor. Technical compressor. Multi-stage compressors. Gas turbine installations. Theoretical cycles of gas turbine installations. 7. Heat transfer.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine tools and cutting	MUPA	3	2	-	1	-

Course description (Syllabus): 1. Classification of machinery and equipment for handling goods; 2. Design of the devices for handling goods; 3. Manipulation of goods conveyers; 4. Manipulation of goods by containers; 5. Manipulation of goods by palletized units.

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

Course description (Syllabus): 1. Introduction. 2. Elastic elements and damping elements. 3. System representation (mathematical models). 4. Systems with one degree of freedom. 5. System with two degrees of freedom. 6. System with multiple degrees of freedom. 7. Approximate methods used to study discrete systems. 8. Introduction to finite element method used for vibration study. 9. Continuous systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hydro-Pneumatic Drives	AHP	4	2	-	1	-

Course description (Syllabus): Introduction. The principle of operation of hydraulic systems. Hydraulic circuits. Basic equations used in hydraulics. Components of hydraulic circuits. Hydraulic transmissions. Using hydrostatic systems. ABS hydraulic system. ESP hydraulic system. Simulation of hydraulic systems (SIMULINK). Pneumatic basics. Simulation of pneumatic systems (SIMULINK).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Machine Elements II	OM2	5	2	-	1	2

Course description (Syllabus): This course introduces fundamental knowledge in design of mechanical transmissions and develops the ability to assembly and details design of mechanical systems The main chapters of course are: Gears (fundamental geometry, materials, loads, faults , cylindrical gears, bevel worm, gears Mdesign analysis); Shifts (structures, materials, faults, calculus models, shafts Mdesign analysis); Journals (structures, materials, faults, calculus models, shafts Mdesign analysis); Rolling bearings (types, calculus, arrangements); Sealing (structures and montages); Belts transmission (calculus, shafts Mdesign analysis); Chain Transmission (geometry, calculus models); Continuous rate transmission (geometry, calculus models, structures).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Elasticity and Plasticity	ELPL	5	2	2	-	-

Course description (Syllabus): Introduction in the theory of elasticity. Concept of stress. Stresses on oblique planes. Material behaviour/design concepts. Plane stresses and strains. Three-dimensional stresses and strains.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Experimental Methods in Mechanical Engineering	MEIM	3	2	-	1	-

Course description (Syllabus): 1. Consideration on the basics of the Theory of Elasticity involved in Experimental Methods. 2. Introduction on measuring techniques in engineering. 3. Basics on the classical Experimental Methods. 4. Classical extensometers (mechanicals, opto-mechanicals, optical, etc.). 5. Half-conductor transducers. 6. Inductive and piezo-electrical transducers. 7. Capacitive transducers' Conclusions concerning on advantages and limits of the analyzed methods.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite Element Method I	MEF1	5	2	-	2	1

Course description (Syllabus): Introduction. Displacements method applied to the double-hinged beam (in plane and in space). Energetically description of the FEM. Stiffness matrix calculation based on energetically method. Triangular element – plane stress state. Triangular element – plane strain state.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics of Composite Materials	MMC	5	2	2	-	-

Course description (Syllabus): Introduction. Manufacturing technologies of composite materials. Micromecanics of composite materials. Mechanics of composite material layer. Macro-mechanics and stiffness of the thin plate element made of composite material. Constitutive equations of the thin laminated composite plate with linear temperature variation in thickness. Failure theories for composite materials. Bending strength of composite laminated thin plates. Strength of composite bars subjected to tensile loading. Numerical modeling of composite materials. Mechanical test methods for composite materials. Effects of the environment on composite materials.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer assisted design (CAD/ CAM)	PAC	4	2	-	1	1

Course description (Syllabus): Introduction in CAD modelling. 2. Modelling of geometrical entities as line or surface. 3. Modelling of volume entities. 4. Assembly modelling. 5. Design parametrization. 6. Process data management. 7. Product manufacturing and cost estimation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Manufacturing technology	TEF	3	1	-	-	2

Course description (Syllabus): I. Fundamentals of the production process. I.1 Production process, manufacturing process. I.2 Technological process. I.3 Production types. I.4 Computer integrated manufacturing. II. Elements of technology. II.1. Calculus of machining allowance. II.2. Calculus of cutting regime (cutting depth, cutting feed, cutting speed). II.3. Setting-up the time standard.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tribology	TRIB	3	2	-	1	-

Course description (Syllabus): 1. Introduction (meaning of friction, lubrication and wear). 2.Lubricants (dynamic and kinematic viscosity, viscosity-temperature relationship, viscosity-pressure relationship, measurements, classification, types of lubricants and their description - mineral and synthetic oils, greases; additives). 3. Dry friction (surfaces topography of solids, model of contact, friction and wear). 4. Boundary and extreme pressure lubrication (model of adsorbtion on sliding surfaces, lubrication mechanism. 5. Hydrodynamic lubrication (Reynolds equation, applications in bearings, computation, pressure distribution, load capacity, friction, power loss). 6. Abrasive, erosive and cavitation wear. Fatigue wear (sliding, rolling).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O1) Vibration of machinery and equipment	VIMU	3	2	-	2	-

Course description (Syllabus): 1. Introduction. Dynamic processes in machinery. The dynamic machinery and equipment. 2. Workflow features. 3. Static and dynamic characteristics of mechanical elements. 4. Elastic structure of plant and machinery. 5. Stability machinery and equipment. 6. Methods and equipment for experimental investigation of the dynamic properties of machinery. 7. Improving the dynamic behaviour of machinery and equipment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O1) Vibroacoustic diagnosis of mechanical structures	DIAG	3	2	-	2	-

Course description (Syllabus): 1. General considerations. Mechanical vibration-physical phenomenon. Noise-physical phenomenon. Vibration-noise correlation. 2. Sources vibration propagation response. Vibration sources. Propagation mechanical vibration. The frequency response of mechanical systems. 3. Vibro-diagnosing operation status. Diagnosing vibration. Diagnosis by noise. 4. Modeling systems with lumped masses of machinery and equipment. Models with a degree of freedom. Models with two degrees of freedom. Models with more degrees of freedom. 5. Devices and measurement techniques. General scheme. Transducers. Preamps and calibration devices. Frequency analysis of vibrations and shocks. Time domain analysis. Amplitude domain analysis. 6. Vibroacustical diagnosis of machine parts. Diagnosis bearings. Diagnosis unbalance rotating parts. 7.Vibroacoustic diagnosis of machinery, plant and equipment.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O2) Fatigue of Mechanical Structures	OSM	3	2	1	1	-

Course description (Syllabus): Introduction. Fatigue cycles. Endurance Limit and Fatigue Strength. Constant Amplitude. Fatigue Strength Data. Fatigue coefficient. Probabilistic Fracture Mechanics. Design to Avoid Fatigue Failure. Fatigue Strength under Fluctuating Stresses. Narrow- Band Random Fatigue Data. Strength a Random Process.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O2) Reliability of mechanical systems	FIAB	3	2	1	1	-

Course description (Syllabus): 1. Mechanical systems used in modern society. Importance in current situation of the economy of material and energy resources. 2. Reliability and maintainability. 3. Design of the reliability of equipment and installations. 4. Manufacturing of the mechanical system, the role of the manufacturing in obtaining conceptual reliability. 5. Reliability during the warranty period. 6. Role of the quality, reliability and maintainability in ensuring the competitiveness of mechanical systems. 7. Contributions of the research on the reliability and maintainability in ensuring the sustainable development of mechanical systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Placement 90 hours/year	PT2	4	3 x 30 hours = 90 hours / semester			

Course description (Syllabus): Practical application in project developed by different companies.

4thYear

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special chapters of strength of materials	CSR	5	2	2	-	-

Course description (Syllabus): Introduction. Equations of elasticity theory. General equations of thermo-elasticity. Thermal stresses in bars. Thermal stresses in tubes. Thermal stresses in disks and plane plates. Computation of thermo-elastic stresses in plane plates. Use of the numerical methods and Finite Element Method. Thermal stresses in internal combustion engine elements. Stresses in tubes under pression. Stresses in rotating disks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite Element Method II	MEF2	5	2	-	2	1

Course description (Syllabus): Isoparametric finite elements – shape functions (general formulation, shape functions). Isoparametric 2D finite elements (plane stress elements, plane strain elements). Isoparametric 3D finite elements (hexahedron element). Convergence evaluation in case of the isoparametric elements. Sensitivity analysis. Structural optimisation using finite element method.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical Acoustics	ACT	5	2	-	1	-

Course description (Syllabus): Introduction (terms, acoustical quantities, etc.). Industrial applications of acoustics. Ultrasound horns. Design of ultrasound horns. Equipment used in industrial applications. Manufacturing with ultrasounds (boring, turning, milling, moulding, cupping, etc.). Environmental noise. Methods of measurement. Methods of noise effect diminish.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Assisted design and optimization of mechanical systems	POSM	5	2	2	-	1

Course description (Syllabus): Introduction. Motivational examples. Mathematical basis of optimization (objective functions, variable, constraints). Size optimization. Shape optimization. Topology optimization. Topometric optimization. Topography optimization. Optimization of composite materials. Multi-objective optimisation. Genetic alghorithms. Examples from industry.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O4) Fluid dynamics	DFL	4	2	2	1	-

Course description (Syllabus): Basic concepts. Parameters and properties that define the state of a fluid. Dynamics of perfect fluids. Turbulent flow of fluids (Navier-Stokes's equations, Reynolds's equations). Elements of dimensional analysis and similitude theory (Rayleigh's method, Buckingham's theorem).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O4) Heat and Mass Exchange	SCM	4	2	2	1	-

Course description (Syllabus): Basics of heat transfer. Heat conduction equation. Steady heat conduction. Fundament of convection. Internal forced convection. Boiling and condensation. Analogy between Heat and Mass Transfer, Mass Diffusion, Boundary Conditions, Steady Mass Diffusion through a Wall, Mass Convection, Simultaneous Heat and Mass Transfer

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O5) Stability	STAB	3	1	1	-	-

Course description (Syllabus): Introduction. Compressible beams loaded with transversal forces. The initial deformation effect. Torque buckling. Plates buckling. Angular buckling.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O5) Calculus of mechanical structures to shock	CSMS	3	1	1	-	-

Course description (Syllabus): Introduction to analysis to low speed impact. Rigid body theory for collinear impact. Rigid body theory for planar or 2D collisions. 3D impact of rough rigid bodies. Rigid body impact with discrete modelling of compliance for the contact region. Continuum modelling of local deformation near the contact area. Impact behaviour of composite structures. Impact assessing by means of finite element method.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O6) Plasticity	PLAS	3	2	1	-	-

Course description (Syllabus): Introduction to plasticity. Computing methods in Mechanical Engineering. General considerations regarding the calculus in plastic domain. Tensile and compression calculus in plastic domain. Torsion of circular and ring sections into the elasto-plastic range. Pure bending calculus in plastic domain.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O6) Dynamical systems	SDIN	3	2	1	-	-

Course description (Syllabus): Matrix Algebra. ODE Solvers. Introduction and Fundamentals. One-dimensional Maps. Two dimensional Maps. Chaos. Fractals. Chaotic attractors. Differential equations. Periodic orbits. Chaos in Differential Equations. Stability. Bifurcation. Cascades.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O7) Thermal equipment	ATER	3	2	1	-	-

Course description (Syllabus): 1. Combustion. Chemical and kinetical aspects. 2. Ignition and flame stabilisation. Burners for solid, liquid and gaseous fuels. 3. Steam and hot water boilers. Configurations. Fireboxes. Furnaces. 4. Steam and hot water boilers. Thermal balance. Circulation. Hydraulic calculation. 5. Heat exchangers. Classification and construction. 6. Heat exchangers. Plate and fin. Extended surface. 7. Condensers. Heat pipes. Thermal accumulators.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O7) CAD/CAM	CADM	3	2	1	-	-

Course description (Syllabus): Basic knowledge overview - Part Design, Assembly, Drawing. Generating 1D (wireframe) elements - dots, lines, curves, planes. Spline and plane splines. Generating surfaces by supporting curves, reusing other surfaces, or extracting faces of solid bodies.Connection curves. Parameterized editing of surfaces at the parametric sketch or spline curves. Generate complex surfaces. Realization of mechanical parts by using of surfaces. Custom CAD software and the distribution of CAD software on industries. Relationship with CAE and CAM software.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Dynamics of Structures	DINS	4	2	1	1	1

Course description (Syllabus): Introduction. Modeling of dynamic actions. Modeling of dynamic system (inertial modeling, dissipative modeling, elastic modeling). Flexibility-stiffness. One degree of freedom systems (un-damped and damped systems, free and forced). Multiple degree of freedom systems (un-damped and damped systems, free and forced). Inertial forces method. The method of displacements or stiffness matrix Transverse vibrations in the case of composite beam beams (equation of movement for symmetrical stratified beams, natural frequencies for composite beams with different end conditions). Un-damped transverse vibrations in the case of the rectangular composite plates.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Plates and shells	PLIN	3	2	2	-	-

Course description (Syllabus): Introduction. Aproximative equation of the deformed fiber. FEM applied to the plates. Mathematical model based on Kirchoff assumption. Mathematical model based on Midlin Reissner assumption. Modeling plates with isoparametric finite elements. Finite element method used for composite plates.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermal Equipment Design	PRET	3	2	1	-	1

Course description (Syllabus): The course includes the main concepts of designing the thermal systems: conceptual project, requirements, specifications, variables, constraints and limitations. For several thermal systems are detailed the phases of design (internal combustion engines, gas turbines, refrigeration installations, heat pumps, vaporisation, drying installations and HVAC). The students are required to design an internal combustion engine (thermal, kinematic and dynamic calculations, strength of material calculations of the main parts from crankshaft mechanism).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O8) Rheology	REOL	3	2	-	2	-

Course description (Syllabus): Introduction. General notions of mechanics of isotropic and anisotropic materials: Viscosity. Rheological systems. Grouping of mechanical elements, simulation and modeling of phenomena associated with rheological models. Models of elasto-plastic bodies. Models of visco-plastic bodies. Models of visco-elastic bodies. Rheology of isotropic materials. Rheology of composite materials. Rheology of orthotropic materials – wood.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O8) Modal analysis	AMOD	3	2	-	2	-

Course description (Syllabus): Fundament (Introduction to the theory of modal analysis. Types of modal testing. Modal analysis applications). Modeling of mechanical structures (modeling of structures by geometrical schematization; modeling of structures by means of block schemes; simplified structural components; characteristic elements of modeling; elastic elements of simple mechanical structures). Damping of mechanical structures. Equations of motion. Transfer function. Frequency response function. The modal analysis of systems with two

degrees of freedom. The modal analysis of systems with "q" degrees of freedom. Experimental modal analysis (structure of experimental modal analysis systems; experimental modal analysis; excitation using impact hammer; excitation using dynamic systems; signal capture system; signal transducers).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O9) Industrial Project Management	MPI	4	2	-	2	-

Course description (Syllabus): Introduction to major concepts of project planning (objective, program, plan, budget, prediction, organization, policy, procedure, standard). The main components of a project and how they are presented/ described within a project. Role of Project Manager (MP) - responsibilities, attributions. Ways to represent the project plan and responsibilities within the project (Gantt diagram, network graph, PERT chart, responsibilities matrix). Project budget, estimation of eligible costs by category of expenditures and their monitoring. Analysis and management risk. The measurement and improvement process. Terms, rights and obligations in the projects - the right to intellectual property, the confidentiality of the results. Assessment and re-planning. Earned value management.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
(O9) Quality Management in Industry	MCI	4	2	-	2	-

Course description (Syllabus): Introduction. Quality concept. Standards family SR EN ISO 9000. Quality management system. Quality management system documentation. Audit and quality certification.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Diploma Project Develop	PDIP	5	-	-	-	2

Course description (Syllabus): Identification of project theme and structure. Review of theoretical concepts required for the diploma project theme. Documentary study (library, Internet, other information/ documentation sources). Analysis of the state of the art and tendencies in the field of diploma project theme (scientific importance, applicability, developments). Identification of main development directions in the diploma project theme. Theoretical and experimental investigations in diploma project theme.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice for Diploma Project	PR3	5	6 hours x 10 weeks = 60 hours / semester			

Course description (Syllabus): Practical application in diploma project developed by different companies. Practical application in diploma project developed within the laboratories of Department of Mechanical Engineering and within Research & Development Institute of Transilvania University.