

Transilvania University of Braşov, Romania

Study program: Mechanical Engineering (RO)

Faculty: Mechanical Engineering

Study period: 4 years (bachelor)

1st Year -1st Semester

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	ANM	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 carthesian 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): This course introduces fundamental principles in developing graphical solutions to engineering problems. It develops the ability to visualize spatial relationships; develop sequential thinking; set patterns of analysis; and spatial visualization through problem-solving. 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	STM	3	2	-	1	-

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.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Materials Technology	TM	3	2	-	1	-

Course description (Syllabus): 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): 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
Communication and ethics	COM	3	2	1	-	-

Course description (Syllabus): The main problem arising when studying the notion of "communication" is establishing its content and the means of transmitting it. The course aims to develop relationship and communication skills. Main chapters: Documentary research at the university library; Introduction into communication; Communication within the group; Verbal communication; Non-verbal communication (body language); Written communication; Expression skills.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English language 1	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
English language 2	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
French language 1	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
French language 2	LF02	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
German language 1	LG01	2	1	1	-	-

Course description (Syllabus): This course introduces students to the main issues of German 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
German language 2	LG02	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
Physical training 1	EF01	1	-	1	-	-

Course description (Syllabus): practical skills training-methodical composition of complex aerobics; analytical exercises for upper limbs and scapular-humeral belt; exercises for trunk and abdominal muscle; individual actions specific basketball game in attack and defence; elementary collective tactical combinations in attack and defence in basketball; bilateral game.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physical training 2	EDF2	1	-	1	-	-

Course description (Syllabus): football: playing without ball; foot hitting; head hitting; strategies; basketball: techniques; tactical offensive and defensive; contra-offensive; bilateral game.

2nd Semester

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): Linear algebra and free vectors; Analytic geometry in space; Conics and quadrics; 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 info- graphics 1	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 1	MEC1	5	3	1	1	-

Course description (Syllabus): Students in this course will study the theory and application of engineering mechanics - statics. Includes topics such as problem formulation and solution methods; two- and three-dimensional vector representation of forces, moments and couples; center of gravity and moment of inertia; static equilibrium of particles, rigid bodies, and engineering structures; problems related to friction.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer programming and programming languages	PCL	5	2	-	2	-

Course description (Syllabus): 1.Introduction; 2.Programming languages and GUI; 3.Buttons, Menu, Tools bar (simple controls); 4.Advanced controls; 5.Design and 2D animation; 6.Data bases; 7.Debugging programs; 8.Complex programming; 9.Project management.

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

2nd Year - 1st Semester

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

Course description (Syllabus): demand, offer, market, concurrency; labour market, employment, unemployment, wages; monetary market, inflation, loan and interest; capital market; macroeconomics; international economic relations.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technical drawing and info-graphics 2	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, linetype, 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 2	MEC2	6	3	2	1	-

Course description (Syllabus): This course represents the second part of the traditional engineering mechanics static-dynamics course. The dynamics deals with accelerated motion of a body. Basic theory of engineering mechanics, using calculus, involving the motion of particles, rigid bodies, and systems of particles; Newton's Laws; work and energy relationships; principles of impulse and momentum; application of kinetics and kinematics to the solution of engineering problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of materials 1	RM1	6	2	2	2	-

Course description (Syllabus)–Introduction; Fundamental concepts; Internal Forces; Geometrical Properties of Plane Areas; Strength of Materials Basic Assumptions; Displacements, stresses and strains; Axial loading; Conventional Shear Calculus; Fundamental Concepts of the Theory of Elasticity; Torsion; Elastic bending.

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

Course description (Syllabus): first order differential equations; differential equations with constant coefficients; systems of differential equations; symmetrical systems; first order partial differential equations; complex functions;; holomorphic functions; integral in complex; Cauchy theorem; power series; Taylor series; Fourier series; Laurent series; Laplace transform; operational methods.

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

Course description (Syllabus): passive circuit components: R, C, L; semiconductor devices: diodes, transistors, thyristors; power supplies, rectifiers, stabilizers; electronic amplifiers and operational amplifiers; logic circuits and digital circuits; microprocessors and microprocessor systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English language 3 & 4	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
French language 3 & 4	LF03	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
German language 3 & 4	LG03	2	1	1	-	-

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

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physical training 3 & 4	EF03	1	-	1	-	-

Course description (Syllabus): football: playing without ball; foot hitting; head hitting; strategies. basketball: techniques; tactical offensive and defensive; contra-offensive; bilateral game.

2nd Semester

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

Course description (Syllabus): The course aims to introduce numerical methods used for the solution of engineering problems. The course emphasizes algorithm development and programming and application to realistic engineering problems; Roots of nonlinear equations; Solutions of systems of linear algebraic equations; Numerical differentiation and integration. Interpolation; Numerical solution of ordinary and partial differential equations; Introduction to error analysis; Implement these methods in a computer language (MATLAB); Engineering case studies.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fluid mechanics and hydraulic equipment	MFMH	4	2	-	2	-

Course description (Syllabus): Fluid properties; Fundamentals of fluid statics; Hydrostatic forces; Ideal fluid dynamics; Real (viscous) fluids flow; Pipeline hydraulics; Introduction on roto-dynamic machinery.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of materials 2	RM02	5	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
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; Cam mechanisms.

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

Course description (Syllabus): Design in Catia 5 – Introduction, The use of surfaces, Generative shape design, The use of features and the use of geometrical sets, 3D elements generation, Top-down design method, DMU Kinematics module, Ergonomic analysis, Technological features

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; Optical instruments for measurement; International tolerance system for limits and fits (ISO 20286-1:1997); Surface roughness parameters; Symbols for tolerances of position and form; Tolerances and fits for general thread parts. Tolerances and fits for gear pairs;

Tolerances for gears and gears pairs; Angle measuring system and techniques; Principal elements and operations of pneumatic gaging systems; Industrial measuring technology applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical work 90 hours	PT1	4	-	-	-	-

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.

3rd Year - 1st Semester

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

Course description (Syllabus): The main objectives of this course are: the study of basic processes regarding thermodynamics, gazodynamics and heat transfer. There are presented thermodynamic laws, principles, equations that describe thermal processes through thermal engines: internal combustion engines, compressors, refrigerating machines, gas and vapour turbines, power plants, boilers. The cognitive technical competences (notions, laws, diagrams, thermal plants): the student will be familiar with thermodynamically field notions and basic laws, working with diagrams for thermal agents, with understanding the functioning principles of thermal plants, their energetic evaluation and basic designing. Applied technical competences (measurements, error evaluation); the skills for measurements techniques will be improved using analogue and digital devices and high precision sensor technology.

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): Introduction; Elastic elements and damping elements; System representation (mathematical models); Systems with one degree of freedom; System with two degrees of freedom; System with multiple degrees of freedom; Approximate methods used to study discrete systems; Introduction to finite element method used for vibration study; 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 1	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
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
Finite Elements 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.

2nd Semester

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

Course description (Syllabus): Experimental methods classification. Tensometry. Captors. Photoelasticity. Moiré Methods (classical, shadow and protection).

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

Course description (Syllabus): Isoparametric elements – shape functions (general aspects). Isoparametric elements – 2D (plane stress, strain). Isoparametric elements – 3D. Convergence evaluation in case of isoparametric elements. Sensitivity analysis. Structural optimisation.

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

Course description (Syllabus): Production Process, Manufacturing Process, Technological Process, Production Types, Computer Integrated Manufacturing, Calculus of machining allowance, Calculus of cutting regime (cutting depth, cutting feed, cutting speed), Setting-up the time standard.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tribology	TRIB	5	2	-	2	-

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 adsorption 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
Vibration of machinery and equipment (O1)	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
Vibroacoustic diagnosis of mechanical structures (O1)	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. Vibroacoustic diagnosis of machine parts. Diagnosis of bearings. Diagnosis of 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
Fatigue of Mechanical Structures (O2)	OBSM	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
Reliability of mechanical systems (O2)	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
Technological practice	PT2	4	-	-	-	-

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

4th Year – 1st Semester

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

Course description (Syllabus): Digital image correlation. Holographic interferometers. Serigraphy. Infrared thermography.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Plates and shells	PLIN	4	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. Modelling 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
Technical Acoustics	ACTH	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
Statics and Dynamics Stability (O3)	STAB	5	2	-	2	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
Active control of mechanical systems (O3)	CASM	5	2	-	2	1

Course description (Syllabus): Mathematical models of system. State variable models. The state variable of a dynamic system. Feedback control system characteristics. The stability of linear feedback systems. The root locus method. Frequency response method and stability in the frequency domain. The design of feedback control systems. Approach of the system design. The use of Bode and root locus diagrams in design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical modelling in fluid mechanics (O4)	MNMF	4	2	2	1	-

Course description (Syllabus): Potential plane movements of fluids considered ideal. Notions of hydrodynamic theory of lubrication. Boundary layer theory. The semi-empirical theory of turbulence. Theoretical and experimental cavitation – the case of hydraulic machines. Elements of similarity theory. Effluent movements: flow of incompressible fluids through small holes. Fluid jets. Special phenomena in fluid mechanics: Coanda effect and its applications, sonicity and its applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Transfer phenomena (O4)	FETR	4	2	2	1	-

Course description (Syllabus): General notions of heat transfer. Unidirectional thermal conduction in stationary regime through bodies with internal heat sources. Thermal conduction through large areas. Thermal convection. Heat transfer to boiling. Heat transfer to condensation. Mass transfer.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Sustainable development in Mechanical Engineering	DEZD	3	1	1	-	-

Course description (Syllabus): Presentation of the concept of sustainable development - threats to the development of human society. Environment - interdependence with the social and economic environment. Environment - relationship with health. Environmental pollution - air component. Environmental pollution - water, soil component. Material and energy resources. The principles of eco-design.

2nd Semester

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermal Equipment Design (O5)	PECT	3	2	-	-	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
Refrigeration and heating installations (O5)	IFTE	3	2	-	-	1

Course description (Syllabus): Burning. Chemical and kinetic aspects. Ignition and flame stability. Burners for solid, liquid and gaseous fuels. Steam boilers and hot water. Configurations. Outbreaks. Ovens. Thermal balance. Circulation calculation. Hydraulic calculation. Heat exchangers. Classification and construction. Heat exchangers with plates and large surfaces. Capacitors. Thermal tubes. Heat accumulators.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Energy efficiency in Mechanical Engineering (O6)	EFEN	3	2	1	-	-

Course description (Syllabus): Overview, priority objectives in energy audit, legal framework, mandatory initiatives. General notions of energy efficiency. Energy management and its purpose. General principles of elaboration and analysis of energy balances. Ways to reduce energy consumption. Energy efficiency of renewable energy sources.

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

Course description (Syllabus): Overview, priority objectives in energy audit, legal framework, mandatory initiatives. Basic elements regarding the structure and composition of buildings. Energy performance required by regulations. Behaviour of buildings under the action of environmental factors. Composition of indoor heating installations. Heat supply sources. Heat supply networks. Energy performance of thermal systems. Energy expertise of existing buildings. Energy certification of buildings. Energy audit and feasibility study.

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

Course description (Syllabus): Introduction. Modelling of dynamic actions. Modelling of dynamic system (inertial modelling, dissipative modelling, elastic modelling). 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). Undamped transverse vibration in the case of the rectangular composite plates.

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

Course description (Syllabus): Introduction. Motivational examples. Course description. Mathematical basis of optimization. Objective functions. Variable. Constraints. Types of optimization problems. The optimization of composite materials. Multi-objective optimisation. Genetic Algorithms. Examples from industry. Course overview. Closing Remarks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Composites materials mechanics	MECC	5	2	2	-	-

Course description (Syllabus): Introduction. Technologies of composite materials manufacturing. Micromechanics of composite materials. Level mechanics. Macro mechanics and stiffness of the thin plate of composite material. Breaking of composite materials. Stratified thin composite materials. Bending of stratified composite materials. Testing of composite materials.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Rheology (O7)	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 modelling 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
Contact mechanics (O7)	MECO	3	2	2	-	-

Course description (Syllabus): Introduction to contact mechanics: geometry, equilibrium equations, boundary conditions, modelling, nonlinearities. Contacts without friction, elastic-rigid contacts. Friction contacts, variational formulation. Analytical solutions for simple contact problems (Hertz's model). Newton's iterative method for solving nonlinear equations. Formulation of the contact problem with the finite element method. Lubrication contacts of kinematic couplings. Friction from kinematic torque contacts. Case studies of contact mechanics: bearings, gears, gripping.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Quality Management in Industry (O8)	MACA	4	2	1	-	-

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
Industrial Project Management (O8)	MAPI	4	2	1	-	-

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
Diploma Project Elaboration	PDIP	4	-	-	-	4

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.