Transilvania University of Braşov, Romania
Study program: Entrepreneurship in materials engineering

Faculty: Materials Science and Engineering
Study period: 4 years

1st Year

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Mathematical analysis	5	3	1	0	0

Course description (Syllabus): Field theory. Scalar and vector fields. Differential operation. Formulas whole. Theory of complex variable functions. Cauchy integrals. Taylor and Laurent series. Partial differential equations of first order. Raw integrated. Trigonometric series. Strings orthogonal Fourier series. Bessel functions. Mathematical Equation. Order partial differential equations II. String equations. Vibrant, heat equation, Laplace equation.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Software and computer programming	5	2	0	2	0

Course description (Syllabus): Microsoft Office, OriginLab, SigmaPlot, HTML programming language; PHP programming language; JavaScript programming language; Java programming language.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Descriptive geometry	4	2	2	0	0

Course description (Syllabus): Principles and graphic methods for making sections. Development of surfaces. Intersections of bodies. Establishing the true sizes of distances, angles and planar elements. Spatial vision skills. Design knowledge**.** Representation of a line. Plan representation.. Representation of polyhedra. Cylindro-conical surfaces. Sphere. Descriptive geometry methods.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Chemistry	4	2	0	2	0

Course description (Syllabus): General notions of chemistry (Atom, molecule, mol equivalent gram). The relationship between structure and properties of substances. Chemical bonds. Water. Water hardness. Water softening and demineralization. Metals. Preparation. Properties. Corrosion. Corrosion protection methods and techniques. Getting thermo chemistry. Fuels. Economic importance and practice materials (lubricants, abrasives, glass). Electrochemical energy conversion. Cells. Macromolecular compounds. Composites. Getting pollution and environmental.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Bases of management	4	1	2	0	0

Course description (Syllabus): General aspects on economic systems. Company structure. SWOT analysis applied in economic systems. General aspects on company's financial management (outgoings cost, resources, accountability, values, financial situations). Expenses analysis of economic systems. General aspects on marketing operations inside of economic systems. General aspects on project management inside of economic systems. General aspects on Quality management inside of economic systems.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Materials science and engineering	5	2	0	2	0

Course description (Syllabus): Structure and properties of metallic materials; Definitions of metal, alloy, crystal structure, types of networks; Influence on the properties of the network type; Allotropic metallic materials; Defects cross linking; Influences; Crystallization of metallic materials; Homogeneous and inhomogeneous crystallization; Defects. Methods of prevention; Plastic deformation and recrystallization; Plastic deformation of crystals; Plastic deformation of polycrystalline aggregates; Hot plastic deformation.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Linear algebra, analytical geometry and differential equations	5	2	2	0	0

Course description (Syllabus): Vector spaces; Euclidean spaces; Space; Plan and right in space; Linear transformations; Values and eigenvectors; Bilinear and quadratic forms; Conic; Sphere; Quadra on reduced equations; Surfaces generated.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Organizational culture	4	2	1	0	0

Course description (Syllabus): Basic aspects of the organizational culture. Organizational values. Organizational rules. Leadership. Organizational communication. Diversity and Inclusion. Organizational change. Employee engagement. Feedback and rating. Employer brand. Human resources. Organizational ethics. Balance between professional and personal life.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Physics	4	2	0	2	0

Course description (Syllabus): Mechanic and acoustic; Thermodynamics and Statistical Physics; Electromagnetism; Maxwell's equations; Potential field; Transition equations for the electromagnetic field components; Field energy in inductors and capacitors electromagnetic; Electrostatics.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Technical drawing and infographics	5	2	0	2	0

Course description (Syllabus): General (presentation software, interfaces, configuration, screen, menus, opening, closing, maneuvers, etc.). Fundamentals for drawing (initiation, ordering, managing screen graphics, design prototype, coordinates and units) Basic 2D drawing techniques. Layer concept. Graphic aids (basic object creation, types of lines, properties). Editing commands and extract information from drawings. Selecting entities (set of selection, editing techniques, attachment points, grips, delete, move, zoom, scale, copy, etc.). Advanced editing techniques (changing object characteristics, beveling, connections, extensions, and so on). The concept of block. Symbols and attributes. External references.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Technological innovation	5	3	2	0	0

Course description (Syllabus): Basic aspects of the innovation system and technological transfer. The need for innovation. The role of innovation at the firm and society level. Strategic framework regarding innovation; Innovation management at company level; Techniques and methods to stimulate creativity and innovation. Intellectual property management. Basic aspects regarding innovative projects and technological transfer.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Communication and academic writting	4	2	1	0	0

Course description (Syllabus): Science communication and communication principles; classification of communication. Written communication: letter, essay, report, request, official and personal letters, E-mail, web pages, CV and cover letter. Mood control in communication. The conflict in the managerial team, communication types during conflicts, dialogue theory. Academic writing.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
English language	3/3	1/1	1/1	0	0

Course description (Syllabus): The Verb. Indicative Mood. Present (simple & continuous, perfect simple & continuous); Practice; The Verb. Indicative Mood. Past (simple & continuous, perfect simple & continuous); Practice; The Verb. Indicative Mood. Future (simple & continuous, perfect simple & continuous). Future-in-the-Past (simple & continuous, perfect simple & continuous). Other ways of expressing the future (Present simple & continuous, be going to, be to, be about to), Practice. The Verb. Subjunctive Mood. Synthetic (Present/Past/Past perfect) & Analytic (modal + inf.), Practice. The Noun. Classification, gender, number, case, Practice. The Adjective. Classification, comparison, special constructions, position, Practice. The Adverb. Classification, types, comparison, position.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Physical training 1/2	1/1	0	0	1/1	0

Course description (Syllabus): Sports, athletics, basketball, football; School walking, running and sports march; School-jumping; School-throwing; Passing strengthening the place of displacement; Strengthening the place and throw away; Repeating structures and finishing the game with 2-3 players; Long jump with 1 ½ steps in flight; Throwing small.

2nd Year

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Probability and statistics	4	2	1	0	0

Course description (Syllabus): Field-probability events; Classical probability distributions; Random variable systems; Law of large numbers; Selection and estimation theory; Confidence intervals; Hypothesis testing.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Strength of materials	4	2	1	1	0

Course description (Syllabus): Strength of materials problems; And static moments of inertia; Sectional efforts to straight beams, curved, flat and spatial structures; Elements of the Theory of Elasticity; Extent-compression; Shear relatively small sections, calculating joints; Torsion bars straight; Bending of straight beams.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Quality management	4	2	2	0	0

Course description (Syllabus): Fundamentals of Quality Management. The main precursors of the Quality Management. Standardization. Vocabulary and terminology in quality. ISO 9000. The concept of Quality Management (QM). Quality Control (QC). Quality Assurance (QA). Quality Management System (QMS). The main documents of the QMS. Principles of Quality Management according to ISO 9000. Total Quality Management (TQM). TQM principles. Assessment and certification QMS. Strategic planning quality. Quality Awards.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
European economic politics	5	2	2	0	0

Course description (Syllabus): The main issues of the course are the European economic history and policies, focusing on selected topics: the Golden Age, the Common Market, the productivity slowdown, the EMS and the EMU. Harmonization of policies and their impact on the Common Market. Competition policy. Economic and monetary union. Agricultural policy. The budget of the European Union. Cohesion and structural funds. Social policy. Employment policy. Environmental policy. Biotechnology Policy.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Applied informatics	5	3	0	2	0

Course description (Syllabus): Database; MySQL language; Interaction between PHP and MySQL; Economic and engineering applications; Creating a virtual store; Server-side ASP.NET language, C# language; Applications in Visual Web Developer express 2008.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Numerical methods	4	2	0	2	0

Course description (Syllabus): Numerical errors; Numerical solution of algebraic equations; Solving systems of equations; Numerical methods for calculating eigenvectors; Approximation of functions; Numerical derivation; Numerical integration; Numerical solution of first order differential equations.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Marketing	4	2	2	0	0

Course description (Syllabus): Marketing definition. Evolution and specialization. Marketing concept. contemporary marketing. Fields of specialization in marketing. The marketing environment. Market segmentation. product positioning. Product policy. Product concept. Product life cycle. Brand strategies. The product mix. The product portfolio. Pricing policy. The importance of price in the marketing mix. Variables considered in pricing. Pricing strategies. Distribution Policy. Promotion policy.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Logistics management	4	2	0	2	0

Course description (Syllabus): Definitions of the maintenance and logistics; Short history of their apparition and development; Types of maintenances; Procedures and plan; Logistics, separation of marketing; Clients, transport, products, stocks.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Sustainable development	4	2	2	0	0

Course description (Syllabus): General characteristics about secondary resources; The valorification of secondary resources from industrial technological processes like: hot processing of metals, from plastics, polymers, elastomers, etc. The valorification of secondary resources from domestic waste; The energetic regenerable resources as a main component of sustainable development in Romania; New technologies in reconversion energy from: sun, wind, waves, geothermal water, combustion cells, etc. Main laws and theorems that explains the functioning of the equipment, apparatus and specific machines.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Machine parts	4	2	0	0	2

Course description (Syllabus): Introduction. Objective and importance of the subject. History. Course contents. Bolted joints and screw-nut transmissions. Assemblies with pins and bolts. Longitudinal assemblies feathers. Grooved assembly. Polygonal wheels on. Tightening assemblies own. Assembly by clamping onto the cone. Assemblies with tapered rings. Couplings. Gears.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Electrotechnics fundamentals (O1)	3	2	0	1	0

Course description (Syllabus): Electrostatic. Primitive and derived sizes. Units. Electrification phenomena. Electric charge, electric charge density. Electric field in the vacuum electrical current, Coulomb's formula, induction electric vacuum voltage vacuum. Laws of electrostatics. Applications. Electro kinetic. Electro kinetic status, power and electric current density. Electric fields printed. Cells and batteries. Classification point of view of electrical conductivity material. Solving linear DC network. Applications. Electrodynamics.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Intellectual property and industrial legislation (O2)	3	2	1	0	0

Course description (Syllabus): General aspects on intellectual property rights, author rights, rights on drawings and models, geographic indications, confidentiality agreements in industry. Theoretical and practical aspects on creativity and inventions. The main organizations from Romania and European Union that regulates this field (OSIM, WIPO, etc.). Brainstorming and Delphi techniques. Notable discoveries and inventions. Romanian and foreign famous inventors. Industrial intellectual creations. Distinctive signs. Copyright and rights related to copyright. Patenting inventions in Romania and abroad. The economic value of the patent.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Practical activity II (90h)	2	0	0	0	0

Course description (Syllabus): Organizational and functional aspects of commercial companies. Primary technologies in materials processing. Machining of materials. Heat treatment technologies. Finishing and super finishing technologies. Industrial equipment working efficiency estimation. Company's primary accounting. Quality management in a manufacturing company. Logistics activities in a manufacturing company.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
English language 3/4	3	1	1	0	0

Course description (Syllabus): The Verb. Indicative Mood. Present (simple & continuous, perfect simple & continuous); Practice; The Verb. Indicative Mood. Past (simple & continuous, perfect simple & continuous); Practice; The Verb. Indicative Mood. Future (simple & continuous, perfect simple & continuous). Future-in-the-Past (simple & continuous, perfect simple & continuous). Other ways of expressing the future (Present simple & continuous, be going to, be to, be about to), Practice. The Verb. Subjunctive Mood. Synthetic (Present/Past/Past perfect) & Analytic (modal + inf.), Practice; The Noun. Classification, gender, number, case, Practice; The Adjective. Classification, comparison, special constructions, position, Practice; The Adverb. Classification, types, comparison, position.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Physical training 3/4	1	0	0	1	0

Course description (Syllabus): Sports, athletics, basketball, football; School walking, running and sports march; School-jumping; School-throwing; Passing strengthening the place of displacement; Strengthening the place and throw away; Repeating structures and finishing the game with 2-3 players; Long jump with 1 ½ steps in flight; Throwing small

3rd Year

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Tribology	6	2	0	2	1

Course description (Syllabus): Fundamental principles of tribology, including friction, wear, and lubrication. Contact mechanics, surface roughness, lubrication regimes, tribological testing methods, and industrial applications in mechanical and materials engineering.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Accounting	6	2	2	0	0

Course description (Syllabus): Principles of financial accounting, accounting records, assets and liabilities, revenues and expenses, financial statements, and the use of accounting information for managerial decision-making.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Environmental Management	5	2	1	0	0

Course description (Syllabus): Environmental policies and legislation, environmental management systems, sustainability principles, environmental impact assessment, pollution prevention, and circular economy concepts.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Fundamentals of Computer-Aided Design	6	3	0	3	0

Course description (Syllabus): Introduction to CAD systems, 2D and 3D modeling, parametric design, assemblies, technical documentation, and CAD applications in product development.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Materials Technology	7	4	0	4	0

Course description (Syllabus): The relationships between structures and properties. Manufacturing, processing and fabrication of materials. Mechanical properties of materials and measurement of mechanical properties: elastic and plastic deformation. Properties and applications of the major metal alloys. Principles for rational and knowledge based selection of materials. Environmental aspects of the production and use of different materials.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Production Management	4	2	2	0	0

Course description (Syllabus): Production system organization, planning and control, scheduling, lean manufacturing principles, productivity analysis, and performance indicators.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Techniques for Materials Analysis and Characterization	4	2	0	2	0

Course description (Syllabus): Microstructure evaluation, crystal structure analysis, electron microscopy, Chemical Thermal Analysis, static and dynamic mechanical testing methods.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Microscopy	3	2	0	1	0

Course description (Syllabus): Optical and electron microscopy principles, sample preparation techniques, image analysis, and applications in materials science.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Ceramic, Polymeric, and Composite Materials	5	3	0	2	0

Course description (Syllabus): Structure, properties, processing technologies, and engineering applications of ceramic, polymeric, and composite materials.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Project Management	4	2	0	0	2

Course description (Syllabus): Project lifecycle management, planning, scheduling, budgeting, risk management, quality assurance, and monitoring techniques.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Production Systems Engineering (Optional)	3	2	0	1	0

Course description (Syllabus): Design and optimization of production systems, automation concepts, manufacturing integration, and performance evaluation.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Human Resources Management (Optional)	3	2	1	0	0

Course description (Syllabus): Human resource planning, recruitment, training, performance evaluation, motivation, leadership, and labor relations.

4th Year

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Business Law	4	2	1	0	0

Course description (Syllabus): Legal framework governing business activities, commercial contracts, company law, competition regulations, insolvency, and legal liability.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Nanomaterials and Nanotechnologies	5	3	0	1	1

Course description (Syllabus): Fundamentals of nanoscience, synthesis and characterization of nanomaterials, applications, and health, safety, and environmental considerations. Characterization methods for nanomaterials. Nanometrology. The structure, shape and properties of different types of nanomaterials. Carbon nanotube-structure, properties, areas of use. Technologies for obtaining carbon nanotubes. Technologies for obtaining nanopowders, structures, properties, areas of use. Nanobiotechnologies.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Thermal and Thermochemical Treatments	6	3	0	2	1

Course description (Syllabus): Heat treatment principles, phase transformations, annealing, quenching, tempering, and thermochemical surface treatments.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Properties of Materials	5	2	0	2	0

Course description (Syllabus): Crystalline structure - Perfection. Defects, planar defects, three dimensional imperfections. Mechanical properties of materials-the theoretical aspects, influences, methods of determination. Thermal properties of materials (heat capacity, thermal expansion, thermal conductivity, thermal shock) - the theoretical aspects, influences, methods of determination. Electrical properties of materials-the theoretical aspects, influences, methods of determination. Magnetic properties of materials-the theoretical aspects, influences, methods of determination (magnetism, ferromagnetism, metallic magnets, ceramic magnets).

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Modeling and Simulation in Materials Processing	4	2	2	0	0

Course description (Syllabus): Mathematical modeling, numerical simulation, finite element methods, and optimization of materials processing technologies.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Entrepreneurship	6	4	0	0	2

Course description (Syllabus): Entrepreneurial mindset development, opportunity identification, business planning, startup financing, innovation management, and risk assessment.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Corporate Finance	4	2	2	0	0

Course description (Syllabus): Financial management of companies, investment decisions, financial analysis, cash-flow management, and financial performance evaluation.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Trade Techniques	5	2	2	0	0

Course description (Syllabus): Commercial operations, distribution channels, sales strategies, market analysis, and trade documentation.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Business Risk	5	2	2	0	0

Course description (Syllabus): Identification, assessment, and management of business risks, decision-making under uncertainty, and risk mitigation strategies.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Additive Manufacturing	5	2	0	2	0

Course description (Syllabus): Additive manufacturing technologies, materials, design principles, process parameters, and industrial applications.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Business Negotiation	3	2	2	0	0

Course description (Syllabus): Negotiation strategies, communication techniques, conflict resolution, ethical aspects, and practical negotiation scenarios.

Course title	No. of credits	Number of hours per week			
		course	seminar	laboratory	project
Bachelor's Thesis Project	4	0	0	0	4

Course description (Syllabus): Independent research project integrating engineering and entrepreneurship knowledge, culminating in the preparation and public defense of the bachelor's thesis.