

# Transilvania University of Braşov, Romania

## Study program: Simulation and Testing in Mechanical Engineering

Faculty: Mechanical Engineering

Study period: 2 years (master)

1<sup>st</sup> Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced Design Elements (CAD)	CAD	5	1	-	2	-

**Course description (Syllabus):** Basics of SIMCENTER software usage; Sketch creation; Part modelling; Assembly modelling; Drafting; Sheet Metal Design; Generative Shape Design; Parametric design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analysis of Mechanical Structures	ASM	5	2	-	-	2

**Course description (Syllabus):** Explaining the concepts specific to the finite element method and the gradual solving of specialized engineering problems based on mathematical computational algorithms; Explaining the calculation principles of the finite element method; Explaining of the stages of development of the mechanical structure models using the finite element method; Modelling and simulation with computer programs specific to the finite element method.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Phyton Programming for Engineering Applications I	PAI I	5	1	-	2	-

**Course description (Syllabus):** The acquisition of an algorithmic thinking and the development of algorithmic solution design skills, as well as the acquisition of techniques for the use of the main data structures, using Phyton programming language. Developing and implementing a given application using Object Orientated Principles (OOP).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Experimental Mechanics	ME	5	2	-	1	-

**Course description (Syllabus):** Improvement of the specific abilities in Mechanical Engineering. Knowledge and skills in data acquisition and processing of vibration signals

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Ethics and Academic Integrity	EIA	1	1	-	-	-

**Course description (Syllabus):** Familiarize students with the problems, concepts and aspects regarding the ethics of scientific research. Knowledge and assimilation of the theoretical-applicative foundations of the Ethics of scientific research.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Control of Dynamic Systems	CSD	5	1	-	1	-

**Course description (Syllabus):** The course has two basic objectives: 1. Mechanical systems modelling: mathematical modelling, time to domain response, transfer response, state space response, frequency response, linearization of nonlinear systems, stability of linear and non-linear systems; 2. Simulation and numerical analysis of systems and mechanical structures with Matlab / Simulink

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Multibody Systems I	SMC I	5	2	-	2	-

**Course description (Syllabus):** Basic theoretical knowledge of the dynamics of multi-body systems, with applications in mechanical engineering. Methodology, algorithms and software for kinematic and dynamic simulation of complex mechanical systems (mechanical systems and sub-systems composed of rigid and deformable elements).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hybrid Engineering	IH	5	1	-	2	-

**Course description (Syllabus):** Development of competences regarding Industry 4.0, simulation and testing of simple and complex systems, comparison of physical and virtual models. Assimilation of theoretical and practical knowledge regarding the design / simulation / testing throughout the life cycle of an element / system / product.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Phyton Programming for Engineering Applications II	PAI II	5	1	-	2	-

**Course description (Syllabus):** The acquisition of algorithmic thinking and the development of algorithmic solution design skills, as well as the acquisition of techniques for the use of the main data structures, using Phyton programming language. Developing and implementing a given application using Object Orientated Principles (OOP).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Lightweight Structures	SU	5	2	-	-	1

**Course description (Syllabus):** Learning the fundamental aspects of lightweight structures. Learning the methods of doing lightweight on existing components or for designing new lightweight products. Understand the opportunities and constraints when doing lightweight. Sandwich beam theory.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanical Systems for Energy Conversion	SMCE	5	2	-	-	1

**Course description (Syllabus):** Knowledge related to mechanical, fossil or renewable energy conversion systems, with the determination of characteristics that influence energy efficiency and low pollutant emissions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fatigue life-based design	PDV	5	2	-	1	-

**Course description (Syllabus):** Developing of necessary skills to understand and formulate the main modern techniques of theoretical and practical approaches specific to the design against fatigue calculations, as well as the essential components of the lifetime design process.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optimization of Thermal Processes and Installations	OPIT	5	2	-	1	-

**Course description (Syllabus):** Knowledge of the analytical and experimental principles and methods for the quantitative and qualitative analysis of the thermal processes and installations, finally aiming at their optimization.

## 2<sup>st</sup> Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Structural Optimization	OS	5	2	2	-	-

**Course description (Syllabus):** Acquiring the fundamental aspects of the structural optimization methods. Familiarization with the basic tools for modeling, analyzing and optimizing mechanical structures. Analytical models for optimization. Numeric models for optimization. Optimization tools and algorithms. Multi-objective optimization problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modal Analysis	AM	5	2	-	1	-

**Course description (Syllabus):** Principles, tools and methods of analyzing the dynamic response of the systems;

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Multibody systems II	SMC II	5	1	-	1	-

**Course description (Syllabus):** Fundamentals regarding the balance of deformable and non-deformable solids and of deformable and non-deformable bodies systems. Algorithms for solving multi-body systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modeling and Simulation of Transfer Phenomena (CFD)	MSPT	6	2	-	1	1

**Course description (Syllabus):** The aim of the course is to give a general overview of the governing equations of fluid dynamics and solving of engineering problems using CFD. The main stages of CFD analyses will be introduced together with discretization schemes of computational domains; CFD simulations will be performed.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Non-linear analysis of deformable solids	ANSD	6	2	-	1	-

**Course description (Syllabus):** ■ Developing competences and abilities in the field of analysis, modeling and simulation of the behavior of the mechanical structures made of non-linear materials (composite materials, elastomers, hyperplastic materials) in the support of the professional training.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Testing of thermal equipments	TET	6	2	-	1	-

**Course description (Syllabus):** principles of thermal equipment testing based on the laws of thermodynamics, fluid mechanics and heat and mass transfer.