

Transilvania University of Braşov, Romania

Study program: Mechatronic Systems for Industry and Medicine

Faculty: Product Design and Environment

Study period: 2 years (master)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Complements of Physics and Applied Mathematics	CFMA	6	2	1	-	-

Course description (Syllabus): The CFMA course approaches some important issues from mathematics and physics, strongly connected to the practical implications of physics and mathematics in engineering. The course contains a special part dedicated to vector analysis, a consistent part of Fourier analysis, a part dedicated to how the Fourier and Laplace transformations can be applied in solving some differential equations and in simulation of some phenomena. For each section, the course presents a collection of problems implied in engineering and also presents practical methods for implementation in the computational approach.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite Element Analysis of Engineering Systems	AFEM	6	2	-	1	-

Course description (Syllabus) - Types of problems solvable with MEF; The general algorithm for modelling and analysing with FEM; Methods of finite element modelling; Types of reference systems used in MEF; Geometrical modelling 1D; Geometrical modelling 2D.

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Modelling And Simulation of Bio systems	MSBI	6	2	-	2	-

Course description (Syllabus): The discipline aims to study the methods and techniques for modelling the structure and functioning of the mechatronic systems in the human body and for assisting it. It would provide specific skills in modelling, simulation and behaviour of human mechatronic subsystems and assisting them.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced Methods of Quality Inspection	MAIC	6	2	-	-	2

Course description (Syllabus): Quality; Quality management system; Concepts and modern methods of quality inspection; Integrated quality assurance; Automation control industry and medicine; Optical quality inspection in industry and medicine; Dimensional inspection of complex systems; Special features for study and design of quality inspection mechatronic systems with applications in industry and medicine.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Experimental and Investigative Methods in Industry and Medicine	MEIM	6	2	-	2	-

Course description (Syllabus): Through this discipline the main methods and techniques of investigation and control of functional processes in industrial and medical/biological systems are studied. Specific competencies in the field of construction, use and control of the operation of investigation systems used in industry and medicine are achieved.

Course title	Code	No. of credits	Number of hours per week			
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Robotic systems for industry and medicine	SRIM	6	2	-	-	2

Course description (Syllabus): Knowledge of the main constructive and functional features of robotic equipment used in medicine. Use of accumulated knowledge to identify the main components with the constructive and functional particularities of robotic equipment used in medicine for investigation, surgery, patient assistance, auxiliary activities in hospitals.

Course title	Code	No. of credits	Number of hours per week			
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Micro-Electro-Mechanical Systems	MEMS	6	2		2	

Course description (Syllabus): The objectives of this discipline are to deepen the knowledge of micro-electromechanical systems (micro actuators, micro sensors, microsystems and information processing, applications of microsystems). Due to its complexity, this discipline integrates the knowledge gained in a number of related disciplines such as sensors and transducers, biomechanics, physics, measuring devices and systems, electrical measurement of non-electrical quantities, automobile mechatronics, etc.

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Protocols and Communication Interfaces In Mechatronic Systems	PICS	6	2		2	

Course description (Syllabus): Discipline aims to give students knowledge about a range of protocols and interfaces for information exchange in industry, focusing on the interconnection of mechatronic systems. Topologies of communication networks, access methods, types of transmission media, as well as the ISO / OSI model, are presented. The main protocols for serial and parallel communication, the Actuator Sensor Interfaces (ASi), Controlled Area Network (CAN) buses, infrared, Bluetooth, WI-FI are studied.

Optional direction I:

Mechatronic Systems for Industry

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Information Systems Management: Ethics And Academic Integrity	MPCM	5	2	-	-	1

Course description (Syllabus): Fundamental knowledge and general knowledge of information management systems with applications for mechatronic systems used in industry and medicine. Fundamental knowledge of project management. Students will study the notion and elements of a project, the research and the setting of the objectives of a project, the distribution of tasks, the timetable of execution, the assignment of resources and costs. You will find out the methods and tools for project planning and management, but also the methods and tools for monitoring and analysing progress, coordinating, estimating and controlling project implementation, and last but not least, you will study the decision-making techniques. Students will learn to organize a rapid implementation of each idea in their field, apply quantitative models for project results evaluation, project management strategies, and clue analysis to enhance the efficiency of the entire process, respecting industry standards. Achieved Skills: Develop, manage and organize projects, Advanced Project Management methods, Advanced Quantitative Financial Methods, Management and use of project management tools, Finance and Investment Management, Planning and management of human resources, Leadership and organization of teams, Personal skills of negotiation, leadership and decision making in the business environment

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modern Manufacturing and Assembly Systems	SMFA	5	2	-	1	-

Course description (Syllabus): Industrial production system, Production organization and planning, Production planning methods, Operation systems for CNC: FANUC, SINUMERIK.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
CAD /CAM Systems in Flexible Manufacturing	SCAD	5	1	-	2	-

Course description (Syllabus): Presentation specific CAD software; Presentation specific CAM software; Integrated CAD-CAM; Integrated production systems; Automation systems. Specific operating systems FANUC for CNC machines; Specific Operating Systems SINUMERIK for CNC machines;

Course title	Code	No. of credits	Number of hours per week			
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Systems for services automation	SASV	6	2	-	-	2

Course description (Syllabus): Systemic and mechatronic approach of equipment and consumer products; Structure of consumer mechatronic equipment; Structural, functional and operating characteristics, concerning mechatronic systems of consumer products; Mechatronics structure of multimedia equipment; Equipment for playback information on compact discs; Structure of mechatronics and video cameras; Systemic and mechatronic approach of equipment and home appliances facilities; Mechatronics structure and structural features of programmable microwave ovens; Heating equipment microcomputer-assisted - towards smart home and reduce energy consumption. Air conditioning and computer-conditioning; Mechatronics structure of safety and security equipment in smart home perspective.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Control of Processes	CCPR	5	1	-	2	-

Course description (Syllabus): The discipline provides to the student advanced information necessary for the design and implementation of control systems with direct applications in the mechatronics field. The issues will be addressed both from the physical part (hardware subsystem) and the logical part (software subsystem). The examples will focus on systems and processes in industry and medicine.

Information flow in control system. Characteristics of control systems, transfer functions. Mathematical models of mechatronic systems. Analysis and design through charts. Simple systems: behaviour of first-order systems, and second order systems. Three-way control, adaptation methods, PID control. Systemic analysis of control processes.

Course title	Code	No. of credits	Number of hours per week			
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Information Acquisition and Processing, Virtual Instrumentation	APIV	6	2		1	-

Course description (Syllabus): Ocular ultrasound; Tomography OCT for retinal pathologies evidence; The non-contact Tonometry; Retinal camera; Eye movements; 6. Apparatus for artificial lens implantation; The installation of laser eye surgery.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Adaptive Control Systems	SICA	6	2	-	1	-

Course description (Syllabus): The discipline aims to give the students technical analysis and research directions in the field of adaptive systems. The concepts and methods used in the control of adaptive control are presented (feedforward and feedback adaptive control; direct, indirect, hybrid methods). Applications for mechatronic systems are presented by modelling, simulation, and experimentation of their operation.

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Advanced mechatronics systems for automotive industry	SAMA	6	2		2	

Course description (Syllabus): The discipline *Advanced Mechatronic Systems in Automotive Industry* aims to develop skills in the field of optimization and performance testing of mechatronic systems implemented on cars, necessary skills in research and design of electronic and computer components from the modern car. These activities are the prestige of some important companies in the country and abroad in the field of production, assembling and / or research in the field of passenger cars, where graduate students with meritorious results and large luggage of theoretical and practical knowledge can engage, first in probation / practice, then even for a longer period.

The main goals of the discipline are the following: knowledge of the role and possibilities of implementation and optimization of modern mechatronic systems, aiming at continuous improvement of the performance and comfort of automobiles; knowing the role and performance of mechatronic systems for automotive's behaviour improvement; knowledge of the functioning and methods of assessing the behaviour and performance of some vehicle mechatronic systems such as sensors, actuators, control systems.

Optional direction II:

Mechatronic Systems in Medicine and Optometry

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Information Systems Management: Ethics And Academic Integrity	MPCM	5	2	-	-	1

Course description (Syllabus): Fundamental knowledge and general knowledge of information management systems with applications for mechatronic systems used in industry and medicine. Fundamental knowledge of project management. Students will study the notion and elements of a project, the research and the setting of the objectives of a project, the distribution of tasks, the timetable of execution, the assignment of resources and costs. You will find out the methods and tools for project planning and management, but also the methods and tools for monitoring and analysing progress, coordinating, estimating and controlling project implementation, and last but not least, you will study the decision-making techniques. Students will learn to organize a rapid implementation of each idea in their field, apply quantitative models for project results evaluation, project management strategies, and clue analysis to enhance the efficiency of the entire process, respecting industry standards. Achieved Skills: Develop, manage and organize projects, Advanced Project Management methods, Advanced Quantitative Financial Methods, Management and use of project management tools, Finance and Investment Management, Planning and management of human resources, Leadership and organization of teams, Personal skills of negotiation, leadership and decision making in the business environment

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Public Health Protection and Safety	SMFA	5	2	-	1	

Course description (Syllabus):Basics of labour protection laws; Employment protection legislation in various countries; Legislation on labour protection in Romania; Work accidents and occupational diseases; Theory of accident prevention; Genesis accidents at work and occupational diseases; Risk factors for injury and occupational; Method of assessing the risk of injury and occupational disease places; Ergonomics in safety and health at work; Work within the work process; The human body in workplace design; The type of manufacturing process and workplace organization.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optometry and Clinical Diagnosis	OPAC	5	1	-	2	-

Course description (Syllabus): The main objective of the courses and practical applications is to satisfy the requirements related to the preparation of the master students for the application of the biomechanics concepts in

the clinical evaluation of the optometric, loco-motor, motor activities or sports performance. In the same context are presented methods of clinical psycho-sensory analysis and evaluations of influences of environmental parameters on the investigations, as well as the use of digital microscopy analyses in the clinical field of dental, ocular or loco-motor prostheses. There are also presented theoretical and practical aspects that develop competences for designing, applying and interpreting the results of some experiments in the field of optometry and clinical medical engineering.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Complex Systems for Visual Investigation	SCBS	6	2		2	

Course description (Syllabus): The general objective of the discipline is to acquire specialized techniques and medical devices in complex visual investigation systems like ocular echography, OCT, tonometry, oculo-graphy, ocular biometry, laser applications. The specific objectives refer to the knowledge of the necessary equipment and equipment in the complex systems of visual investigation, to the realization and analysis of the kinematic schemes of the medical devices and the acquisition of their operating mode, the knowledge of the general notions regarding the operating techniques and the medical applications of the visual investigation systems.

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Preventive school optometry	OSPI	5	1		2	

Course description (Syllabus): The main objective of the courses and practical applications is to satisfy the requirements for the preparation of the master students for the prevention, recovery and development of strategies for restoration of the visual function for the category – human subjects like children and adolescents. It also presents theoretical and practical aspects to develop competencies in designing, applying and interpreting some strategies of primary activities - informative and visual screening, or specific activities of visual rehabilitation of visual function in amblyopic children or those with special needs.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Complementary Methods of Experimental Bio systems Analysis	MCAB	6	2	-	1	-

Course description (Syllabus): Basic principles of experimental and investigation methods in industry and medicine, Basic principles of measurement systems structure; Stereo metric methods: stereo photogrammetric; Stereo metric methods: rapid optical recording method. Stereo metric methods: Methods based 3D scanning light. Experimental data processing Sources of error. Experimental data processing; filtering and numerical differentiation of experimental data. Clinical applications of bio systems and consistent measurements

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computerized Management of Patients and of Medical Engineering and Optometry Systems	MCPS	6	2	-	1	-

Course description (Syllabus): The discipline provides the student with general information on the fundamental elements and stages of design and implementation of information management systems, with particularization for patients and medical engineering and optometry systems. Advanced aspects related to the security, diagnosis and maintenance of computer systems to current standards in the field will be discussed with examples in the medical field. Computerized integrated information management systems. Components of the Information System. Information flows. Design, development, exploitation and maintenance of information systems. Applications in the sanitary system. Human resources involved in sanitary information systems. Document management systems. Electronic document management systems. New concepts in the field of information management. Cloud Computing. Advanced Information Management Systems Used in Hospitals (HIS - Hospital Information Systems). Medical databases. Medical records. New Trends in Health Systems.

Course title	Code	No. of credits	Number of hours per week			
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Experimental optometry and low vision prosthetics	OEPO	6	2	-	2	-

Course description (Syllabus): *Experimental optometry and low vision prosthetics* concerns the thoroughness and completion of previous knowledge required by a high qualification level in the domain of experimental optometry and low vision prosthetics.