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Curriculum for the joint **Bachelor Degree Programme of Mechatronics** of the University of Innsbruck and the UMIT – Private University for Health Sciences, Medical Informatics and Technology

§1 Outline of the Joint Degree Programme

(1) Mechatronics (deriving from Mechanical Engineering – Electronic Engineering) includes all approaches and techniques for developing systems, procedures, devices and products that are marked by the integration and interaction of mechanic, electronic and information-processing components. It is this integration of methods and techniques that makes it possible that the formerly independent technical specialist fields develop modern systems marked by high-level functionality, efficiency and productivity. This synthesis of the engineering science disciplines of Mechanical Engineering, Electrical Engineering and Informatics that are based on the natural science disciplines of Mathematics, Physics and Chemistry, reflects the interdisciplinary technological challenges of modern engineering processes and appliances and is a driving force for present and future product innovations.

(2) The joint Bachelor Degree Programme of Mechatronics of the Leopold-Franzens-University of Innsbruck (LFUI) und the UMIT – Private University for Health Sciences, Medical Informatics and Technology (UMIT) is divided in a general education and a subject-specific specialization part. Students have to choose between the following two specialist fields:
A1: Industrial Mechatronics and Material Sciences
A2: Biomedical Technology
Each specialist fields consists of a compulsory module covering 4.5 ECTS-credits (ECTS-C hereafter) and an optional module covering 7.5 ECTS-credits.

(3) The field of specialization must be chosen at the time of registration for the course according to §6 para. 2 no. 1 to 2 and the Dean of Studies of the University of Innsbruck or the UMIT Study Management resp. must be informed of the choice in writing. The field of specialization may only be changed if the responsible bodies of the two universities agree.

(4) The general education part covers 18 compulsory modules with a total of 160.5 ECTS-credits. The optional specialization covers a compulsory module of 4.5 ECTS-credits and an optional

module of 7.5 ECTS-credits each. Moreover, the students have to pass a total of 7.5 ECTS-credits from a further optional module.

(5) One semester hour (SSt hereafter) equals the number of course units corresponding to the number of university weeks in the semester. A teaching unit has the duration of 45 minutes. Compulsory modules covering a total of 165 ECTS-credits and optional modules covering 15 ECTS-credits have to be passed.

(6) For courses held at the UMIT the same regulations for the evaluation apply as at the University of Innsbruck.

§2 Qualification Profile

(1) The joint Bachelor's Degree Programme of Mechatronics at the LFUI and UMIT is part of the Engineering Studies.

(2) Within the scope of the Bachelor's Degree Programme of Mechatronics at the LFUI and UMIT students acquire knowledge based on the latest findings of the discipline. They are able to correctly apply this knowledge for the finding of solutions and also for scientific discourse with colleagues. Graduates possess the following competences:

1 Natural Science Competence
   a) by acquiring a profound knowledge of the basic principles and methods used in natural science,
   b) by strengthening the ability of analytical and interdisciplinary thinking and critical reflection,
   c) by improving abstraction and modelling powers;

2 Engineering Competence
   a) by improving the understanding of contexts and problems of engineering science in theory and practice with advanced knowledge,
   b) by gaining subject-specific competence to make the graduates able to apply the basic knowledge of the core areas of the application-oriented subjects,
   c) by encouraging the creative potential for independently finding problem solutions for complex tasks of the engineering practice,
   d) by imparting knowledge of state-of-the-art IT, management and presentation methods;

3 Social Competence
   a) by encouraging the ability to work in a team,
   b) by improving foreign language skills,
   c) by arising the interest in lifelong learning and to continue advanced education individually.

(3) Graduates of the Bachelor's Degree Programme of the LFUI and the UMIT can, thanks to their education, call on the competence fields listed above and are qualified for jobs acc. to para. 4 and for a subject-related Master's Degree Programme to further their knowledge and skills acquired in the Bachelor's Degree Programme. They are able to continue their advanced studies successfully.

(4) A central element of the Bachelor's Degree Programme of Mechatronics is its focus on sustainability and relevance of knowledge and skills. This is why the imparting of knowledge and competences of scientific methods are given priority to specialist user knowledge. Graduates are especially qualified for demanding tasks in industry and business enterprises in the different areas of mechatronics and the related subjects of mechanical and electrical engineering after brief training periods.

(5) The passing of special courses and projects in cooperation with industrial businesses reinforces the competence of using the acquired knowledge in practice and facilitates the graduates' passage to professional life.

§3 Scope and Duration

The Bachelor's Degree Programme of Mechatronics covers 180 ECTS-credits and based on a workload of 30 ECTS-credits per semester it has a duration of six semesters. One ECTS-creditscorresponds to a workload of 25 hours for the students.

§4 Types of Courses and Maximum Number of Participants

(1) Lectures (VO)
1. Lectures aim at conveying the subject matter with oral presentations, explanations and with examples and demonstrations. Interaction of students and lecturer is aimed at.
2. This type of course encourages e.g. the understanding and integration of knowledge based on the latest developments of the discipline.
3. Lectures are courses without continuous performance assessment.

(2) Tutorials (UE)
1. Tutorials are courses that encourage the practical application of the knowledge acquired in an accompanying lecture on the one hand and encourage students to independently deal with tasks on the other hand. Depending on the subject matter these tasks can be e.g. calculation tasks, constructions, plans, programming tasks, presentation and management tasks, but also laboratory task or a mix of these tasks.
2. This course type encourages et al. self and time management, the ability to work in a team, presentation and media competence, decision-making and problem-solving competence and the development of individual learning strategies.
3. Tutorials are courses with continuous performance assessment.
4. The maximum number of participants is usually 30, for practical, laboratory and machine tutorials and for tutorials within the scope of the Bachelor's Thesis the maximum number participants is usually 15.

(3) Lecture Tutorials (VU)
1. VU-type courses are a combination of lecture and tutorial, whereby the lecture and tutorial share can be adjusted flexibly depending on the requirements of the subject matter. Should it because of the number of participants be necessary to divide the group for the tutorial part, courses of the VU type have a share of 50% for the lecture part and 50% for the tutorial.
2. This course type similarly encourages the competences and skills listed in para. 1 and 2 no. 2.
3. VU courses are courses with continuous performance assessment.
4. The maximum number of participants for VU courses is usually 30, for practical training, laboratory or machine tutorials usually 15.

(4) Seminars (SE)
1. In seminars students are introduced to scientific methods and scientific discourse. Students have to deal with a given theme/project in a scientific way. Participants have to make independent oral and/or written contributions.
2. This course type encourages et al. the self and time management, the ability to work in a team, reliability, communication competence, presentation and media competence, and the development of autonomous learning strategies.
3. Seminars are courses with continuous performance assessment.

4. Maximum number of participants is usually 30.

(5) Practical Trainings (PR)
1. Practical trainings serve the acquisition of skills by working independently with laboratory equipment.
2. This course type encourages et al. the ability to work in a team, reliability, communication skills, structured working and professional competence in unfamiliar situations
3. Practical trainings are courses with continuous performance assessment.
4. The maximum number of participants is usually 15.

(6) Project Studies (PJ)
1. In PJ courses projects are dealt with by writing and giving oral reports.
2. This course type encourages et al. self and time management, the innovation ability, decision-making and problem-solving competence, reflection, competence in project management, presentation and media.
3. Project studies are courses with continuous performance assessment.
4. Maximum number of participants is usually 30. If the courses take place within the scope of Bachelor's Degrees the maximum number of participants is usually 15.

§5 Admission procedures for the admission to courses with a limited number of participants

The following criteria are considered for allocating places for courses with a limited number of participants:

1. Students, the study time of who would be prolonged without admission to the course, are given priority for admission.
2. If the criteria in no. 1 is not sufficient for regulating admission to a course, students, for whom it is mandatory to pass the course, come first, and students that attend the course as optional course second.
3. Should the criteria in no. 1 and no. 2 not suffice for regulating the admission to a course, the available places are drawn.

§6 Compulsory and Optional Modules

(1) Irrespective of the chosen field of specialization the following 18 compulsory modules covering 160.5 ECTS-credits must be passed.

1.	Compulsory Module 1: Fundamentals of Natural Sciences	SSt	ECTS-credits	Univ.
a.	**VO Introduction to Chemistry** Basic principles of chemistry; solid body chemistry; selected chapters from chemistry (e.g. basic structure of matter, aggregates, intermolecular interdependencies, catalysis); engineering processes of materials that are important for industry; features, analytic and application of selected materials;	2	3.0	LFUI
b.	**VO Introduction to Physics** Basic principles of physics; selected chapters from physics (e.g.: measurement and measurement precision, electricity and magnetism, vibrations and waves, optical science, acoustics, quantum mechanics, atoms and solid state bodies);	2	3.0	LFUI

	Total	**4**	**6.0**	
	Learning Objectives of the Module Students are able to understand the fundamentals of the natural sciences of chemistry and physics and are able to apply this knowledge in mechatronics.			
	Registration requirements: none			

2.	**Compulsory Module 2: Electric Engineering und Process Control 1**	**SSt**	**ECTS-Credits**	**Univ.**
	VO Principles of Electrical Engineering Physical fundamentals, electrostatics, charge, potential, tension, electricity, power, direct-current circuits, magnetostatics, electrodynamics, Maxwell's equations, alternating current circuits, alternating current parameters, phasor display, impedance, admittance, complex performance, frequency response locus, Bode diagram, network analysis, polyphase alternating current;	4	6.0	UMIT
	Total	**4**	**6.0**	
	Learning Objectives of the Module Students have an advanced knowledge of electrotechnical principles and parameters, their features and relations.			
	Registration requirements: none			

3.	**Compulsory Module 3: Mathematics and Informatics 1**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VO Mathematics 1** Fundamentals of mathematics for engineering studies: basic principles of mathematics, differential and integral calculus in one variable, linear algebra (vector analysis, matrices, linear system of equations, eigenvalues);	4	5.5	LFUI
b.	**UE Mathematics 1** Lecture-accompanying tutorial: advanced knowledge of the contents, arithmetic problems, examples for application in engineering sciences, computer-aided solution processes;	2	2.5	LFUI
c.	**VO Technical Informatics 1** Depiction and processing of information, Boolean algebra, combinatorial circuits, sequential circuits;	2	3.0	UMIT
	Total	**8**	**11.0**	
	Learning Objectives of the Module Students are familiar with the fundamentals of mathematics and informatics for engineering sciences (linear algebra, differential and integral calculus, digital information processing and the functionality of computers). They also have the qualification to competently apply these disciplines for solving practical problems.			
	Registration requirements: none			

4.	**Compulsory Module 4: Mechanics and Mechanical Engineering 1**	**SSt**	**ECTS-Credits**	**Univ.**

a.	**VO Construction Material 1** Chemical fundamentals (atoms and atom models, atomic bonds), material structure (crystals, x-ray diffractometer, amorphous materials), processes (diffusion, convection, reaction kinetics, phase diagrams);	2	3.0	LFUI
b.	**VU Mechanics in Mechatronics 1** Basic terms of mechanics, power and power groups and their reduction, equilibrium conditions; introduction to the statics of linear frames and liquids; friction, demonstration of the calculation and exercising of independent solving of basic static problems;	3	4.0	LFUI
	Total	**5**	**7.0**	
	Learning Objectives of the Module Students have an advanced knowledge of the background of material features and of the relations of the features and the material structures and of the material structure and the atomic bonds and thus of the atomic compounding respectively. Students are familiar with the basic standard terms of mechanics of solid-state and liquid bodies; They are able to apply the principles of mechanics to basic model problems of statics and have the qualification to develop appropriate (suitable for computers) formulations and mathematical models.			
	Registration requirements: none			

5.	**Compulsory Module 5: Electrical Engineering and Process Automation and Control 2**	**SSt**	**ECTS-AP**	**Univ.**
a.	**VO Electronic Components and Circuits** Fundamentals of electronic components, the physical effects and features they are based upon an their application for realizing basic electronic circuits; analysis and synthesis of passive networks, basic diode and bipolar- and field-effect transistor circuits and basic circuits with analogously integrated components (operational amplifiers, comparators etc);	3	4.0	UMIT
b.	**PR Electronic Components and Circuits** Lecture-accompanying practical laboratory course	1	1.0	
	Total	**4**	**5.0**	
	Learning Objectives of the Module: Students have an advanced knowledge of electronic components and basic circuits of analogous and electronic circuit technology. They are able to design and dimension analogous circuits for special problems, based on basic circuits.			
	Registration requirements: none			

6.	**Compulsory Module 6: Mathematics and Informatics 2**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VO Geometric Modelling, Visualization and CAD in Mechatronics** Projection methods for engineering drawings and CAD, features of geometric objects and their relations, geometric transformations in plane and space, constructions by hand and CAD;	1	1.5	LFUI
b.	**UE Geometric Modelling, Visualization and CAD in Mechatronics** Lecture-accompanying tutorial: furthering of the contents of the	1	1.5	LFUI

	lecture, examples for application in mechatronics, independent making of engineering drawings, constructions by hand and CAD;			
c.	**VO Mathematics 2** Fundamentals of mathematics for engineering studies: differential and integral calculus with several variables and applications, differential equations;	2	3.0	LFUI
d.	**UE Mathematics 2** Lecture-accompanying tutorial: furthering of the contents of the lecture, arithmetic problems, examples for application in engineering science, computer-aided solution methods;	2	2.5	LFUI
e.	**VU Technical Informatics 2** Structure and functionality of the hardware components of a computer, RISC and CISC architectures;	2	3.0	UMIT
	Total	**8**	**11.5**	
	Learning Objectives of the Module Students have an advanced knowledge of the fundamentals of mathematics, geometry and informatics for an engineering study programme (differential and integral calculus with several variables, differential equations; basic geometric objects and their features and relations, illustration methods and their application for depicting objects); They have an advanced understanding of the structure and functionality of computers and are able to competently apply these disciplines for finding innovative solutions to practical problems.			
	Registration requirements: none			

7.	**Compulsory Module 7: Mechanics and Mechanical Engineering 2**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Manufacturing Techniques 1** Fundamentals of manufacturing techniques; chipping and chipless shaping procedures; their application areas and implementation in machine tools; programming of machine tools (CNC and CAD/CAM); rapid prototyping method; measuring techniques in manufacturing;	2	3.0	LFUI
b.	**VO Strength of Materials in Mechatronics** Introduction to the linear elasticity theory and linear bar theory (internal force variables, tension, bending line, flexural buckling);	2	3.0	LFUI
c.	**UE Strength of Materials in Mechatronics** Lecture-accompanying tutorial; furthering of the contents taught at the lecture, calculating problems in linear bar theory;	2	3.0	LFUI
d.	**VU Construction Materials 2** Features of materials (elasticity, plasticity, creepage, shrinkage, transport features); experimental characterization (chemically/thermic matrix-enclosed materials, poly-crystals, amorphous materials, cellular materials); imaging methods (microscopy lab);	4	4.5	LFUI
	Total	**10**	**13.5**	
	Learning Objectives of the Module Students have an advanced knowledge of the most important engineering techniques, their possible applications and methods of measuring technology; They have the competence required for selecting a suitable method for a specific application, to use and program tool machines and to			

	interpret measurement results. Students are able to determine tensions and deformation of deformable bars based on static and thermal stress. Students have advanced knowledge of the most important types of material, their production, their physical features and experimental characterization and the resp. normative classification.
	Registration requirements: none

8.	**Compulsory Module 8: Electrical Engineering and Process Automation and Control 3**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Digital Technology and Semiconductor Circuit Design** Fundamentals of digital technology, TTL and CMOS, combinatorial logics and basic circuits, logic gates, K-map, flip-flops, synchronous and asynchronous counters, integrated circuits, digital interfaces, D/A and A/D converters, circuit design (synchronous/asynchronous sequential logics), application specific integrated circuits- PLDs (PAL, GAL, PROM, FPLA), complex programmable logic devices (CPLD, FPGA), calculation exercises with MultiSim;	4	5.0	LFUI
b.	**PR Electronics** Design, dimensioning and structure of electronic circuits based on transistor and operational amplifier circuits in the lab; metrological validation and documentation of the circuit structure and debugging in electronic circuits;	2	3.0	UMIT
	Total	**6**	**8.0**	
	Learning Objectives of the Module Students have an advanced knowledge of the most important digital components, their structure and of analogue electronic and digital circuit technology. They are familiar with electronic circuits and the interconnection of digital components to complex functional units. They have the competence to independently design digital circuits.			
	Registration requirements: none			

9.	**Compulsory Module 9: Mathematics and Informatics 3**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Principles in Programming** Procedural, modular and object-oriented concepts of programming using a relevant programming language as an example; fundamentals of software engineering, application scenarios, development environment, frameworks;	3	5.0	UMIT
b	**VO Numerical Analysis** Fundamentals of numerical analysis: representation of numbers in computers, numeric differentiation and integration, interpolation and approximation, matrix analysis and linear equation systems, solution of non-linear equations, differential equations;	2	2.5	LFUI
c.	**UE Numerical Analysis** Lecture-accompanying tutorial: furthering of the contents of the lecture, arithmetic tasks, application examples in engineering sciences plus computer aided support with mathematical software and independent programming;	2	2.5	LFUI

d.	**VU Probability Theory and Statistics** Statistics of one- and multi-dimensional data, basic concepts of probability theory, one- and multi-dimensional random variables, important distribution categories, sampling theory, confidence intervals, statistic tests, fundamentals of the probabilistic safety concept; basic stochastic concepts;	2	2.0	LFUI
	Total	**9**	**12.0**	
	Learning Objectives of the Module Students have an advanced knowledge of the basic concepts, methods and tools for programming, designing software and engineering software. Students are familiar with the methods of numerical analysis and of statistics. They have the competence to apply these fundamentals and concepts to solving concrete problems and developmental tasks			
	Registration requirements: none			

10.	**Compulsory Module 10: Mechanics and Mechanical Engineering 3**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Machine Design** Stress determination, dimensioning (interdependency stress – behaviour of the element – failure cause), depiction and application of machine elements (e.g. axis/axles, bearings, gear wheels, screws, shaft-hub joints etc.) under consideration of material, engineering process, assembly, operation and cost etc.;	3	4.0	LFUI
b.	**VO Mechanics in Mechatronics 2** Kinematics; activity and potential energy; fundamental law of dynamics; principle of linear momentum and principle of angular momentum for solid-state and liquid bodies; harmonic oscillators, energy theorem and Bernoulli's principle;	2	3.0	LFUI
c.	**UE Mechanics in Mechatronics 2** Demonstration of the calculation and exercising of independent solving of basic tasks of kinematics and dynamics of solid-state and liquid bodies;	2	3.0	LFUI
	Total	**7**	**10.0**	
	Learning Objectives Students have the ability to deconstruct technical components to elements and to appropriately select, apply and dimension machine components; They have an advanced knowledge of the relations of mechanic and engineering-relevant mechanisms as well as the functionality of machine elements. Students are familiar with the basic terms of kinematics and dynamics of solid-state and liquid bodies in their standardized descriptions; They have the competence to apply principles of kinematics and dynamics on basic model problems and for developing appropriate (suitable for computers) formulations and mathematical models.			
	Registration requirements: none			

11.	**Compulsory Module 11: Electrical Engineering and Process Automation and Control 4**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Electrical Measurement and Sensors** Measuring signals and data processing, debugging, noises, error propagation, analogous measurement technology, measuring feeders and transformers, pointer instruments, measuring of direct and	4	5.0	UMIT

	alternating quantities, test circuits, testing bridges, digital measuring technology, sensors, measuring of non-electric quantities (temperatures, power, pressure, flow, number of rotation and speed etc.);			
b.	**VU Microcontroller Architecture and Applications** Micro- and macro-architectures of microcontrollers;	3	4.0	UMIT
	Total	**7**	**9.0**	
	Learning Objectives of the Module: Students have an advanced knowledge of the most important and fundamental principles of electric measuring technology and electric measuring methods and of the measuring procedures and systems; They are familiar with the functionality and use of important sensors or measuring devices resp. and the appropriate basic circuits. Students have the required knowledge of the functionality of micro- and macro-architectures of microcontrollers and they have the qualification to implement macro architectures using micro architectures.			
	Registration requirements: none			

12.	**Compulsory Module 12: Mathematics and Informatics 4**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Algorithms, Data Structures and Software Engineering** Analysis, time and effort quantification and implementation of algorithms for sorting, searching in sets, trees and graphs; characteristics of efficient algorithms and their resp. data structures; basic concepts of software engineering;	4	5.0	UMIT
b.	**VU Modelling and Simulation** Introduction to modelling of mechatronic systems; linear and non-linear models of dynamic systems; analysis of dynamic systems; algebraic and numeric procedures for simulating system behaviour; model validation and parameter validation; accompanying computer-aided tutorials with standard software packages;	3	4.5	UMIT
	Sum	**7**	**9.5**	
	Learning Objectives of the Module Students have the competence to apply problem-oriented designing, selecting and analysis methods for algorithms and data structures and to model and simulate mechatronic systems.			
	Registration requirements: none			

13.	**Compulsory Module 13: Mechanics and Mechanical Engineering 4**	**SSt**	**ECTS-AP**	**Univ.**
a.	**PR CAD** Functioning of CAD-systems, CAD data model; options of component engineering; construction processes (top-down vs. bottom-up); group of components; standardised preparation of drawings; possibilities of CAE and KBE in modern working processes; practice of the contents with the manufacturing of a simple group of components with preparation of drawings with a 3D-CAD-system if possible in cooperation with an industrial business;	3	4.0	LFUI
b.	**VU Mechanical Engineering and Construction Technology 1** Calculation and application of machine components; standardized	3	4.5	LFUI

	depiction; free-hand drawing and manufacturing drawing; mathematical interpretation and appropriate construction of components according to the specifications sheet; methodical engineering and developing in consideration of the material, assembly, stress, operation and cost etc;			
c.	**VU Thermodynamics** Introduction to thermodynamics; definition of the basic terms (system, state and process variables), conservation principles (mass, impulse, energy), 1st and 2nd law of thermodynamics and their application; ideal gases and real materials and mixtures; fundamentals of thermal transfer;	2	3.0	LFUI
	Total	**8**	**11.5**	
	Learning Objectives of the Module Students are familiar with the abstract basics of 3D-CAD systems and with the different connected modelling types. Students have the competence to independently manufacture simple component groups and drawings and to constructively implement the technical tasks as specified in the specification sheet or in the functionality description by selecting and dimensioning appropriate components and their synthesis to component groups and machines suitable for mechanical engineering and to technically depict them (schematic diagrams, freehand and CAD engineering drawings). Students are able to describe and analyse simple, thermodynamic processes quantitatively; They are familiar with the energy balances of energy conversion and are able to determine quantities that are required for describing thermodynamic states of different working materials;			
	Registration requirements: none			

14.	**Compulsory Module 14: Electric Engineering and Process Automation and Control 5**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VO Electrical Power and Drive Engineering** Energy and power in electric circuits; energy supply; fundamentals of electric power grids and facilities; tasks and structures of transmission and distribution networks; transformers; insulation and high-voltage technology; synchronous and asynchronous machines; characteristics of prime movers and working machines; electric drives via direct-current and three-phase machines; fundamentals of process automation and control;	3	4.5	UMIT
b.	**VU Process Automation and Control** Description of linear, continuous systems as linear transfer elements in the domain of time (differential equations, state-space theory) and in the frequency domain (Laplace-transformation, transfer function, frequency slope); stability analysis; control circuit structures and control synthesis; accompanying computer-aided tutorials and practical application in selected lab-models;	3	4.5	UMIT
	Total	**6**	**9.0**	
	Learning Objectives of the Module Students have an advanced knowledge of the basic terms, components, action principles or mechanic-electric relations of control, energy and drive technology and are able to put these into practice.			
	Registration requirements: none			

15.	Compulsory Module 15: Mathematics and Informatics 5	SSt	ECTS-Credits	Univ.
a.	**VO Advanced Mathematics** Complex mathematical analysis, Fourier series and discrete Fourier transformation; partial differential equations, variational calculus, stochastic analysis, advanced mathematical methods, SVD of matrices, optimizing;	2	3.0	LFUI
b.	**UE Advanced Mathematics** Lecture-accompanying tutorial;	1	1.5	LFUI
c.	**VO Principles of Theoretical Computer Engineering** Propositional logic; automata theory and application; conventional languages; formalizing of languages/grammars; syntax and semantics in languages; computability; Turing-machine; halting problem and decidability; complexity of algorithms; p_ and NP-classes; procedures for solving NP problems;	3	4.5	UMIT
	Total	**6**	**9.0**	
	Learning Objectives of the Module Students are able to apply advanced mathematical methods, linear algebra and numerics for solving practical problems. Students are familiar with the theoretical fundamentals of informatics and have the competence to apply abstract analysis and develop algorithms.			
	Registration requirements: none			

16.	Compulsory Module 16: Mechanics and Mechanical Engineering 5	SSt	ECTS-Credits	Univ.
a.	**PR CNC and Chipping Techniques** Introduction to the application and programming of tool machines; making and implementing simple NC programmes for multi-axle tool machine; furthering of the knowledge of complex tool machines (machining centres) with practical demonstrations and if possible tutorials in the engineering department of an industrial business;	2	2.5	LFUI
b.	**VO Introduction to the Finite Element Method** Introduction to the displacement formula of the finite element method for solving tasks of the linear elasticity theory (flat and spatial finite elements and finite elements for bars, sheets and boarding);	2	2.5	LFUI
c.	**UE Introduction to the Finite Element Method** Demonstration of solutions to practical tasks of the linear elasticity theory with a finite-element programme (calculation of linear discs, sheets and boardings) and guidance for independently solving such tasks;	2	2.5	LFUI
	Total	**6**	**7.5**	
	Learning Objective of the Module Students are familiar with the different types of tool machines and their fields of application; They are able to make simple NC programmes and to implement them on a tool machine. Students know the theoretical fundamentals of the Finite Element Method and have the competence to apply numeric solving processes to tasks of mechatronics; They are able to safely assess the application possibilities and limits of the processes for practical use.			

	Registration requirements: none

17.	Compulsory Module 17: Mechanics and Mechanical Engineering 6	SSt	ECTS-Credits	Univ.
	VU Mechatronic Systems Fundamentals and features of mechatronic systems; mechatronic system design, system description, features and analysis; stationary and dynamic features; actuators and sensors in mechatronics; strategies for reliable operation of mechatronic systems; fault diagnosis and classification, fault prevention; furthering of practical knowledge if possible in cooperation with an industrial business;	3	4.5	LFUI
	Total	**3**	**4.5**	
	Learning Objectives of the Module Students have an advanced knowledge from mechatronic system design to computer-aided manufacturing of mechanic or mechatronic system components resp.			
	Registration requirements: none			

18.	Compulsory Module 18: Bachelor's Thesis	SSt	ECTS-Credits	Univ.
a.	**SE Introduction to Scientific Methods** Rules of good scientific practice; systematic search of literature; structure of a scientific paper; correct quoting; introduction to LaTeX;	1	1.5	LFUI
b.	**PJ Bachelor Project** The theme of the Bachelor project must be chosen from a field of mechatronics;	2	9.0	LFUI/ UMIT
	Total	**3**	**10.5**	
	Learning Objectives of the Module Students are able to independently handle a mechatronic assignment in consideration of the rules of good scientific practice and of the relevant social and ethical requirements.			
	Registration requirements: Compulsory module A1 or A2 according to the chosen field of specialization			

(2) Depending on the chosen field of specialization the compulsory module A1 or A2 covering a total of 4.5 ECTS-credits must be passed.

1.	Compulsory Module A1: Industrial Mechatronics and Material Sciences	SSt	ECTS-Credits	Univ.
	VU Hydraulics and Pneumatics Fundamentals of hydraulics and pneumatics; pneumatic and hydraulic systems (pumps, motors, valves, hydrostatic drives, hydraulic switches, controllers and accumulators); functionality of pneumatic switches; compressed air generation and drives; comparison of fluidic, electric and mechanic solutions for drives; if possible tutorial exercises in cooperation with an industrial business;	3	4.5	LFUI

	Total	**3**	**4.5**	
	Learning Objectives of the Module: Students have an advanced knowledge of the structure and functionality of hydraulic and pneumatic systems and drives, as well as the competence to lay and assemble suitable solutions for drives and automation.			
	Registration requirements: none			

2.	**Compulsory Module A2: Biomedical Technology**	**SSt**	**ECTS-Credits**	**Univ.**
	VU Medical Physics and Biophysics Structure and functionality of imaging methods (x-ray, computer, magnetic resonance, electrical impedance tomography, ultrasound, endoscopy); laser applications in medicine; selected chapters of biophysics;	3	4.5	UMIT
	Total	**3**	**4.5**	
	Learning Objectives of the Module: Students have an advanced knowledge of the physical principles of imaging procedures and are able to apply biophysical methods in bio-medicine.			
	Registration requirements: none			

(3) Depending on the selected field of specialization the optional module A1 or A2 covering a total of 7.5 ECTS-credits must be passed.

1.	**Optional Module A1: Industrial Mechatronics and Material Engineering**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**PR Applied Automation** Introduction to the components of modern automation systems; process peripherals, field bus systems, process control systems; computer languages for process automation; real-time programming and feedback control system implementation in practice incl. extensive laboratory tutorials;	2	2.5	UMIT
b.	**VU FEM – Material Engineering** Simulation and designing of damaging processes; demonstration of solutions to practical problems with a finite-element program;	2	2.5	LFUI
c.	**SE Mechatronics in Practice 1** Students are advised to pass a subject-specific practical training in technology to test the acquired knowledge and skills in practice. A practical training covering 240 hours is a precondition for attending the seminar. Within the scope of the seminar students report and discuss their work experience in a technical area of mechatronics of at least 240 working hours.	1	2.5	UMIT
d.	**VU Robotics 1** Introduction to the different robot systems (serial, parallel and rolling robots); Denavit-Hartenberg-notation, forward and backward transformation, singularities;	2	2.5	LFUI

e.	**VU Structural Dynamics 1** Analysis of single-degree-of-freedom and multi-degree-of-freedom systems in the domain of time and frequency; modal analysis; vibration insulation and absorption;	2	2.5	LFUI
	Total Courses covering 7.5 ECTS-credits have to be passed from the courses listed from a. to e.		**7.5**	
	Learning Objectives of the Module Students are able to implement the acquired knowledge and competences in the areas of mechatronics for finding correct solutions for practical problems in the area of industrial mechatronics and material sciences. They are familiar with the required theoretical foundations, methods and theories and know their fields of applications as well as their limits. They are able to document and discuss the found results and solutions appropriately.			
	Registration requirements: Compulsory module A1 acc. to ³6 para. 2 no. 1			

2.	**Optional Module A2: Biomedical Technology**	**SSt**	**ECTS-Credits**	**Univ.**
a.	**VU Image-Based Diagnostics and Therapy in Medical Technology** Basic methods, especially marker-based and marker-less registration. Specific requirements and fields of application in surgery, radiation therapy, endoscopy, radiology.	2	2.5	UMIT
b.	**VU CARS – Computer-Assisted Radiology and Surgery** Basic methods of image interpretation and classification in clinical fields of application. Navigation and tracking methods in OR and other treatment settings. Tele-manipulation and robotics in clinical medicine, specific problems and requirements, examples.	2	2.5	UMIT
c.	**SE Mechatronics in Practice 1** Students are advised to pass a subject-specific practical training in technology to test the acquired knowledge and skills in practice. A practical training covering 240 hours is a precondition for attending the seminar. Within the scope of the seminar students report and discuss their work experience in a technical area of mechatronics of at least 240 working hours.	1	2.5	UMIT
d.	**VU Software Project Biomedical Informatics** Development of software for finding a solution to a practical biomedical problem by using advanced concepts of software design, engineering and project managements;	2	2.5	UMIT
	Total Courses covering a total of 7.5 ECTS-credits must be passed from the courses listed from a. to d.		**7.5**	
	Learning Objectives of the Module Students are able to implement the acquired knowledge and competences in the areas of mechatronics for finding correct solutions for practical problems in the area of biomedical technology. They are familiar with the required theoretical foundations, methods and theories and			

	know their fields of applications as well as their limits. They are able to document and discuss the found results and solutions appropriately.
	Registration requirements: Compulsory module A2 acc. to §6 para. 2 no. 2

(4) To encourage subject-unspecific, interdisciplinary competences the following optional module covering 7.5 ECTS-credits must be passed.

	Elective Module: Subject-Unspecific, Interdisciplinary Competences	**SSt**	**ECTS-Credits**	**Univ.**
	Courses covering 7.5 ECTS-credits can be freely chosen from the curricula of other BA study programmes of the LFUI and UMIT. It is especially recommended to visit a course dealing with gender aspects and the subject-specific results of gender research (e.g. Gender Aspects in Technology); Also recommended is the attending of courses encouraging language and social skills; Moreover courses dealing with aspects of safety technology (legal foundations, work and product safety) in mechatronics are recommended.		7.5	LFUI/ UMIT
	Total Courses covering 7.5 ECTS-credits must be passed.		**7.5**	
	Learning Objectives of the Module Students have the qualification to get involved in a scientific discourse in a constructive, responsible and gender-sensitive way that also goes beyond the boundaries of their special discipline.			
	Course requirements: The course requirements specified in the respective curricula must be met.			

(5) The recommended course of studies is shown in the electronic study guide of the resp. websites of the LFUI and UMIT.

§7 Study Orientation Period

(1) The study orientation period covers one semester (30 ECTS-credits) and gives the students an overview of the most important contents of the study programme and of its further course to give them a factual basis for a decision on and a personal assessment of their choice of studies.

(2) Within the scope of the orientation period the following courses that may be repeated twice must be passed:
1. Mathematics 1 (VO4, 5.5 ECTS-credits, §6 para. 1 no 7 littera a)
2. Technical Informatics 1 (VO2, 3.0 ECTS-credits, §6 para. 1 no. 3 littera c)

(3) Positive passing of the exams listed in para. 2 entitles to passing all further courses and examinations that go beyond the orientation period, as well as to writing the Bacherlor's thesis specified in the curriculum. The registration requirements given in the curriculum must be met.

§8 Bachelor's Thesis

A Bachelor's thesis covering 9 ECTS-credits must be written. The theme of the Bachelor's thesis must be chosen from an area of mechatronics. The Bachelor's thesis must be presented within the scope of the Bachelor project course and be submitted in writing and electronic form to the head of the lecture.

§9 Examination Regulations

(1) Course lecturers inform the students on the evaluation criteria before the course starts and determine an examination method as listed in para. 2 to 6.

(2) An exam takes place at the end of the course to assess the performances of each lecture of a compulsory or optional module. Examination method: written and/or oral examination.

(3) Tutorials and practical courses of a compulsory or optional module are courses with continuous performance assessment all through the course.

(4) Lecture-tutorials of optional and compulsory modules are courses with continuous performance assessment for the tutorial part and a final examination at the end of the course for the lecture part of the course. Examination method: tutorial: continuous performance assessment; lecture: written and/or oral examination.

(5) Seminars of compulsory and optional modules are courses with continuous performance assessment and a final examination at the end of the course. Examination method: continuous performance assessment and written and/or oral examination.

(6) A project paper and its presentation is the basis for assessment of project studies. Examination method: continuous performance assessment

(7) A compulsory module is passed with the positive evaluation of all required courses of the respective module.

(8) Optional modules are passed with the positive evaluation of all courses required for reaching the amount of ECTS-credits according to §6 para. 3 and 4.

§10 Academic Degree

Graduates of the joint Bachelor's Degree Programme of Mechatronics of the Leopold-Franzens-University of Innsbruck and the UMIT – Private University for Health Sciences, Medical Informatics and Technology earn the academic degree of "Bachelor of Science", abbreviated as "BSc".

§11 Coming into Force/Coming our of Force

(1) This curriculum comes into force on 1 October 2011.

(2) §7 in the version of the University of Innsbruck bulletin of 31 May 2012, Issue 29, No. 307 goes out of force at the end of 30 September 2014.

(3) §7 in version of the University of Innsbruck bulletin of 31 May 2012, Issue 29, No. 307 goes into force on 1 October 2012 and is to be applied to all students.

(4) §11 para. 2 and 3 go out of force at the end of 30 September 2013.

(5) The changes of the curriculum in the version of the University of Innsbruck bulletin of 11 June 2013, Issue 40, No. 318 goes into force on 1 October 2013 and is to be applied to all students.

(6) §7 in the version of the University of Innsbruck bulletin of 11 June 2013, Issue 40, No. 318 goes out of force on 31 December 2015.