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Curriculum for the **Master's Programme Electrical Engineering** at the Faculty for Engineering Sciences at the University of Innsbruck

Contents

§ 1 Allocation of the study programme

Acc. to §54 par. 1 Universities Act 2002, the Master's Programme Electrical Engineering is allocated to the group of engineering studies.

§ 2 Qualification profile

(1) The Master's Programme Electrical Engineering advances the knowledge gained in the joint Bachelor's Programme Electrical Engineering at the Leopold-Franzens-University of Innsbruck and the UMIT – the Private University for Health Sciences, Medical Computer Sciences and Technology with advanced relevant knowledge and skills that enable the pursuit of highly qualified, independent and innovative research and development work in essential disciplines of electrical engineering. In addition, students of electrical engineering are taught problem-solving strategies as part of their studies, which make them attractive as graduates for many responsible positions in all industries with a technological connection. This is achieved through in-depth study of selected current subfields of electrical engineering together with involvement in modern research.

(2) Graduates of the Master's Programme Electrical Engineering are able to plan, project, analyse and advise on the planning, construction and operation of systems and solutions in the above-mentioned fields in companies of various sizes and in relevant industries and to take on management positions. This also applies to jobs in research and development, product management, sales, production or technical purchasing in industry. Furthermore, they can take on positions in the patent system or decide to become self-employed. Possible career fields are also activities in public administration, associations, chambers, interest groups and media as well as activities in teaching and research institutions.

(3) In preparation for these tasks, the students of the Master's programme advance their knowledge of both, the fundamentals and methods of electrical engineering in a first phase, while the second phase focuses on research-oriented independent profile formation. An increased offer of research-supported teaching both in the area of the key research strengths of the university's internal research groups and within the framework of two innovative specialisations, qualifies students for doctoral study programmes and promotes creative thinking.

§ 3 Scope, duration and structure

(1) The Master's Programme Electrical Engineering covers 120 ECTS-Credits. This corresponds to a duration of the study programme of four semesters. One ECTS-Credit corresponds to a workload of 25 hours.

(2) The Master's Programme Electrical Engineering offers the opportunity to select one of the specialisations (i)"Power Electronics, Drive Technology and Energy Technology" (or (ii) "Control Engineering, Measurement Technology and Robotics".

§ 4 Languages of instruction

The courses and examinations are held in German or English. The Master's Thesis can also be written in German or English.

§ 5 Admission

(1) The admission to the Master's Programme Electrical Engineering requires the completion of a subject-relevant Bachelor's study programme or a subject-specific Bachelor's degree from a university of applied sciences or another equivalent degree programme of a recognised post-secondary educational institution in Austria or abroad.

(2) In any case, the completion of the joint Bachelor's Programme Electrical Engineering at the University of Innsbruck and the UMIT Private University for Health Sciences, Medical Computer Sciences and Technology is deemed to be a subject-relevant study programme. The Rectorate decides on the admission to the Maser's programme based on the regulations of the Universities Act 2002 on the completion of another eligible degree programme or on the equivalence of a study

programme completed at a recognised post-secondary educational institution home or abroad.

(3) If equivalence is given in principle, with only a few supplements missing for full equivalence, the Rectorate is entitled to prescribe examinations to be taken during the Master's programme for full equivalence. Acc. to UA §64 par. 3, the supplementary examinations prescribed to compensate for subject-related differences within the framework of admission must be taken by the end of the second semester of the Master's programme.

§ 6 Types of courses and maximum number of participants per course

(1) Courses without continuous performance assessment:

Lectures (VO) are courses held in lecture format. They introduce the research areas, methods and schools of thought for a given subject.

(2) Courses with continuous performance assessment:

1. Practical courses (UE) focus on the practical treatment of concrete scientific tasks within an area. Maximum number of students per course: 30; for practical, laboratory and equipment parts: 15.
2. Seminars (SE) provide in-depth treatment of scientific topics through students' presentations and discussion thereof. Maximum number of students per course: 30
3. Lectures with practical elements (VU) focus on the practical treatment of concrete scientific tasks that are discussed during the lecture parts of the course. Maximum number of students per course: for the course: 30; for the practical, laboratory and equipment parts: 15.
4. Practical training courses (PR) provide practical experience with concrete scientific tasks, complementing occupational and academic training. Maximum number of students per course: 15.

§ 7 Allocation of places in courses with a limited number of participants

The following criteria shall apply for the allocation of places in courses with a limited number of students per course:

1. Students for whom the study duration would be extended due to the postponement are to be given priority.
2. If the criteria in no. 1 do not suffice to regulate the admission, first, students for whom this course is part of a compulsory module, and second, students for whom this course is part of an elective module are to be admitted.
3. If the criteria in no. 1 and 2 do not suffice to regulate the admission, the available places are drawn at random.

§ 8 Compulsory and elective modules

(1) Compulsory modules covering altogether 20 ECTS-Credits are to be passed as follows:

1.	**Compulsory Module: Higher Mathematics and Control Engineering**	**h**	**ECTS-Credits**
a.	**VU Mathematical Optimisation**	2	3
b.	**VU Advanced Control**	3	4.5
	Total	**5**	**7.5**
	Learning Outcomes: After successful completion of this module, the students have a profound understanding of the mathematical concepts, tasks and methods of optimisation and optimum control and are able to apply them. They also have advanced knowledge of modern concepts for the control of linear and non-linear SISO and MIMO systems and can use these purposefully for the design of model-based controls.		

	Prerequisites: none

2.	**Compulsory Module: Sensor Technology and Power Electronics**	**h**	**ECTS-Credits**
a.	**VU Sensor and Actuator Design**	2	3
b.	**VO Power Electronics**	2	3
c.	**UE Power Electronics**	1	1.5
	Total	**5**	**7.5**
	Learning Outcomes: After successful completion of the module, the students have an advanced understanding of numerical methods in sensor and actuator technology and can apply them practically to solve problems. They are able to analyse and model advanced systems and concepts of power electronics and to realise them with power electronics components.		
	Prerequisites: none		

3.	**Compulsory Module: Preparation of the Master's Thesis**	**h**	**ECTS-Credits**
	Agreement on the topic, the scope and the form of the Master's Thesis on the basis of a brief description of the content (synopsis) as well as agreement on the work processes and the study progress; planning of an appropriate time frame for the completion of the Master's Thesis.	-	2.5
	Total	**-**	**2.5**
	Learning Outcomes: After successful completion of the module, the students are able to write a short description of the contents of the Master's Thesis (synopsis) and to outline a time schedule.		
	Prerequisites: none		

4.	**Compulsory Module: Master's Thesis Defence (Defensio)**	**h**	**ECTS-Credits**
	Final oral defence of the Master's Thesis before a an examination board	-	2.5
	Total	**-**	**2.5**
	Learning Outcomes: Reflection on the Master's Thesis in the overall context of the master's programme; the focus is on theoretical understanding, methodological principles, communication of the results of the Master's Thesis and presentation skills.		
	Prerequisites: positive evaluation of all other compulsory and elective modules as well as the Master's Thesis		

(2) Elective modules covering altogether 75 ECTS-Credits are to be passed as follows:

1. 15 ECTS-Credits are to be acquired by passing two elective modules acc. to §8 par. 3 no. 1 to 4.
2. Another 60 ECTS-Credits are to be selected from
   a. 30 ECTS-Credits in the form of a specialisation acc. to no. 3 and further modules covering 30 ECTS-Credits from elective modules acc. to §8 par. 3 no. 5 to 14 or
   b. 60 ECTS-Credits from the elective modules acc. to §8 par. 3 no. 5 to 14.
   c. In place of the elective module "Interdisciplinary Skills" acc. to §8 par. 3 no. 13 and the "Individual Choice of Specialisation" acc. to §8 par. 3 no. 14, a Minor (Supplementary Subject Areas) for Master's Programmes may be passed, providing the availability of places. Minors are fixed modules from other disciplines covering 30 ECTS-Credits. They are published in the University of Innsbruck Bulletin.
3. The specialisations "Power Electronics, Drive Technology and Energy Technology" and "Control Engineering, Measurement Technology and Robotics" are available. If a specialisation is chosen, the Master's Thesis must be written in the field of the specialisation.
   a. By passing the elective modules acc. to §8 par. 3 no. 5, 6 and 7, the specialisation "Power Electronics, Drive Technology and Energy Technology" is passed.
   b. By passing the elective modules acc. to §8 par. 3, no. 8, 9 and 10, the specialisation "Control Engineering, Measurement Technology and Robotics" is passed.

(3)

1.	**Elective Module: Microelectronics**	**h**	**ECTS-Credits**
a.	**VU Microelectronics**	2	3
b.	**VU Electronic Systems**	2	2.5
c.	**PR Microelectronics**	1	2
	Total	**5**	**7.5**
	Learning Outcomes: After successful completion of this module, the students possess advanced knowledge in the field of analysis, design, realisation and testing of microelectronic circuits and systems.		
	Prerequisites: none		

2.	**Elective Module: Machine Learning**	**h**	**ECTS-Credits**
a.	**VU Machine Learning**	3	5
b.	**VO Information Technology**	2	2.5
	Total	**5**	**7.5**
	Learning Outcomes: After successful completion of the module, students have in-depth theoretical knowledge in the area of machine learning and classic information theory. They are able to realistically assess possible applications of machine learning and use their knowledge to solve specific problems.		
	Prerequisites: none		

3.	Elective Module: Power Converter Technology	h	ECTS-Credits
a.	**VU Power Converter Technology**	2	2.5
b.	**VU Power Converter Control**	1	2
c.	**VO Digital Signal Processing**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After successful completion of the module, the students have an in-depth understanding of the structure, function, control and possible applications of modern power converters. They are able to combine this knowledge with methods from other fields of engineering, for example measurement and control technology. They are able to recognise and analyse problems that occur in practice-relevant situations and find possible solutions.		
	Prerequisites: none		

4.	Elective Module: High Frequency Technology	h	ECTS-Credits
a.	**VO High Frequency Technology**	2	2.5
b.	**VU Integrated Radio Systems**	2	2.5
c.	**VU Signals and Systems 3**	2	2.5
	Total	**6**	**7.5**
	Learning Outcomes: After successful completion of the module, students have a deeper understanding of energy and active power transport by means of electromagnetic waves. They have an advanced understanding in connection with wireless communication of integrated systems with high-frequency components.		
	Prerequisites: none		

5.	Elective Module: Power Electronics	h	ECTS-Credits
a.	**VO Power Semiconductors**	2	2.5
b.	**UE Power Semiconductors**	1	1.5
c.	**VU Flexible AC-Systems**	2	3
d.	**PR Power Electronics**	2	3
	Total	**7**	**10**
	Learning Outcomes: After successful completion of the module, students are familiar with the physical and technological properties of modern power semiconductors and can select, analyse and model them for the use in power electronic systems.		
	Prerequisites: none		

6.	Elective Module: Electric Drive Technology	h	ECTS-Credits
a.	**VU Electrical Machines**	2	3
b.	**VO Electric Drive Technology**	2	3
c.	**VU Control of Drive Systems**	1	2
d.	**PR Electric Drive Technology**	1	2
	Total	**6**	**10**
	Learning Outcomes: After successful completion of the module, the students have an in-depth understanding of the physical functional principles of electrical machines. They are able to analyse and model electrical machines in stationary and dynamic operating conditions. They have experience in handling electrical machines and drives in practice-relevant situations.		
	Prerequisites: none		

7.	Elective Module: Energy Systems	h	ECTS-Credits
a.	**VO Energy Systems**	2	3
b.	**UE Energy Systems**	1	1.5
c.	**VO Energy Conversion and Storage**	2	3
d.	**VU Photovoltaic Systems**	2	2.5
	Total	**7**	**10**
	Learning Outcomes: After successful completion of the module, students are familiar with the special characteristics of conventional, renewable and decentralised energy sources. They have in-depth knowledge of methods of energy conversion from renewable energy sources and are able to define sustainable use concepts.		
	Prerequisites: none		

8.	Elective Module: Control Engineering	h	ECTS-Credits
a.	**VU Optimum Control and Regulation**	2	3
b.	**PR Optimum Control and Regulation**	1	1.5
c.	**VU Control of Nonlinear Systems**	2	2.5
d.	**PR Linear and Nonlinear Control Engineering**	1	2
	Total	**6**	**10**
	Learning Outcomes: After successful completion of the module, students have in-depth knowledge of non-linear phenomena of dynamic systems as well as methods for their characterisation. They are familiar with analytical and optimisation-based design methods for the control of dynamic systems and are able to use them to solve demanding control tasks in a targeted way.		
	Prerequisites: none		

9.	Elective Module: Measurement Technology	h	ECTS-Credits
a.	**VU Process Measurement Technology**	2	2.5
b.	**VO Embedded Systems**	2	3
c.	**VU Computer-Vision**	2	2.5
d.	**PR Process Measurement Technology**	1	2
	Total	**7**	**10**
	Learning Outcomes: After successful completion of the module, the students are familiar with advanced methods of measurement technology and can design modern measurement systems of process measurement technology and use computer-aided measurement technology. They know important tasks of computer vision and can algorithmically implement procedures for the reconstruction of three-dimensional scene geometries. They know modern hardware and software components of embedded systems as well as the special requirements of embedded operating systems.		
	Prerequisites: none		

10.	Elective Module: Automation and Robotics	h	ECTS-Credits
a.	**VU Robot Systems**	2	2.5
b.	**VU Robotics 2 in Electrical Engineering**	2	2.5
c.	**PR Robot Systems**	1	2.5
d.	**VU Discrete Event Systems**	2	2.5
	Total	**7**	**10**
	Learning Outcomes: After successful completion of the module, the students have an in-depth understanding of the kinematic description of robot systems and are able to use this knowledge for the analysis, synthesis and evaluation of mechanical systems. They have advanced knowledge of the structure and main functions of robot systems and can solve complex handling tasks with collaborative and mobile robots. They master methods for modelling, analysing and designing combinatorial and sequential controls and are able to use these to solve demanding control tasks.		
	Prerequisites: none		

11.	Elective Module: Specialisation A	h	ECTS-Credits
a.	**VU Specialised Topics 1**	3	5
b.	**VU Specialised Topics 2**	3	5
	Total	**6**	**10**
	Learning Outcomes: In-depth understanding of specialised fields in electrical engineering; acquisition of the ability to independently advance one's knowledge and skills in the field;		
	Prerequisites: none		

12.	Elective Module: Specialisation B	h	ECTS-Credits
a.	**VU Specialised Topics 3**	3	5
b.	**VU Specialised Topics 4**	3	5
	Total	**6**	**10**
	Learning Outcomes: In-depth understanding of specialised fields in electrical engineering; acquisition of the ability to independently advance one's knowledge and skills in the field;		
	Prerequisites: none		

13.	Elective Module: Interdisciplinary Skills	h	ECTS-Credits
	Providing the availability of places, courses from the curricula of the master's and/or diploma programmes offered at the University of Innsbruck are to be selected. It is recommended to select a course from the field of Gender Studies, Women's and Gender Studies.	-	10
	Total	**-**	**10**
	Learning Outcomes: Expansion of the study programme and acquisition of additional qualifications;		
	Prerequisites: The perquisites specified by the respective curricula must be met.		

14. Individual Choice of Specialisation

For individual specialisation, modules covering 20 ECTS-Credits can be freely selected from the curricula of the Master's programmes offered at the Faculty of Engineering Sciences and the Faculty of Mathematics, Computer Science and Physics of the University of Innsbruck. The registration prerequisites specified by the respective curricula must be met.

§ 9 Master's Thesis

(1) A Master's Thesis amounting to 25 ECTS-Credits has to be written. The Master's Thesis is a scientific piece of work which serves to prove the student's ability to work independently on a scientific topic and to do so in an impeccable manner in terms of content and methodology.

(2) If a specialisation acc. to §8 par. 2 no. 2 is selected, the Master's Thesis must be written in the field of the specialisation, otherwise the topic is to be picked from the field of electrical engineering.

(3) The students are entitled to suggest the topic for their Master's Thesis or to select one from a number of suggestions.

§ 10 Examination regulations

(1) Modules are assessed by module examinations. Module examinations are exams that serve to demonstrate the knowledge and skills acquired in a module. Modules are completed with the positive assessment of all parts of a module examination.

(2) The performance evaluation of courses of modules – with the exception of the compulsory modules 3 and 4 – shall be assessed by means of course examinations. Course examinations are

a. examinations that assess the knowledge and skills covered in an individual course in which course assessment is based on a single examination at the end of the course. The course instructor has to announce the method of examination (written or oral) before the start of the course.

b. courses with continuous assessment, for which course assessment is based on regular written and/or oral contributions by participants.

(3) Before the start of the course, the course instructors have to inform the students in a suitable manner about the objectives, contents and methods of their course as well as the contents, methods and evaluation criteria and standards.

(4) The assessment of the compulsory module “Preparation of the Master’s Thesis” is made by the supervisor based on a synopsis. Positive evaluation reads “successfully completed”, negative evaluation “unsuccessfully completed”.

(5) The performance of the compulsory module “Master’s Thesis Defence” is assessed by an oral examination before an examination board. The examination board shall consist of three persons.

§ 11 Academic Degree

Graduates of the Master’s Programme Electrical Engineering are awarded the academic degree “Diploma Engineer”, abbreviated as “Dipl.-Ing.” or “DI”.

§ 12 Coming into Force

This curriculum comes into force as of 1 October 2022.