



SUBJECT-SPECIFIC CRITERIA

Relating to the accreditation of Bachelor's and Master's degree programmes in electrical engineering and information technology

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The following specifications complement the "ASIIN General Criteria for the Accreditation of Degree Programmes".

1. Classification

1.1 Function

The Subject-Specific Criteria (SSC) of the Technical Committee for Electrical Engineering and Information Technology have the premise that the intended learning outcomes framed by Higher Education Institutions in their own responsibility and according to their academic profile concerning the programmes submitted for accreditation build the main scale for their curricular review.

Above this the Subject-Specific Criteria of all ASIIN Technical Committees meet a number of important functions:

The SSC are the result of an assessment, regularly performed by ASIIN Technical Committees, which summarize what is considered as good practice by a professional community formed equally by academics and professional practitioners in higher education and is required as future-oriented quality of training in the labour market. The expectations outlined in the SSC for the achievement of study objectives, learning outcomes and competency profiles are not developed statically. They are rather subject to constant review in close cooperation with organizations of the professional community, such as associations of faculties and university departments, professional societies and federations relating professional practice. Applicant universities are asked to study critically the interaction between the intended learning outcomes they strive for, the curricula and their relating quality expectations by using SSC and to position themselves in the light of their own higher education goals.

In their role in the accreditation process the SSC also provide a professionally elaborated basis for discussion among experts, Higher Education Institutions and bodies of ASIIN. By this they make an important contribution to the comparability of national and international accreditation procedures, since it should not be left to chance of the characters of the individual evaluators which technical parameters find their way into discussion and individual assessment. Simultaneously the SSC enumerate those abilities, skills and competencies which may typically be considered as state of the art of a discipline, but which can always be exceeded and varied, and also should be in accordance with the objectives of the university.

For inter- and multidisciplinary studies the SSC of ASIIN can provide orientation for presentation and evaluation. However, they are basically aligned on the core subjects of particular disciplines.

The SSC of the ASIIN are positioned and coordinated internationally and thus contribute to the achievement of the unified European Higher Education Area. They act on requirements of the "Bologna 2020" European strategy to formulate subject specialized, discipline-oriented learning outcomes as one of the most important means for the promotion of academic and professional mobility in Europe as quality requirement. The SSC consider, among others, the many preparations in the context of European projects (e.g. "Tuning") and professional networks.

In this context, the educational objectives and competencies for Bachelor's and Master's degree programmes in electrical engineering and information technology described in the following sections should be a support tool for the application and the assessment in the accreditation process.

1.2 Collaboration of the Technical Committees

The Technical Committee Electrical Engineering and Information Technology works together with the other Technical Committees of ASIIN, mostly to give consideration to the requirements of interdisciplinary study programmes. The universities are called upon to submit their assessment of the assignment of one or several Technical Committees in the course of the application for an accreditation procedure.

Degree programmes with a proportion of more than 50 percent of electrical and information engineering contents are overseen by the Technical Committee Electrical and Information Engineering who is, as a rule, in charge of the accreditation procedure and seeks advice of auditors from other areas, if needed. When it comes to interdisciplinary study programmes with a weighted share of electrical and information engineering contents (below and up to and including 50%) the Technical Committee Electrical and Information Engineering and the disciplines involved are jointly responsible or simply provide auditors.

2. Educational Objectives and Learning Outcomes

The educational objectives are outlined by the description of the learning outcomes required by the graduates for practising their profession or for post-graduate studies. These outcomes vary in extent and intensity in accordance with the differing objectives of Bachelor's and Master's programmes.

2.1 Requirements on Bachelor's Degree Programmes

Bachelor's degree programmes on the one hand should qualify for a professional career, which means the possibility of an early career start in the fields of electrical engineering and information technology, and on the other hand should qualify graduates also for further scientifically profound studies or for postgraduate studies not dealing with electronics or information technology.

The development of a profile in either electrical engineering or information technology takes place by the formation of a particular focus during general studies, discipline-specific studies and by the core areas of application. Possible **core areas of application** of the study subjects electrical engineering or information technology or the combination of both areas are e.g.:

- automation technology
- electronics
- power engineering
- high-frequency technology
- information transfer
- communication technology
- illumination engineering
- mechatronics
- medical engineering
- microsystems engineering
- telecommunication technology
- technical informatics

Educational objectives	Learning outcomes	Exemplary curricular contents
<p>Knowledge and understanding</p>	<p>Graduates have in particular ...</p> <ul style="list-style-type: none"> • gained a broad and sound knowledge in mathematics, natural sciences and engineering enabling them to understand the complex phenomena peculiar to electrical engineering / information technology. • gained an understanding for the broader multi-disciplinary context of Engineering Sciences. 	<ul style="list-style-type: none"> • Algebra, complex numbers, elementary analysis, vector calculus, differential calculus, integral calculus, functions of several variables, linear equations, Fourier series, Laplace transformation, probability theory and statistics, differential equations, discrete mathematics, numerics, mechanics, vibration theory, wave theory, optics, structure of matter, thermodynamics, acoustics, theory of heat. • Electric circuits with direct current, electric field, magnetic field, complex AC circuits, network theory and analysis, non-sinusoidal currents and voltages, energy conversion and energy transport, measuring and control engineering, electrical components, switching in electrical networks, linear and nonlinear circuits. <p>Boolean algebra, information theory and cryptography, circuit components, digital circuit design, principles of programming, programmes and machines, software engineering, algorithms and data structures, fundamentals of computer architecture.</p> <ul style="list-style-type: none"> • Theoretical electrical engineering, control engineering, electric machines, electric installations, communication technology, microelectronics, high-frequency technology. <p>Computer architecture, software engineering, technical computer science, computer networks, media technology, application-oriented computer systems, Internet technology.</p>
<p>Engineering analysis</p>	<p>Graduates are able ...</p> <ul style="list-style-type: none"> • to select and apply actual methods of modelling, calculating, and testing concerning their field of specialisation. • to make research of 	

	<p>technical literature and other sources of information relating given problems.</p> <ul style="list-style-type: none"> • to design and run experiments and computer simulations and to explain the results. • to consult data base systems, information on norms, guidelines („codes of good practice“) and safety regulations for these purposes. 	
Engineering design	<p>Graduates ...</p> <ul style="list-style-type: none"> • have special abilities to develop analogue and digital electric and electronic circuits, devices and products. • control in their design work the use of elements like modelling, simulation and tests as well as their integration in a problem oriented way. • are able to design products for the global market. 	
Engineering practice and product development	<p>Graduates ...</p> <ul style="list-style-type: none"> • can apply their knowledge and understanding to acquire practical skills for problem solving, for research tasks and the design of systems and procedures, • have access to experience concerning possibilities and limits of the application of materials, computer-based model designs, systems, processes and tools for the solution of problems when solving complex problems, • know the practice and its demands in production plants, • are capable of searching technical literature and other information sources, • demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, • commit to professional ethics, responsibilities and norms of engineering practice, • use the appropriate scientific methods and new findings of 	

	<p>the engineering and science environment in their practical work while taking into consideration the economic, ecological, technical and social requirements,</p> <ul style="list-style-type: none"> • are aware of the non-technical effects of engineering activities, • are in the position to develop marketable products for the global market. 	
Transferable skills	<p>Graduates are able to ...</p> <ul style="list-style-type: none"> • analyse and present technical contexts understandingly in their own field and in neighbour fields; • operate on technical working tasks in a team and to coordinate it if necessary; • demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations; • recognise the need for, and have the ability to engage in independent, life-long learning. 	

2.2 Requirements on Master's Degree Programmes in Electrical Engineering and Information Technology

The concrete designing of the Master's degree programmes is orientated on the specific strengths of the respective universities. The decision upon admission to Master's degree programmes should not solely be based on the individual qualifications of the applicants.

The **creation of a profile** for the courses in electrical engineering or information technology is based on focal fundamentals, especially as to advanced specific fundamentals of electrical and information engineering as well as the focal points of application mentioned before (*vide* 2.1).

Educational objectives	Learning outcomes	Exemplary curricular contents
	<p>Graduates ...</p> <ul style="list-style-type: none"> • have in-depth knowledge in advanced fundamentals in mathematics and sciences. • have in-depth knowledge in advanced subject-specific fundamentals in electrical engineering. <p><i>or</i></p>	<p>Vector analysis, ordinary and partial differential equations, discrete mathematics, numerics.</p> <p>Electric field, magnetic field, electromagnetic fields, network theory and analysis, non-sinusoidal currents and voltages, energy conversion and energy transport, measuring and control engineering, special components of electro-techniques, linear and nonlinear circuits</p>

Knowledge and understanding	<p>have in-depth knowledge in advanced subject-specific fundamentals in information technology.</p> <ul style="list-style-type: none"> • have in-depth knowledge in one of the mentioned primary fields of application based on subject-specific fundamentals. 	<p>Information theory and cryptography, digital circuit design, principles of programming, programmes and machines, software engineering, algorithms and data structures, advanced computer architecture, computer networks, traffic theory.</p>
Engineering analysis	<p>Graduates ...</p> <ul style="list-style-type: none"> • can evaluate new complex modelling, measuring, design and test methods concerning their relevance, effectiveness and efficiency and can develop independently new methods. 	
Engineering design	<p>Graduates ...</p> <ul style="list-style-type: none"> • have specific skills for the design, development and operation of complex technical systems and services, thereby they • are capable to assembly the best components of these systems optimally as well as to evaluate the interaction of the systems with their environment, taking into account technical, social, economical and ecological aspects. 	
Investigations and assessment	<p>Graduates ...</p> <ul style="list-style-type: none"> • can develop suitable methods to make concepts, do and evaluate detailed research concerning technical topics relating their standard of knowledge and understanding, 	
Engineering practice and product development	<p>Graduates are in the position ...</p> <ul style="list-style-type: none"> • to classify knowledge methodically in different areas, to combine information elements systematically, and to handle the phenomena of complexity. • to use and to develop their knowledge and skills in order to gain practical power for the solution of problems, for the organizing of research and the development of systems and processes, 	

	<ul style="list-style-type: none"> • to familiarize quickly, methodically and systematically with new and unknown tasks, • to judge applicable methods and their limits, • to reflect systematically non-technical implications of engineering work and to integrate the results responsibly in their actions, • to develop marketable products for the global market. 	
Transferable skills	<p>Graduates are...</p> <ul style="list-style-type: none"> • able to control and organise complex, changing inter-relations of work and learning which require new strategic approaches, • able to take over responsibility for scientific contributions to professional knowledge and to professional practice and/ or • to check the strategic capacity of teams. 	

2.3 Practical Training (Industrial Placements)

Carrying out a practical activity is an essential element of engineering education and is preferably completed on the basis of realistic problems prior to and during the study period in the form of industrial placements.

The aim of a **pre-study industrial placement** is the familiarisation with the industry from a technical perspective prior to studies in a Bachelor's Degree Programme. Preferable activities are i. a. the work on and processing of metallic and non-metallic materials, assembly and maintenance, laboratorial and pilot plant work in the industrial environment. In accordance with this aim, the qualified pre-study industrial placement is ideally completed prior to studies and thus constitutes an admission requirement. As it does not form part of the curriculum and is not supervised by the university, no credit points are awarded.

In an **industry placement** forming part of the degree programme, the technical and methodical competences gained at university level are to be applied to, extended and deepened in an industrial environment within the framework of typical engineering activities. Preferred fields are i. a. development, construction, planning and application technology. Technical laboratories are supervised by the universities as part of the curriculum, are completed by colloquia and are awarded credit points.

3. Curriculum

3.1 Fields of Studies and Focal Subjects

Exemplary study schedules serve students' orientation. If the students are free to prepare individual study schedules, the university employs means for ensuring a technically sensible composition of the individual schedules in line with the level and intended competence profile of the relevant degree.

3.2 Master's Degree Programmes

The curricula of Master's degree programmes reflect the specific R&D competence of the respective university and consistently operate on Master's level. In the decision upon the admission to Master's degree programmes in particular the applicants' individual skills are considered.

Suitable measures are taken for applicants who are not qualified to a sufficient extent, to achieve such qualification.