LEARNING OUTCOME

PENGANTAR

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Kriteria yang ditetapkan oleh ASIIN salah satunya adalah kriteria specific, dimana didasarkan pada LO prodi. Dokumen ini berisi LO – 10 dari 13 SSC (Subject spesific criteria), yang sesuai dengan bidang keilmuan di ITS. Dokumen ini diharapkan dapat membantu Prodi dalam melakukan evaluasi terhadap LO (CPL) maupu kurikulum Prodi.

Akhir kata semoga buku ini bermanfaat.

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Kantor Penjaminan Mutu

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DAFTAR ISI

1. SSC1 - Mechanical engineering / process engineering / chemical engineering

1.1 Knowledge and Understanding

Bachelor	Master
Graduates of **more research-oriented Bachelor's degree programmes** have in particular: 1. gained a broad and sound knowledge in mathematics, science and engineering, enabling them to understand the complex phenomena peculiar to mechanical engineering / process engineering / chemical engineering; 2. gained an understanding for the broader multi-disciplinary context of Engineering Sciences.	Graduates of **more research-oriented Master's degree programmes** have in particular: **1.** extensive advanced knowledge of mathematic-scientific and engineering principles of mechanical engineering / process engineering / chemical engineering and their interdisciplinary expansion; **2.** as well as a critical awareness of the latest findings in their discipline.
Graduates of **more practice-oriented Bachelor's degree programmes** have in particular: 3. gained extensive technical knowledge as to engineering, mathematics and natural science with a view to mechanical engineering / process engineering / chemical engineering, enabling them to carry out scientifically substantiated work and act responsibly in their professional activities; 4. gained an understanding of the multi-disciplinary context of Engineering Sciences.	Graduates of **more practice-oriented Master's degree programmes** have in particular: **3.** consolidated knowledge of mathematic-scientific and engineering principles of mechanical engineering / process engineering / chemical engineering as well as deepened practice-oriented knowledge in special subjects **4.** a critical awareness of the newer findings in their discipline.

1.2 Engineering Analysis

Bachelor	Master
Graduates of **more research-oriented Bachelor's degree programmes** are in par-ticular qualified to: 1. identify, abstract, formulate and holistically solve problems peculiar to mechanical engineering / process engineering / chemical engineering in their complexity with an orientation on the fundamentals; 2. penetrate, analyse and assess products, processes and methods forming part of their discipline on the basis of system technology; 3. choose, apply and (further) develop suitable methods of analysing, modelling, simulating and optimising.	Graduates of **more research-oriented Master's degree programmes** are particularly qualified to: **1.** analyse and solve problems scientifically, which are unusual and/or incompletely defined and show competing specifications; **2.** abstract and formulate complex problems arising from a new or emerging field of their discipline; **3.** apply innovative methods to problem-solving based on fundamentals and to develop new scientific methods.
Graduates of **more practice-oriented Bachelor's degree programmes** are in particular qualified to: 4. identify, formulate and solve problems peculiar to mechanical engineering / process engineering / chemical engineering based on the application of established scientific methods; 5. analyse and assess products, processes and methods used in their discipline based on scientific facts 6. choose suitable methods of analysing, modelling, simulating and optimising and apply them with a high degree of competence	Graduates of **more practice-oriented Master's degree programmes** are particularly qualified to: 1. analyse and solve problems scientifically, which are incompletely defined and show competing specifications; 2. formulate practice-oriented problems arising from a new or emerging field of their specialised subject, 3. use innovative methods for practice-oriented problem-solving *(EUR-ACE).*

1.3 Engineering Design

Bachelor	Master
Graduates of **more research-oriented Bachelor's degree programmes** have in par-ticular: **1.** the ability to conceive the design of complex machinery, devices, EDP programmes or processes correspondent to the status of their knowledge and understanding and according to specified requirements; **2.** a well-founded understanding of design methods and the ability to apply and (further) develop them. Graduates of **more practice-oriented Bachelor's degree programmes** have in par-ticular: **3.** the ability to conceive designs for machinery, devices, EDP programmes or processes correspondent to the status of their knowledge and to develop them according to specified requirements; **4.** a practically orientated understanding of design methods and the ability to apply them in a competent manner	Graduates of **more research-oriented Master's degree programmes** are particularly qualified to: **1.** develop concepts and solutions for fundamentally orientated and partially unusual problems under broad consideration of other disciplines; **2.** use their creativity to develop new and inventive products, processes and methods; **3.** apply their scientific ability to judge in order to work with complex, technologically impure or incomplete information. Graduates of **more practice-oriented Master's degree programmes** are particularly qualified to: **4.** develop solutions for practice-oriented and partially unusual problems also under consideration of other disciplines; **5.** use their creativity to develop new and inventive practical solutions; **6.** apply their scientific ability to judge in order to work with complex, technologically impure or incomplete information.

1.4 Investigations and Assessment

Bachelor	Master
Graduates of **Bachelor's degree programmes** are in particular able to: **1.** carry out literature research in accordance with the status of their knowledge and understanding and to use data bases and other sources of information for their work; **2.** plan and carry out suitable experiments correspondent to the status of their knowledge and understanding, to interpret the data and draw suitable conclusions	Graduates of **Master's degree programmes** are in particular qualified to: **1.** identify, find and procure necessary information; **2.** plan and carry out analytic, model and experimental investigations critically assess data and draw conclusions; **3.** investigate and assess the application of new and emerging technologies in their discipline.

1.5 Engineering Practice

Bachelor	Master
Graduates of **more research-oriented Bachelor's degree programmes** have in par-ticular: **1.** the ability to combine theory and practice with the aim to analyse and solve problems peculiar to engineering sciences with an orientation on methods and fundamentals; **2.** an understanding of applicable techniques and methods and their limits; **3.** the ability to responsible apply and independently consolidate their	Graduates of **more research-oriented Master's degree programmes** are in particu- lar able to: ◦ classify and systematically combine knowledge of different fields and handle complexity; ◦ familiarise themselves speedily, methodically and systematically with the new and unknown; ◦ assess applicable methods and their limits; ◦ reflect non-technical effects of engineering activities systematically and to integrate them into their actions in a responsible manner.

knowledge in different fields under consideration of economic, ecologic and safety requirements as well as sustainability and environmental compatibility; **4.** an awareness of the non-technical effects of engineering activities. Graduates of **more practice-oriented Bachelor's degree programmes** are in par-ticular: **5.** able to transfer new findings in engineering and natural sciences to industrial and commercial production under consideration of economic, ecologic and safety requirements as well as sustainability and environmental compatibility **6.** able to plan, control and monitor processes and to develop and operate systems and equipment **7.** able to independently consolidate the knowledge gained **8.** aware of the non-technical effects of engineering activities	Graduates of **more practice-oriented Master's degree programmes** are in particu- lar able to: ◦ combine knowledge in different fields for fast realisation and to handle complexity; ◦ familiarise themselves in a fast and targeted way with the new and unknown; ◦ assess applicable techniques on the basis of their imminent knowledge and to assess their limits; ◦ recognise non-technical effects of engineering activities systematically and to integrate them into their actions in a responsible manner.

1.6 Transferable Skills

Bachelor	Master
Transferable skills required for practical engineering activities and beyond are developed and extended within the study programme. Graduates of **Bachelor's degree programmes** are able to **1.** function effectively as an individual and as a member of a	Transferable skills required for practical engineering activities and beyond are developed and extended within the study programme. Graduates of Master's degree programmes are able to: **1.** fulfil all the Transferable Skill requirements of a First Cycle

team, including where relevant coordination of the team; **2.** use diverse methods to communicate effectively with the engineering community and with society at large; **3.** 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, and commit to professional ethics, responsibilities and norms of engineering practice; **4.** demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations; **5.** recognise the need for, and have the ability to engage in independent, life-long learning; **6.** work and communicate in national and international contexts.	graduate at the more demanding level of Second Cycle; **2.** function effectively as leader of a team that may be composed of different disciplines and levels; **3.** work and communicate effectively in national and international contexts.

2. SSC2 - Electrical Engineering / Information Technology

2.1 Knowledge and Understanding

Bachelor	Master
Graduates have in particular … 1. **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.	**Graduates …** 1. **have in-depth knowledge** in advanced fundamentals in mathematics and sciences. 2. **have in-depth knowledge** in advanced subject-specific fundamentals in electrical engineering. **Or**

2. **gained an understanding** for the broader multidisciplinary context of Engineering Sciences.	1. have in-depth knowledge in advanced subject-specific fundamentals in information technology. 2. have in-depth knowledge in one of the mentioned primary fields of application based on subject-specific fundamentals**.**

2.2 Engineering Analysis

Bachelor	Master
Graduates are able 1. to select and apply actual methods of modelling, calcu- lating, and testing concern- ing their field of specialisa- tion. 2. to make research of technical literature and other sources of information relating given problems. 3. to design and run ex- periments and computer simulations and to explain the results. 4. to consult data base sys- tems, information on norms, guidelines („codes of good practice") and safety regula- tions for these purposes.	**Graduates …** 1. can evaluate new complex modelling, measuring, de- sign and test methods con- cerning their relevance, ef- fectiveness and efficiency and can develop independ- ently new methods.

2.3 Engineering Design

Bachelor	Master
Graduates … 1. have special abilities to develop analogue and digital electric and electronic circuits, devices and products. 2. control in their design work the use of elements like modelling, simulation and tests as well as their in- tegration in a problem oriented way. 3. are able to design products for the global market.	**Graduates …** 1. 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 envi- ronment, taking into account technical, social, economical and ecological aspects.

2.4 Investigations and Assessment

Bachelor	Master
-	**Graduates ...** 1. can develop suitable methods to make concepts, do and evaluate detailed research concerning technical topics relating their standard of knowledge and understanding,

2.5 Engineering practice and product development

Bachelor	Master
Graduates ... 1. can apply their knowledge and understanding to acquire practical skills for problem solving, for research tasks and the design of systems and procedures, 2. 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, 3. know the practice and its demands in production plants, 4. are capable of searching technical literature and other information sources, 5. demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environ-mental context,	**Graduates are in the position ...** 1. to classify knowledge methodically in different areas, 2. to combine information ele- ments systematically, and to handle the phenomena of complexity. 3. 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,

6. commit to professional ethics, responsibilities and norms of engineering practice, 7. use the appropriate scientific methods and new findings of the engineering and science environment in their practical work while taking into consideration the economic, ecological, technical and social requirements, 8. are aware of the non-technical effects of engineering activities, 9. are in the position to develop marketable products for the global market.	

2.6 Transferable skills

Bachelor	Master
Graduates are able to ... 1. analyse and present technical contexts understandingly in their own field and in neighbour fields; 2. operate on technical working tasks in a team and to coordinate it if necessary; 3. demonstrate an awareness of project management and business practices, such as risk and change manage- ment, and understand their limitations; 4. recognise the need for, and have the ability to engage in independent, life-long learning.	**Graduates are...** 1. able to control and organise complex, changing inter- relations of work and learning which require new stra- tegic approaches, 2. able to take over responsibil- ity for scientific contributions to professional knowledge and to professional practice and/ or 3. to check the strategic capac- ity of teams.

3. SSC3 - Civil Engineering and Geodesy / Architecture / Interior Design / Landscape Architecture / Urban and Regional Planning

3.1 Civil Engineering

Bachelor	Master
1. have acquired **well-founded knowledge in the fields of mathematics and natu-ral science**, for example in the fields of mathematics, statistics, information processing, mechanics (fundamentals of statics and strength of materials), fluid mechanics. 2. have acquired and deepened **well-founded knowledge of subject-specific funda-mentals** in civil engineering, for example in the areas construction geology, materials science, construction physics, surveying, principles of planning, structural theory, tech-nical design, construction informatics. 3. have **deepened and expanded subject-specific skills**, e.g. in the fields of structural analysis, structural engineering (steel, wood and solid construction), geo-technics/ foundation engineering, hydraulic engineering, water management, urban planning, transport, road system, railway system or water supply and management in settle-ments. 4. and have **applied** them e.g. in fields of construction economy/ construction business/ construction management, computer-aided building design, building restoration, build-ing services engineering, finishing crafts, building permit procedure, construction con-tract law, facility management, design practice. 5. can make use of classical and modern research methods to identify, interpret and inte-grate technical literature and data bases.	1. They can analyze demanding tasks of the building industry, such as: analysis of carrying structures, infrastructure measures (concerning roads, bridges, sewage systems, etc.), flood protection measures, construction procedures, etc. 2. They can identify required information and data, determine available sources of such in-formation, and evaluate data at a stage when the task itself is still not clear enough. 3. They can provide novel and complex designs, constructions and developments (design), e.g. construction of buildings, development of new building products and components, development of new construction methods, design of wastewater systems, planning and development of transport facilities, etc. 4. They are capable to develop new, challenging and innovative methods for documented evidence and forecasting, such as methods for verifying stability, energy efficiency, noise protection, flood protection, water supply etc. 5. They can independently create plans and concepts in the work field of civil engineering and determine by their own the requirements for overall responsible control and man-agement of complex processes. 6. They are able to face complex projects in an interdisciplinary and holistic way in light of sustainability, environmental, ecological and

6. can identify and formulate typical tasks by themselves, taking into account scientific evi-dence and methods of construction engineering. 7. can identify tasks of civil engineering in their own complexity, can analyze, abstract, formulate, for example: analysis of carrying structures, infrastructure measures (relating roads, bridges, sewage systems, etc.), flood protection measures, construction proce-dures, etc. 8. are able to develop methods for proof and forecast, e.g. methods for documented evi-dence of stability, energy efficiency, noise protection, flood protection, water supply etc. 9. are able to develop concepts and plans in their area that meet the technical and profes-sional standards. They can reflect critically on these and are able to argue for them to-wards others. 10. are able to assess projects holistically and interdisciplinary, taking into account sustain-ability, environmental, ecological and economic aspects, and to perform such projects with the help of contributions from other disciplines. 11. are able to pursue practice research and to establish and interpret empirical data sets by the use of qualitative and quantitative methods. 12. by applying of practical experience in technical and engineering fields can - organize and evaluate concepts and planning procedures constructively and inno-vatively, theoretically soundly and well reflected, - develop concepts in teams and in an interdisciplinary way, - develop and make use of resources,	economic aspects, and to operate them re-sponsibly by the help of contributions of other disciplines. 7. They are capable to acquire autonomously the current state of scientific knowledge re-lating a research question and to examine to what extent this helps to describe, analyse and solve problems. 8. They have the capacity to participate in the practical, methodical and scientific, theoreti-cal development of the subject, to follow it, as well as to analyze, evaluate and commu-nicate critically, in writing and orally their own or other's research results or information. 9. They are able to describe and to analyze independently by scientific means new, ob- scure and unusual tasks in civil engineering facing the current scientific discussion. They can test and develop methods and evaluate them concerning their effectiveness and range. 10. They are able to create solution strategies for complex, undefined or novel duties on the basis of scientific methods and current research results, to reflect on them and repre-sent them to others. 11. They are able to integrate interdisciplinary research and development processes in plan-ning and concepts. 12. They are able to guide others professionally concerning the analysis of new, unclear and untypical tasks.

- evaluate the usefulness of methods and their range. 13. have knowledge of economics and legal sciences to be able to classify their actions eco-nomically and legally. 14. are able to **communicate** on content and problems of civil engineering with both pro-fessional colleagues and individuals of a wider public in foreign languages and in inter-cultural relations. 15. in their actions are aware of the **social and ethical responsibility** and know about business ethical principles and standards. 16. are able to work both individually and as a part of international and mixed gender groups and to effectively organize and perform **projects** to grow into an appropriate and responsible leadership role. 17. are well prepared for **socialization and work in business or scientific environ-ment** when they enter professional life by a sufficient extent of practice relevance of the study programme. 18. are capable of **lifelong learning.**	13. They are able to establish quality management systems based on scientific methods, to support and develop them further and by this to evaluate their own activities and the activities of others. 14. They have the capacity to undertake leading management responsibilities. 15. They have adapted scientific, technical and social competences (ability to abstract, sys-tem-analytical thinking, teamwork and communication skills, international and intercul-tural experience, etc.) and are therefore especially prepared to take over management responsibilities. 16. They acquired skills to work independently in a scientifically oriented way and to organ-ize complex projects, implement and manage them.

3.2 Geodetics Engineering and Surveying

Bachelor	Master
Graduates 1. have acquired a profound knowledge in mathematical and	Dependent on their orientation graduates have achieved the following exemplary learning out comes:

scientific areas, e.g. in the subjects mathematics, geometry, statistics, physics, information processing. 2. also have knowledge in key skills relevant for professional practice, e.g. in public and private law, business administration, environmental protection, management techniques, communication and presentation techniques. 3. have acquired thorough knowledge of subject-specific fundamentals of surveying and geo-informatics, e.g. in the fields of surveying and geodesy, photo-grammetry and remote sensing, adjustment, cartography, computer science, geographic informa- tion systems (GIS) and spatial data infrastructure. 4. have deepened and expanded their subject-specific skills , e.g. in the fields of: engineering surveying and mapping, navigation, geodesy, database systems, software engineering, in-depth GIS issues and modeling questions, e-commerce, internet tech- nologies, property management, real estate registry, land consolidation, geo-topography, cartography, enhanced satellite and airborne data collection methods. 5. and have applied them, for example in the fields of cadastral survey systems networks, building	**1.** Based on in-depth and specific knowledge of mathematical and statistical methods, they are capable to accomplish, develop and make use of complex and novel evaluation models relating all areas of surveying, e.g. deformation monitoring, GIS analysis, design independently assessment of the value of land, develop and use. **2.** They have a deeper, even interdisciplinary understanding of the earth as a whole, its gravitational field and its astronomical spatial reference and by this are able to e.g. work independently on geodetic datum issues, including relations with satellite measurement systems in the areas of research, development and application. **3.** They can describe and analyze independently demanding tasks e.g. in surveying, geo- informatics and land management, develop solutions and implement them in projects responsibly and for this purpose collect necessary data, including research of data and evaluation of their sources, even if the task is not clear. **4.** They are able to develop independently geospatial and other professional data models, discuss them interdisciplinary and make use of them in a targeted way. This includes the ability to model appropriate software applications. For this purpose they make use of – among others – in-depth IT knowledge. **5.** Relating land management, they are capable to apply various principles and procedure practices within the context

surveying, structural monitoring, land surveying, land management, information systems for geo-data, Information systems concerning professional information. 6. know technical handbooks, periodicals and information systems for purposes of avail-ability and verification of current measurement and evaluation procedures and for data collection. 7. can analyze and understand typical survey tasks and GIS requirements, can arrange them properly, operate them efficiently and present the results. 8. can also handle incompletely defined, complex problems and are able to manage risks accordingly, especially under aspects of geodesic reliability. 9. are able to tap into new methods and tools for existing problems and to develop further existing entities, plants and constructions on the bases of their own understanding and personal experience. 10. have profound professional openness and creativity, to make new applications accessi- ble in surveying and geo-informatics and to design them in an economical way. 11. have a pronounced customer-oriented and interdisciplinary	of tasks needs and to develop them further technically – with a safe understanding of legal, economic and social conditions. **6.** They are in a position to create solution strategies for complex, undefined or novel tasks on the basis of scientific methods and current research results, to reflect on them and represent them to others. **7.** They are able to develop innovative methods and strategies on the basis of scientific analysis. **8.** They are able to consider demanding projects in a holistic and interdisciplinary way, to bring an optimal contribution of the surveying business to bear. **9.** They are capable to acquire independently current state of scientific knowledge from various fields of surveying and to examine whether it is helpful for running own tasks. **10.** They are in a position to participate in practical, theoretical, methodological and scientific development of the subject, to follow its results, to analyze critically research results or information of others and of their own, to evaluate and communicate them in writing and orally. **11.** They are able to describe and analyze independently new, vague and unusual tasks in surveying in the background of current scientific discussion using

understanding and behavior, to define clearly and to perform surveying tasks and GIS services with non-specialist partners such as professionals from civil engineering, mechanical engineering or the fields of architecture. 12. are able to lead a team independently, e.g. to operate as a survey team leader in sur- veying field service, as a group leader in GIS, cadastral, land consolidation, etc., or as employee or self-employed in a surveying office. 13. are aware of their actions relating ethical and social responsibility and understand ethical principles and standards. 14. are well prepared for socialization and work in business or scientific environ- ment when they enter professional life by a sufficient extent of practice relevance of the study programme. 15. are capable of lifelong learning.	scientific methods. They can experiment with methods, develop and evaluate them relating their scope and effectiveness. **12.** They can integrate interdisciplinary research and development processes in their pro- jects and concepts. **13.** They are in the position to guide others professionally in the analysis of new, vague and untypical tasks. **14.** They are able to implement quality management systems based on scientific methods, to support and to develop them further and by this to evaluate their own activities and those of others. **15.** They are capable to lead a larger business unit, which may be organized in a complex and interdisciplinary way, effectively, efficiently and sustainably as well as to develop it independently and in team work – in accordance with the technical and social environ- ment.

3.3 Archtiect

3.3.1 Qualifications of Arcitects

Requirements **of the professional activities as an architect**
Learning outcomes: **1.** ability **to create** architectural designs that satisfy both aesthetic and technical require-ments; **2.** **adequate knowledge** of the history and theories of architecture and the related arts, tech-nologies and human sciences;

3. **knowledge** of the fine arts as an influence on the quality of architectural design;
4. **adequate knowledge** of urban design, planning and the skills involved in the planning process;
5. **understanding** of the relationship between people and buildings, and between buildings and their environment, and of the need to relate buildings and the spaces between them to human needs and scale;
6. **understanding of the profession** of architecture and the role of the architect in society, in particular in preparing briefs that take account of social factors;
7. **understanding of the methods** of investigation and preparation of the brief for a design project;
8. **understanding of the structural design, constructional and engineering problems** associated with building design;
9. **adequate knowledge of physical problems and technologies** and of the function of buildings so as to provide them with internal conditions of comfort and protection against the cli-mate;
10. the necessary **design skills** to meet building users' requirements within the constraints im-posed by cost factors and building regulations;
11. **adequate knowledge of the industries, organisations, regulations and procedures** involved in translating design concepts into buildings and integrating plans into overall planning

a. Design expertise

Bachelor & Master
Graduates 1. have the ability to think creatively and to control and integrate the activities of other parties involved in the planning. 2. have the ability to collect information, to define problems, to apply analysis, to judge critically and to formulate strategies for action. 3. have the ability to think in three dimensions and to develop plans methodically, scientifically and artistically. 4. have the ability to bring divergent factors in accordance to each other, to integrate knowledge and to apply skills when creating a design solution.

b. Knowledge and Skills (knowledge and Undertsnading)

b.1. Cultural and arts sciences

Bachelor & Master
Cultural and arts sciences
Graduates 1. can apply their knowledge of historical and cultural references in the field of international ar- chitecture. 2. can apply their knowledge concerning the influence of visual arts to the quality of architectural design. 3. have developed an understanding of the heritage of built environment and of topics relating monument protection. 4. have developed an awareness of the connections between architecture and philosophy, and political trends and cultural movement of other creative disciplines.

b.2. Social and human sciences

Bachelor & Master
Social and human sciences
Graduates **1.** have the ability to develop programmes for construction projects and thereby to define the needs of developers, users and the public. **2.** have understanding of the social context of a construction project. **3.** have an understanding of the ergonomic and spatial requirements of the working environment. **4.** have knowledge of relevant laws, rules and standards for planning, design, construction, health, safety and the handling of built environment. **5.** have knowledge of architecture-related content of philosophy, political science and ethics. **6.** can apply their knowledge to society, clients and users. **7.** can identify and define functional requirements for different sectors of environment.

b.3. Environmental Sciences

Bachelor & Master
Environmental Sciences
Graduates

1. have an understanding of topics such as environmental sustainability, plans to reduce energy consumption, impact on the environment and an understanding of passive systems and their control.
2. have an awareness of technology and technological consequences.
3. have a sense of history and practice of landscape architecture, urban planning, regional and national planning.
4. can apply their knowledge on natural systems and built environment.

b.4. Science and Engineering

Bachelor & Master
Science and Engineering
Graduates 1. can apply their knowledge of bearing structure, materials, supply and disposal. 2. have an understanding of the processes in technical design and the integration of bearing 3. structure, civil engineering, industrial expansion into a functionally meaningful ensemble. 4. have an understanding of infrastructure and of how to develop related communications, main- tenance and security systems. 5. have an awareness of the importance of technical infrastructure for design and implementa- tion and are alert to the planning and control of construction cost. 6. have knowledge of physical problems and technologies associated with the function of a building to create comfort and protection against influence of weather.

b.5. Design methods

Bachelor & Master
Design methods
Graduates 1. can apply knowledge of design theory and design methods. 2. have an understanding of design techniques and design processes as well as knowledge in analysis and interpretation of framework. 3. have information on the history of design and architecture criticism.

b.6 Construction Economics/ construction management

Bachelor & Master
Construction Economics/ construction management
Graduates **1.** can apply knowledge of professional, business, financial and legal requirements. **2.** have an appreciation on how the real estate business does work, have awareness of financial relationships, real estate investment, and alternative methods of procurement and facility management. **3.** have an awareness of the potential roles of architects in new and already familiar fields of action as well as in international context. **4.** have an understanding of market mechanisms and their effect on the development of built environment, an understanding of project management, project development and client consulting. **5.** have an understanding of professional ethics and codes of conduct relating to the exercise of profession and an understanding of legal obligations regarding the registration of an architect. **6.** can plan and coordinate the construction process. **7.** can organize processes involved in building construction and its economic management.

c. Skill

Bachelor & Master
Graduates 1. have the ability to work in teams and communicate ideas by means of speech, text, drawings, models and statistics. 2. have the ability to apply analogue and digital, graphical and model making skills making pro- jects to analyze and develop a construction plan and to convey this vividly. 3. have an understanding of evaluation systems, which utilize manual and/ or electronic means for the diagnosis of built environment. 4. Students should acquire appropriate knowledge, skills and abilities in all study schemes that aim at the licensing to work as an architect.

3.3.2 Information for Bachelor's degree programmes for architects

Information for Bachelor's degree programmes for architects	Information for Master's degree programmes for architects
Graduates of these bachelor degree programmes have e.g.: 1. knowledge and understanding of subject contents and can apply their skills in various profes-sional fields. This includes, aside sophisticated, advanced standard knowledge, particular is-sues that go far beyond standard requirements. 2. acquired skills in analysis and synthesis of problems and in the development of problem-solving concepts. 3. competence in the scientific comprehension of all relevant statements and their interpretation and knowledge in observation of results, examining social, scientific and ethical impacts. 4. gained particularly skills and sound knowledge in designing, building construction, civil engi-neering and construction business and developed awareness to be able to coordinate and im-plement projects. 5. the ability to communicate and present all information, ideas, problems and solutions to spe-cialists or laymen.	Master degree programmes built up on the Bachelor's programmes add knowledge, skills and abilities arousing from the bachelor studies to the above mentioned qualification profile for pro-fessional approval as an architect (see section 2.3.2).

3.3.3 Practice

Practice	
Internship prior to the beginning of studies Principally recommended is a construction-related training before the beginning of the	

course. Such training will not be countable concerning the study period. It is used to check the chosen programme and brings valuable experience to the studies. **Practical phases during the study** Study-related internships are part of the student's amount of work and are awarded ECTS credit points. The higher education institutions need to specify transparently which content in detail will be taught in practice and what relation this has to the curriculum. Contents of the internship must be agreed upon with the internship host, for example by support of a learning agreement. **Practice phase after completion of bachelor's degree as a prerequisite for admission to master's degree** As further special admission requirement a pre-study internship may also be required for mas-ter's degree programmes. An internship between the bachelor and the master degree has no influence on the congruity of the follow-up master programme. According to the UNESCO/UIA standards, the internship periods may not be integrated in the period of study, because this reduces the ratio of the theoretical studies. **Professional Practice** Professional practice following after the completion of degree programmes is not subject of higher education itself, but has to be viewed in the context of approbation as an architect. After successfully completing of studies, practical training under the guidance of an architect in the corresponding discipline is needed according to German laws of architects in the federal states, to be eligible to use the title "architect" - after formal admission and enrolment in the list of	

architects. The duration of this activity is at least two years.	

4. SSC4 - Informatics / Computer Science

4.1 Specialist Competences

Bachelor	Master
1. Computer scientists with a Bachelor's degree have acquired **a fundamental understanding of central concepts and methods of their discipline**; 2. they are informed about important current developments of their field of study; 3. they are able to **integrate their knowledge and competences** in a wider context. 4. They command the scientific **foundations necessary for informatics, in particular the mathematical, logical, statistical, and physical tools**. 5. They **understand central notions and conceptions of informatics, such as "algorithm" and "data processor**", in an abstract form which is not dependent on actual technical realisation. 6. They are able to **assess the possibilities and constraints of algorithmic operations.**	**Formal, Algorithmic, Mathematic Competences** **Graduates of Master's Degree Programmes** **1.** have a profound knowledge and understanding of the principles of informatics; i.e. general computer science expertise independent of current technology and applicable in the long term, rooted in mathematically founded theory or in the body of knowledge of methods that has become established; **2.** are able to describe and analyse problems using formal methods; **3.** have developed a critical awareness of the latest findings in computer sciences and are able to assess their implications; **4.** possess comprehensive and detailed knowledge in a specialist field of computer science, in- cluding its current state of development.

7. **They are in a position to think in abstract models, and they have mastered constructive approaches.** 8. They are thoroughly familiar with the most important algorithms, data structures and problem- solving patterns, including central paradigms of programming. 9. They possess a basic under- standing of the composition and functioning of computers and key informatics systems such as operating systems, database systems, and communication systems. 10. They **understand the basic principles of complex informatics systems** consistent with state-of-the-art technique, and they have first-hand experience of handling them adequately. 11. They have **mastered the methods of modelling, construction, verifying and testing typically used in informatics;** 12. they are able to **apply these methods to solving problems**. 13. Graduates are familiar with important applications of informatics. 14. They are able to develop solu- tions for practical problems using informatics techniques and evaluate them, having due regard to technical, ergonomic, economic, juridical, and social constraints.	**Analysis, Design and Implementation Competences** **Graduates of Master's Degree Programmes** **5.** are capable of solving problems which are unusual, incompletely defined or have more than one possible specification; **6.** can apply their judgement to work with complex, contradictory and incomplete information; **7.** are able to formulate, structure and formalise problems stemming from a new and develop- ing field within their specialisation, develop and evaluate possible approaches, and select and implement solutions. **Technological Competences** **Graduates of Master's Degree Programmes** **8.** can combine knowledge from different fields and deal with complexity; **9.** have developed a comprehensive understanding of applicable techniques and methods and their limits; **10.** have obtained profound technical knowledge in a chosen field of informatics and have thereby reached the limits of today's knowledge and state-of-the-art technology. **Methodological Competences** **Graduates of Master's Degree Programmes** **11.** are in a position to use their knowledge and understanding to

	design and implement infor- mation models, systems and processes; **12.** are capable of applying innovative methods to solving problems; **13.** can make contributions to the further development of informatics as a scientific discipline.

4.2 Social Competences

Bachelor	Master
1. Graduates know the history of informatics; 2. they are aware of juridical aspects of informatics and its effects on society. 3. They are aware of ethical questions and security problems connected with the application of information processing systems. 4. They possess key skills such as e.g. techniques of learning and working, the capacity for team- work and communicating, the ability to undertake literature research and to apply new media. 5. They are able to independently complement and deepen the knowledge acquired during their studies and to adapt to developments in the field. 6. They have experience of solving application problems in teams covering all phases of system development, from analysis of requirements, specification and implementation to testing. 7. They are able to reflect critically on their own contributions and explain them both to experts and to persons not acquainted with informatics, using sound arguments. 8. They are prepared to take on responsibility in technical as well as	**Project Management Competence** **Graduates of Master's Degree Programmes** **1.** are able to assess ideas, conceptions, methods, procedures, techniques and technologies from different points of view; they have a critical awareness of new knowledge within infor- matics; **2.** are familiar with the opportunities arising from the non-technical effects of their practical work as computer scientists; **3.** are able to responsibly lead interdisciplinary groups or organizations and present the results of their work to outsiders; **4.** are able to define topics and objectives in professional practice as well as in academic con- texts, derive assignments of tasks from these and organise and monitor the solution process.

management roles. In particular, periods of practical train- ing as an integral part of the curriculum help to develop the professional skills of graduates. 9. Ideally, they will have broadened their horizons by taking advantage of offers of mobility inte- grated in their study programmes; 10. they will have made use of opportunities to extend their language skills; 11. they will be aware of and understand international and global developments in information technology and their possible effects on business and society.	

5. SSC5 - Physical Technology / Material Science / Material Engineering

5.1 Knowledge and Comprehension

Bachelor	Master
Being in command of the fundamental knowledge and comprehension of Natural Sciences, Mathematics and Engineering forms the basic competencies to achieve further educational objectives. **Graduates:** **1.** Know and comprehend the principles of Natural Sciences, Engineering, Technology and Mathematics that are the basis of the subject area of their focal studies, **2.** Have a systematic comprehension of the central elements and concepts of the subject ar- ea of their focal studies, **3.** Possess interdisciplinary (coherent) knowledge on the subject areas of their focal studies **4.** Have knowledge of additional aspects of subject related sciences.	Being in command of in-depth knowledge and comprehension of the Natural Sciences, Mathe- matics as well as the fundamentals of Technological Science and professional practice, are fea- tures of a Master Degree level and are necessary to achieve further educational results. Graduates: **1.** Possess profound knowledge and in-depth comprehension of the subject-specific funda- mentals of the main focus of their degree programme (theory and practice), **2.** Have advanced knowledge of related subject areas, **3.** Have developed a critical awareness of the new insights in their discipline **4.** Are informed about the current status of their subject area ('status of technology')

5.2 Analysis and Methodology

Bachelor	Master
The ability to analyse systemically can encompass identification of a problem, clarification of a specification, reviewing possible solutions, selection of the most suitable method and its im- plementation. In order to perform these different analytical processes with high quality and achieve good and sustainable learning outcomes, knowledge and command of proven scientifi- cally based methods is necessary. The fundamental principles of relevant methods must be known and understood. They must be mastered by the graduates. The graduates: **1.** possess the necessary knowledge and comprehension to identify, formulate and to solve problems, including aspects outside of their area of specialisation, by means of estab- lished or newly developed methods, **2.** are able to transform generally formulated tasks into feature- oriented requirement pro- files and conduct a scientifically based analysis by applying learned methods, **3.** are able to apply their knowledge and comprehension to analyse developments (material characteristics, products, processes, methods), advance these developments and com- municate these to others, **4.** are in the position to apply various methods – mathematical analysis, computer-aided de- signs or	The analysis can include the identification of a problem, clarification of a specification, the consideration of possible solutions, the selection of the most suitable methods and their imple- mentation. In order to execute these processes with the highest quality and to get results that are sufficient for further requirements, e.g. regarding the development status or a leadership position, scientifically based methods for executing these processes are broadly known. In a broader scope, they can be applied and if needed further developed according to problem specific requirements. Graduates: **1.** possess the ability to independently identify, analyse and solve problems that are incom- pletely defined, that are uncommon and that in some cases exhibit contradictory specifi- cations **2.** are able to apply innovative methods in solving technological problems **3.** are able to formulate and solve problems within a new or developing area of their spe- cialisation **4.** are in the position to apply their knowledge and comprehension to design complex scien- tific models, systems and processes **5.** are in the position to apply and further develop various methods. This includes, for in- stance, mathematical scientific analyses, model design and

systematic experimental research – to conduct task-specific analyses and/or in- dependently resolve issues of development tasks. 5. Are able to select and apply suitable analysis and modelling techniques	execution of precise experi- mental research.

5.3 Development

Bachelor	Master
Development encompasses the entire development process up to the accomplishment of a technical project objective. Objectives of a development process are, for instance, applicable products, devices, processes and methods, but also material features that are adapted for a specific purpose. Development processes also include consideration of ethical, social, health, safety, ecological and economic conditions. Graduates: 1. are able to apply their knowledge and comprehension to conduct developments according to predefined and specific requirements, to realise results and do this in collaboration with a team of engineers, scientists and representatives of other subject areas, 2. have learned fundamental development and planning methods and possess the compe- tency to apply these systematically	Development activities can refer to devices, processes, methods, models and materials. Beyond scientific and technological aspects, the specifications can involve the consideration of social, health and safety, ecological and economical requirements. Graduates: 1. are in the position to realise technical scientific designs while collaborating with engi- neers, scientists and representatives of other subject disciplines, 2. are able to apply their knowledge and comprehension in order to develop solutions to complex problems, and also by integrating other disciplines 3. are able to apply their creativity to develop new and original ideas and methods 4. are able to apply their scientific judgement to gather, process and/or augment incom- plete information in order to solve complex and technical challenging problems in such a way that it justifies their use while respecting scientific but also ecological aspects, 5. are in the position to develop and/or optimise systems, processes or methods based on their acquired knowledge,

	6. are able to independently develop and apply their knowledge later within their professional practice.

5.4 Research and Evaluation

Bachelor	Master
Graduates: 1. are capable of carrying out literature and data research and use data banks and other sources of information 2. have a solid command of methods and procedure to document research results, 3. are able to conduct a comparative analysis between their own findings and results from theory and relevant literature, and to draw conclusions relevant to their interest.	Graduates: 1. are in the position to apply suitable methods to conduct systematically complex investiga- tions or detailed research. They are in the position to independently expand their knowledge and learning as required, 2. are able to explicitly identify and evaluate the information needed, to localise the infor- mation (e.g. literature research, patent research, etc.) and to acquire it, 3. they can define and conduct investigations that utilise the means of analysis, modelling and experiments, 4. are able to critically evaluate data and draw conclusions, 5. are able to investigate and evaluate the applicability of newly emerging technologies in their discipline.

5.5 Application

Bachelor	Master
Successful practice requires a solid competency in knowledge and methodology, combined with practical experience in completing typical development tasks. Only this will lead to the effective and efficient development of solutions. A critical additional element is a profound knowledge of the fundamentals of natural science including sufficient theoretical knowledge. Only this will ensure targeted expansion of existing knowledge or be transferred onto new tasks. Further- more, the cross-sectional character of the respective disciplines requires that experts of this subject area also possess fundamental knowledge of other engineering or applied sciences. Part of the professional profile is also the ability to transfer independently acquired ‚know-how' to other areas (technology transfer). This **includes practical knowledge of:** **1.** the applicability of technologies, the usability of materials and the applicability of pro- cesses as well as their possible limitations, **2.** specific technologies, processes and procedures **3.** data processing, measurement engineering and experimental procedures, as well as the design of models **4.** technologies, processes and procedures, devices and tools that correspond to the specific focal points of the respective study areas **5.** practices in the production facility	Successful practical work requires practical experience with typical issues, in order to either further develop or newly develop effective solutions. Graduates possess practical skills to solve problems. These include practical knowledge of: **1.** the applicability of materials and methods, simulations, engineering and scientific processes, devices and tools, **2.** the practice in research, development and production, the state of the art in research and technology. Graduates: 1. are able to combine theory and practice in order to solve scientific or technological problems 2. are able to combine knowledge and learning from various areas and to cope with complex issues, 3. have comprehensive knowledge of applicable technologies and methods and their limitations, 4. know the non-technological implications of the work of engineers and scientists, particu- larly the safety, social and ethical consequences of their activities.

6. professionally and methodologically relevant literature and other sources of information Graduates: 1. are able to combine theory and practice to solve problems related to a setting of Physical Technology, Material Science or Material Engineering 2. are able to initiate respective developments and justify their necessity 3. are in a position to select and apply the necessary and suitable devices, tools (hard and software) and methods, have developed an understanding of applicable techniques and methods and their limitations, 4. apply safety technology 5. are aware of the ethical and social implications of their actions	

5.5 Multidisciplinary Competencies

Bachelor	Master
Graduates: 1. are able to work in teams and are able to constructively contribute as an individual and as a team member 2. are able to apply various methods to communicate effectively with the engineering or scientific community and with any community in general 3. are aware of the health, safety and legal implications and responsibilities of the engineer- ing practice, as well as the implications resulting from technical-scientific solutions within a social and natural environment. Graduates also	Graduates: 1. meet all the requirements of a Bachelor degree, regarding the key qualifications neces- sary for the higher level Master degree, 2. are able to lead a team that can be comprised of various disciplines and levels, 3. are able to effectively work and communicate in a national and international context, 4. are in the position to recognise and evaluate the social, ethical, ecological and

commit to appropriately act according to professional ethics, accountability and norms set by the technical-scientific practice. 4. Are aware of the methods and limitations of project management and business practice, such as risk and change management 5. Acknowledge the need and have the ability for independent and lifelong further learning	economic implications, as well as the basic requirements of their projects, 5. should be in the position to evaluate their projects regarding occupational safety and work conditions and take precautions to prevent accidents.

6. SSC6 - Engineering and Management, Economics

6.1 Knowledge

Bachelor	Master
All graduates **have a sound basis in natural sciences, engineering and economics**. This enables them to understand the principles of a business as well as the phenomena and problems of their working environment, and to solve them with a methodological approach. Graduates **have knowledge and understanding** in the following areas: 1. natural sciences/ engineering/ mathematics, economics, law and social sciences 2. a set of integrated subjects including foreign languages, soft skills and foreign languages 3. and have completed a practical placement. All Bachelor's graduates have acquired specialist skills based on the current state of	All graduates have 1. acquired in-depth knowledge of their relative fields within engineering and natural sciences in both theory and practical work, based on a broad understanding of their area of expertise. They are familiar with the principles and laws of their chosen engineering discipline and the methods used in their working environment and can develop them further independently (engineering and scientific knowledge). 2. also acquired in-depth knowledge of essential micro- and macro-economic contexts in both theory and practical work, based on a broad understanding of their area of expertise. They are familiar with the principal responsibilities of different business functions and understand operational, macro-economic and management-related processes as well as their

teaching and investigation in their area of expertise. They have 1. a broad understanding of selected fields within engineering and natural sciences, with in- depth theoretical and practical examples. They are familiar with the principles and laws of their chosen engineering discipline and the methods used in their working environment (engineering and scientific knowledge). 2. a broad understanding of essential micro- and macro-economic contexts, with in-depth theoretical and practical examples. They are familiar with the responsibilities of different business functions and understand operational, macro-economic and management-related processes as well as their reciprocal effects (economic knowledge). 3. a broad understanding of a set of interrelated and integrated subjects, which bring together economic, technical and social aspects and processes. They are familiar with the principles of coordination, communication, methodology and leadership (integrative knowledge). 4. an understanding of empiricism and are familiar with the methods of academic research and writing (academic research and writing).	reciprocal effects. They can develop such models further independently (economic knowledge). 3. acquired in-depth knowledge of a set of interrelated and integrated subjects which bring together economic, technical and social aspects and processes, based on a broad understanding of their area of expertise. They have a broad knowledge of the principles of coordination, communication, methodology and leadership (integrative knowledge). 4. acquired in-depth knowledge of empirical research and are familiar with independent academic research and writing as well as with the methods of inductive and deductive modelling (knowledge based on scientific theory).

6.2 Skills

Bachelor	Master
All graduates are able to 1. identify, abstract, structure and solve technical and economic tasks and	All graduates know how to 1. identify, abstract, structure and solve complex technical and economic tasks

problems both in a holistic and in an integrative way, **2.** grasp, analyse and evaluate methods and processes, **3.** develop, optimise and use application-oriented solutions based on specified analyses of processes and data, **4.** collect and interpret relevant primary and secondary technical and economic data based on the methods of academic research and writing, **5.** choose and apply adequate methods of modelling, simulation, design and implementation, **6.** evaluate, plan and choose adequate technical and economic systems, **7.** conduct literature research and use specialist data for their work.	and problems within a broad context and with, to some extent, new and/or unknown parameters, both in a holistic and an integrative way, **2.** grasp, analyse and evaluate scientific methods and operational processes systematically and use them for new areas of application,1develop, optimise and apply complex application-oriented solutions based on specified analyses of processes and data, **3.** collect, interpret and critically reflect on relevant primary and secondary technical and economic data based on the methods of academic research and writing, **4.** choose and apply adequate methods of modelling, simulation, design and implementation and develop them further, **5.** devise and develop adequate technical and economic systems autonomously and define the framework for their implementation, **6.** conduct in-depth literature research and use current research findings for their work.

6.3 Competences

Bachelor	Master
All industrial engineering Bachelor's graduates have acquired specialist skills and competences. They are able to **1.** understand and evaluate the economic, political, social and legal framework of the economy (understanding of the economic environment), **2.** make rational decisions based on an ethical argumentation, think critically in	All industrial engineering Master's graduates have typically enhanced their methodological and analytical skills based on their previous degree, especially with regard to the combination of teaching and investigation, therefore enabling them to acquire a number of additional skills. They are able to • understand and evaluate the economic, political, social and legal

order to find innovative and effective solutions for inter-divisional, qualitative and quantitative problems (critical thinking), 3. express themselves in a logical and convincing way both orally and in writing and communicate with their specialist colleagues on the contents and problems of their respective discipline, - in different languages and between different cultures (communication), 4. effectively cooperate with others in different situations, in international environments, across several disciplines and in a constructive manner (cooperation and teamwork), 5. recognise and solve complex tasks and problems of a technical and economic context in a holistic and systematic manner across several disciplines (inter-disciplinary problem solving and professional competence), 6. 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, • the ability to responsible apply and independently consolidate their knowledge in different fields under consideration of economic, ecologic and safety requirements as well as sustainability and environmental compatibility, 7. use the appropriate scientific methods and new findings of the engineering and economics environment in their practical work while taking into consideration the economic, ecological, technical and social requirements (transfer competence), 8. work individually and as part of an international group, organise and implement projects effectively and	framework of the economy (understanding of the economic environment), • make rational decisions based on an ethical argumentation in a complex environment with, to some extent, new and/or unknown parameters, think critically in order to find innovative and effective solutions for inter-divisional, qualitative and quantitative problems (critical thinking), • think in an abstract, analytical and interconnected way beyond individual cases and are able to familiarise themselves quickly, systematically and methodically with new and unknown concepts (interconnected thinking), • communicate in a logical and convincing way at all times, both orally and in writing, and exchange with both their specialist colleagues and the general public on the contents and problems of their respective discipline in different languages and between different cultures (communication), • effectively cooperate with others in different situations, in international environments, across several disciplines and in a constructive manner (cooperation and teamwork), • work in a leading position in inter-disciplinary and cross-cultural teams and organisations (leadership skills), recognise and solve complex tasks and problems of a technical and economic context in a holistic, innovative and systematic manner across several disciplines, • use and further develop scientific methods and new findings in the engineering and economics

become accustomed to the responsibilities of leadership (cross-cultural competence), 9. integrate into a working environment with ease thanks to a sufficient practical orientation of the degree and collaborate with partners on different levels (social competence), 10. effectively use modern information technologies (IT competence), 11. acquire knowledge autonomously thanks to their Bachelor's degree and continue their training and studies (life-long learning), 12. transfer new findings in engineering and natural sciences to industrial and commercial production under consideration of economic, ecologic and safety requirements as well as sustainability and environmental compatibility.	environment during their research and practical work whilst taking into consideration economic, ecological, technical and social requirements (inter-disciplinary and innovative problem solving and professional competences), • work individually and as part of an international group, organise, implement and lead projects effectively (transfer competences), • integrate into a working environment with ease based on a sufficient practical orientation of the degree and collaborate with partners on different levels, form social relationships and take on social responsibilities (social skills), (project management competences), • be flexible in their actions according to the changing requirements of today's dynamic and globalised business world (change-management competences), • plan and manage the use of modern information technologies (IT competence), • apply and support management methods in an international and intercultural environment • (cross-cultural competency), • acquire knowledge autonomously in order to remain up to date with the developments in science and research (life-long learning).

7. SSC 7 - Business Informatics/Information Systems

Bachelor programmes:

	Business Fundamentals	Business informatics (in the strict sense)	Informatics fundamentals	Other fundamentals

Anteil	15-35%	25-35%	15-35%	15-35%

Consecutive Master programmes:

	Business Fundamentals	Business informatics (in the strict sense)	Informatics fundamentals	Other fundamentals
Anteil	10-30%	50%-60%	10-30%	0-20%

Non-consecutive Master programmes:

	Business Fundamentals	Business informatics (in the strict sense)	Informatics fundamentals	Other fundamentals
Anteil	15-35%	25-35%	15-35%	15-35%

8. SSC 08 Agriculture, Nutritional Sciences and Landscape Architecture

8.1 Knowledge and Understanding

Bachelor	Master
Graduates: 1. know and understand the principles of natural sciences, social science, mathematics, medical science, economics and engineering their discipline is based on; 2. have a coherent knowledge in their discipline including knowledge of the latest findings in their discipline; 3. know concepts of identification and safeguarding of quality in their respective fields of work; 4. know the essential legal regulations relating to their discipline; 5. are aware of the further multidisciplinary context of agriculture, nutrition science, or land-scape and neighbouring fields.	Graduates: 1. have profound knowledge and understanding of their technical including engineering spe-cialisation and the further scientific context; 2. have developed differentiated knowledge and critical awareness of the latest findings in their discipline; 3. have differentiated and advanced knowledge of the legal provisions relevant for their pro-fessional field; 4. have advanced knowledge of quality standards and quality processes as well as their man-agement.

8.2 Engineering Analysis

Bachelor	Master
Graduates: 1. have the required knowledge and understanding to identify and formulate problems arising in agriculture, nutrition science, or landscape architecture (which may contain aspects stemming from areas other than their field of specialisation); 2. are able to apply different methods orientated on fundamentals – such as mathematical, statistical, and experimental (laboratory) analysis; 3. are qualified to plan and conduct respectively suitable experiments, interpret the data, and draw conclusions.	Graduates: 1. are qualified to formulate and solve problems arising in new and developing fields of the area of their specialisation; 2. are able to use their knowledge and understanding to design scientific including engineer-ing models, systems, strategies, and processes; 3. are able to design and apply different methods – such as mathematical analysis, computer-aided model design, practical (laboratory) experiments or plans; 4. are able to recognise the relevance of the ecologic and economic framework conditions re-lating to social and health and safety issues; 5. are qualified to plan, conduct, and evaluate field and laboratory experiments.

8.3 Investigations

Bachelor	Master
Graduates: 1. are able to pursue literature searches in a targeted way and to use data bases and other sources of information; 2. are qualified to carry out assessments on the basis of	Graduates: 1. are qualified to apply suitable methods to pursue investigations or detailed research as to technical-scientific issues in accordance with the status of their knowledge and understand-ing;

comparisons with literature refer-ences and plausibility considerations.	2. are able to identify, locate, and procure required information; 3. can define and conduct investigations using the means of analysing, modelling, and ex-perimenting; 4. are qualified to assess data critically and to draw conclusions, 5. are able to investigate the application of new emerging technologies in their scientific disci-pline.

8.4 Engineering Design

Bachelor	Master
	1. are qualified to solve problems which are incompletely defined or unusual and show con-flicting targets or competing specifications; 2. are able to analyse and assess system performance; 3. are able to use their knowledge and understanding to develop solutions for unusual prob-lems together with the integration of other disciplines; 4. can apply their scientific ability to judge when working with complex, technically impure, and incomplete information; 5. are qualified to apply innovative methods to problem solving processes.

8.4 Engineering Practice

Bachelor	Master
Graduates: 1. have the skills to solve practical problems; 2. can combine theory and practice to solve subject-specific practical problems; 3. are able to select and apply suitable devices, processes, and methods;	Graduates: 1. can combine theory and practice to achieve quality of structures, processes, and results; 2. can deal with complex facts and combine knowledge from different fields;

4. have developed an understanding of applicable techniques and methods and their limita-tions; 5. recognise the technical, health and safety, social, ecological, and legal implications of en-gineering practice in their field of scientific expertise; 6. can apply methods relevant for their profession; 7. are aware of the usability and the restrictions of concepts and solution strategies; 8. can resort to experience with problems, topics, and processes relating to their scientific discipline; 9. are able to consult adequate literature and information sources and coordinate the work of experts.	3. can develop and implement deductive and inductive methods; 4. have developed a comprehensive understanding of applicable theories, models, tech-niques, and methods and their limitations; 5. recognise the social, economic, and ecological implications of practical engineering and can assess them.

8.5 Social Competences

Graduates: 1. are able to work efficiently on their own and as team members; 2. are qualified to apply different methods to communicate effectively with the scientific com-munity and the society as a whole; 3. feel obliged to act in accordance with professional ethics and the responsibilities and stan-dards of practical engineering; 4. are aware of the methods of project management and business practices such as risk and change management and understand their limitations;	Graduates: 1. fulfil the requirements on graduates of Bachelor's degree programmes with a view to key qualifications on the higher level of Master's degree programmes; 2. can work effectively as leaders of teams comprising different disciplines and levels; 3. can work and communicate in national and international contexts.

5. recognise the necessity of independent life-long learning and are qualified to do so; 6. depending on the professional field they have competences in the fields of management and marketing, in particular project management, acquisition, personnel management, con-trolling etc, 7. are adequately competent in the area of communication, e.g. presentations or moderation.	

9. SSC9 -Chemistry

7.1 Specialist competences

Bachelor	Master
Graduates of Bachelor's degree programmes in the field of chemistry: 1. have gained chemistry-relevant fundamental knowledge of mathematics and the natural sciences, 2. have sound knowledge of the core subjects of chemistry including inorganic, organic and physical chemistry, as well as of analytical chemistry, 3. have gained knowledge in one or several other special areas in the natural sciences or humanities, 4. are able to carry out practical chemistry work and have learnt how	Graduates of Master's degree programmes in the field of chemistry: 1. have deepened their knowledge in core subjects, special subjects or interdisciplinary subjects, 2. have knowledge building up on a Bachelor's degree level in chemistry, which forms a basis for original and competent development and implementation of ideas within a research area and 3. have competences qualifying them professionally, e.g. to work as a chemist in industry or public service. Such graduates are able to

to handle chemicals independently and safely in lab practicals, 5. have knowledge of safety and environmental issues and the legal fundamentals, 6. have gained methodological competence in chemistry and are able to apply this in other contexts, and 7. have interdisciplinary knowledge and skills, such as in economics, ethics or philosophy. Such graduates are able to 8. obtain, interpret and evaluate data of scientific and technical relevance, and to draw sound conclusions, which take into account scientific, technological and ethical findings, 9. solve problems of a scientific/application-oriented nature independently, and to present the results, as well as 10. pursue lifelong learning.	1. carry out independent scientific work as well as 2. apply their knowledge and understanding, in order to solve problems in new and unaccustomed situations, involving broader (or multidisciplinary) issues.

7.2 Social competences

Bachelor	Master
Graduates of Bachelor's degree programmes in the field of chemistry: 11. are able to communicate with colleagues working in the field as well as with the broader public, about chemistry-related contents and problems, also in a foreign language and on an intercultural basis, 12. are aware of social and ethical responsibility in their actions and are familiar with the professional ethical principles and standards of chemistry, 13. are able to work both alone and as a member of international, mixed-gender groups,	Graduates of Master's degree programmes in the field of chemistry (beyond the social competences specified for the Bachelor's degree programmes): 1. have acquired a capacity to carry out independent scientific work and to organise, conduct and lead more complex projects, 2. have acquired scientific, technical and social competences (abstraction ability, systems analytical thinking, capacity for teamwork, ability to communicate, international and intercultural experience etc.), and are

14. are familiar with the basic principles for conduction of projects and able to develop appropriate leadership responsibility and 15. are prepared for entry to professional life in an industrial or academic environment, through adequate practical relevance of the degree programme.	therefore prepared to take on leadership responsibility, 3. can combine and independently apply specialised knowledge in various component disciplines, in order to organise, work on and manage complex problems, 4. are also capable of making decisions, based on incomplete or limited information and 5. take into account ethical responsibility in their decisions.

10. SSC10 - Life Sciences, Biology

10.1 Subject-Specific Competences

Bachelor	Master
Graduates of Bachelor's degree programmes in the area of the life sciences: 1. have acquired sound fundamental biology-relevant knowledge of mathematics and the natural sciences, 2. have sound knowledge of the fundamentals of molecular, cell and organismic biology, 3. have gained methodological competence in Life Sciences and are also able to apply this in other contexts, 4. are capable of independent practical work in laboratories and in the field as well as handling organisms, 5. have relevant knowledge of safety and environmental issues as well as the associated legal fundamentals, 6. have acquired sound knowledge in at least one special area of Life Sciences, 7. are capable of recognising and solving subject-specific problems,	Graduates of Master's degree programmes in the area of the life sciences: 1. have advanced their knowledge in core subjects, subject-relevant or interdisciplinary subjects; 2. are in a position to discuss complex life science issues as well as own research results comprehensively and in the context of current international research and present these in writing (e.g. Master's thesis, scientific publication) and orally (e.g. lecture with free discussion); 3. have gained subject-specific and interdisciplinary problem solving competence.

8. are capable of solving Life Science problems and presenting the results.	

10.2 General and Social Competences

Bachelor	Master
Graduates of Bachelor's degree programmes in the area of the life sciences: 1. have trained conceptual, analytical and logical thinking, 2. have an awareness of possible social, ethical and environment-related effects of their actions, 3. have acquired communication skills – also in a foreign language – and can communicate scientific information to experts and laypersons in a suitable manner, 4. have a capacity for teamwork, also on an intercultural basis, 5. have acquired lifelong learning strategies.	Graduates of Master's degree programmes in the area of the life sciences: 1. have gained the ability to combine specialised knowledge of various component disci- plines, carry out independent scientific work and organise, conduct and lead more complex projects as well as publish the results; 2. have acquired social competences, such as abstraction ability, systems analytical think- ing, capacity for teamwork, ability to communicate, international and intercultural expe- rience and others, and are therefore especially prepared to take on leadership respon- sibilities; 3. are in a position to also assess the social and environment-related effects of their ac- tions.

11. SSC11 - Geosciences

11.1 Underlying basis

Bachelor	Master
1. Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Mathematics) underlying the study of Geology	1. advanced knowledge and understanding of the principles of Geosciences 2. deeper knowledge of a chosen specialization

2. Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life 3. Basic knowledge and understanding of the key aspects and concepts of geology, including some at the forefront of that discipline 4. Knowledge of the common terminology and nomenclature and the use of bibliography in Geo-science 5. Awareness of the wider spectrum of geological disciplines 6. Awareness and understanding of the temporal and spatial dimensions in Earth processes 7. Awareness of the applications and responsibilities of Geosciences and its role in society includ- ing its environmental aspects 8. Awareness of major geological paradigms, the extent of geological time and plate tectonic 9. Knowledge and understanding of the complex nature of interactions within the geosphere 10. Appropriate knowledge of other disciplines relevant to geosciences	3. critical awareness of the forefront of their specialization 4. advanced understanding of earth system relevant to their specialisation 5. appreciation of the learning capacity needed to progress to independent research

11.2 Analysis, Design and Implementation

Bachelor	Master
1. Some understanding of the complexity of problems in the specific field of study and the fea- sibility of their solution	1. ability to specify and complete geological tasks that are complex, incompletely defined or unfamiliar

2. Understanding the need of a rational use of earth resources 3. Basic ability in the formalisation and specification of problems whose solution involves the use of geo- methods 4. Knowledge of appropriate solution patters for geosciences problems 5. Basic ability to describe a solution at an abstract level 6. Knowledge of the range of applications of geosciences 7. Ability to integrate field and laboratory evidence with theory following the sequence from ob- servation to recognition, synthesis and modelling 8. Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory 9. Ability to formulate and test hypotheses	2. some ability to formulate and solve problems in new and emerging areas of their disci- pline 3. ability to apply state of the art or innovative methods in problem solving, possibly in- volving use of other disciplines 4. ability to think creatively to develop new and original approaches and methods

11.3 Technological, Methodological and Transferable Skills

Bachelor	Master
1. Basic ability to become familiar with new geological methods and technologies 2. Ability to select and use relevant analytic and modelling methods 3. Basic ability to apply appropriate technology and use relevant methods 4. Ability to use simple quantitative methods and to apply them to geological problems 5. Basic ability to independently analyze Earth materials in the field and laboratory and to de- scribe, process, document and	1. ability to design appropriate experiments, to analyze and interpret data and draw con- clusions integrating knowledge from different disciplines, and handling complexity 2. ability to use advanced, and to develop customized, quantitative methods 3. comprehensive understanding of

report the results 6. Ability to undertake field and laboratory investigations in a responsible and safe manner, pay- ing due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigations on the environment and stakeholders 7. Basic ability to combine theory and practice to complete geology tasks 8. Ability to undertake literature searches, and to use data bases and other sources of informa- tion 9. Ability to receive and respond to a variety of information sources (eg textual, numerical, verbal, graphical) 10. Ability to conduct appropriate experiments, to analyze and interpret data and draw conclusions 11. Basic awareness of relevant state-of-the-art technologies and their application	applicable techniques and methods for a particular specialisation, and of their limits 4. awareness of the limits of current knowledge and the practical application of the state- of-the-art technology 5. knowledge and understanding of Geosciences to create models of complex systems and processes 6. basic ability to contribute to the further development of Geosciences in practice and re- search

11.4 Other Professional Competencies

Bachelor	Master
1. Ability to complete assigned tasks in a range of technical, economical and social contexts 2. Ability to learn and study including effective time management and flexibility 3. Awareness of the concept of professionalism and professional ethics 4. Knowledge of the economic, social, environmental and legal conditions expected in profes- sional practice 5. Basic awareness of project management and business practices and understanding of their limitations 6. Ability to work effectively as an individual	1. ability to produce independent work in their professional and scientific fields 2. ability to manage and work effectively as leader of teams that may be composed of dif- ferent disciplines and levels 3. basic ability to work effectively and communicate in national and international contexts 4. appreciation of the role of Geosciences in the development of knowledge,

and as a member of a team 7. Recognition of the need for, and engagement in, self-managed and life-long learning 8. Ability to organise their own work independently 9. Basic ability to formulate an acceptable problem solution using geological methods in a cost- effective and time-efficient way 10. Basic knowledge in estimating and measuring costs and productivity 11. Basic ability to communicate effectively in written and verbal form with colleagues, other pro- fessionals, customers and the general public about substantive issues and problems related to their chosen specialisation 12. Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages	wealth crea- tion and improving quality of life 5. ability to evaluate performance as an individual and a team member 6. ability to identify individual and collective goals and responsibilities and to perform in a manner appropriate to these roles

12. SSC12- Mathematics

Type M (Degree programme in Mathematics with a minor or an applied subject):

Mathematics as such is clearly the main focus; structural mathematics1 and formal argumentation are core components of the curriculum. The necessary scope and depth of the mathematical con- tent leads to an average maximum of 20% of credit points being reserved for another subject or other subjects. This other subject or subjects can largely be freely elected by the students and do not necessarily need to be directly related to mathematical curricular content.

Type xM (Degree Programme in Mathematics with applied orientation):

There is a close in- terconnection with one or more applied subjects that contain requirements on which the mathematical programme is oriented (generally this is in the form of an integrated degree pro- gramme). Besides fundamental training in abstract and applied mathematics,

mathematics in- cluding formal argumentation is firmly anchored in the curriculum; at least in those areas of mathematics where this is relevant. Examples are Statistics, Business Mathematics, Technical Mathematics or Biomathematics.

Type iM (Interdisciplinary Degree Programme with a large mathematical proportion):

These are interdisciplinary degree programmes in which generally at least three subjects are studied that represent mathematics as the core of the mandatory curriculum and where it is possible to opt for a mathematical specialisation. The amount of structural mathematics is focused on the interdisciplinary content. Mathematics is being pursued not as the end in itself, but with a clear focus on its applications. Examples are Business Calculations, Computer Science and Engineer- ing (CSE), Biometrics, Biostatistics, Data Science, etc.

12.1 Knowledge

<table>
<tr><th colspan="2"></th><th colspan="3">Bachelor</th><th colspan="3">Master</th></tr>
<tr><th colspan="2"></th><th>M</th><th>xM</th><th>iM</th><th>M</th><th>xM</th><th>iM</th></tr>
<tr><td rowspan="3">Remember</td><td colspan="5">Possesses profound knowledge of the fundamentals ...</td><td>possesses further knowledge ...</td></tr>
<tr><td colspan="2">... of abstract and applied mathematics

As well as at least one minor subject</td><td>As well as in the re- spective applied sub- ject</td><td>... in selected chapters of abstract and/or applied mathematics as well as in the respective applied subjects</td><td>... of abstract and ap- plied mathematics as well as at least one minor</td><td>... of the relevant mathematics for the applied subject as well as in the respective applied subject</td><td>... in selected chapters of abstract and/or ap- plied mathematics as well as in the respec- tive applied subjects</td></tr>
<tr><td colspan="3">Is familiar with relevant practical standard software</td></tr>
<tr><td>Comprehend</td><td colspan="2">• is able to identify and explain the quality of complex mathematical problem
• is able to general-ise complex math-</td><td colspan="2">is able to mathematically formulate com plex, applied problems</td><td colspan="2">• Is able to identify and explain the quality of simple[4] mathematical problems
• Is able to generalise simple mathematical problems</td><td>• Is able to formulate Simple mathemati- cal problems</td></tr>
</table>

12.2 Ability

	Bachelor			Master		
	M	**xM**	**iM**	**M**	**xM**	**iM**
Apply	• Is able to use fundamental mathematical statements to solve simple mathematical problems • Is able to formulate fundamental mathematical hy- potheses	• Is able to solve simple practical problems by ap- plying funda- mental mathe- matical methods	Is able to solve sim- ple practical prob- lems by applying fundamental math- ematical methods (where applicable only with software)	• is able to use mathematical statements to solve mathemati- cal problems • is able to formulate mathematical hypotheses and verify them	is able to solve problems in the applied area with the help of math- ematical	is able to solve problems in the applied area with mathematical methods (where applicable with software)

Anallyse	Recognises the formal structure of simple mathematical problems	Is able to allocate practical problems to a mathematical category	• recognises the mathematically abstract structure of problems and is able to analyse this	• recognises the mathematicall y abstract structure of applied prob-lems	• is able to allocate complex prob-lems in the ap-plied subject to a mathematical

12.3 Competency

	Bachelor			**Master**		
	M	**xM**	**iM**	**M**	**xM**	**iM**
	Formally and correctly proves simple mathematical statements with facts and methods that students are familiar with			Formally and correctly proves mathematical statements	Formally and correctly proves mathematical statements from selected areas	

<table>
<tr><td rowspan="1">Evaluate</td><td>Masters fundamental strate- gies for transferring methods in the area of Mathematics</td><td>Masters fundamental strate- gies for transferring methods in selected areas of Mathematics, depending on the practical ap- plication</td><td>Masters strategies to transfer meth- ods within a wide area of Mathemat- ics</td><td>Masters strategies to transfer methods in selected areas of Mathematics, depending on the area of application</td></tr>
<tr><td rowspan="4">Create</td><td></td><td>Creates simple, realistic mathematical problems under supervision</td><td></td><td>Masters the mathematical creation of realistic problems</td></tr>
<tr><td colspan="2">Implements simple, mathematical processes on the computer</td><td colspan="2">Implements mathematical processes for complex problems on the computer</td></tr>
<tr><td></td><td>Additionally, utilises elementary mathe- matical software</td><td>… by applying mathe- matical standard soft- ware</td><td>… by applying relevant standard software</td></tr>
<tr><td colspan="2">Within the framework of Bachelor activities, works on a simple and clearly defined scientific task and is able to adequately present the results orally and in writing</td><td colspan="2">Is able to scientifically work on and present mathematical problems</td></tr>
</table>

	in the area of abstract or applied mathematics or from a minor subject with a large mathematical proportion	in an applied area with a large mathematical proportion	in an applied area with a generally mathematical proportion	Within the area of abstract and applied mathematics or a minor with a close mathematical relation	Within an area of application with a large mathematical proportion	Within an area of application with a generally mathematical proportion
				Within the framework of Master activities, independently works on an advanced scientific		
				Within the area of abstract applied mathematics or a minor with a large mathematical propostion	With an area of application with a large mathematical propostion	Within an area of application with a generally mathematical proportion
				and is able to adequately present and scientifically discuss the results both orally and in writing		

13. SSC-13 Physics

Bachelor	Master
1. They have sound knowledge of classical physics (mechanics, electrodynamics, thermodynamics, vibrations, waves and optics) and are familiar with the fundamentals of quantum, atomic and molecular, nuclear, elementary particle and solid state physics. **2.** They are familiar with important mathematical methods used in physics and can use these to solve physics problems. **3.** They have an extensive understanding of the fundamental principles of physics, their in- herent relation and mathematical formulation and, based on this, have acquired methods suitable for theoretical analysis, modelling and simulation of relevant processes. **4.** They have applied their knowledge to physics problems in an exemplary manner and studied some areas in greater depth, thereby acquiring a first basis for problem solving competence. **5.** They have a basic capacity to comprehend physics problems. This will in general however not yet facilitate a deeper understanding of current research areas. **6.** They are therefore in a position to independently classify physics-based and to some ex- tent also interdisciplinary problems that require a	1. They have advanced their knowledge in natural sciences and mathematics, extended their overview of inner-physical correlations as well as those with related disciplines, and have specialised themselves on one field of physics in such a way that they can find access to current international research. 2. They have exemplarily applied their knowledge to complex physical problems and tasks to analyse, formulate, and possibly broadly solve them on a scientific basis. 3. They are qualified to plan, construct, and conduct experiments and interpret the results (focus on experimental physics) in order to solve complex physical problems or use simu- lation and modelling on the basis of physical fundamental principles (focus on theoretic physics). 4. They have acquired generic competences in their degree programme, e.g. in the areas communication, presentation, project work and capacity for teamwork. 5. They have advanced knowledge of relevant specialized technical English. Basic knowledge of another foreign language are desirable. 6. They have gained the capacity to acquaint themselves with any special area in phys- ics/technology, to research and understand the relevant current international specialist literature, to conceive and conduct experiments or theoretical methods in the field, to classify the findings in the light of

target-oriented and logic-based approach, and to analyse and/or solve them by using natural scientific and mathematical methods. **7.** They are familiar with basic principles of experimentation, are able to use modern physics measurement methods, and are in a position to assess the significance of results correct- ly. **8.** They have generally also acquired an overview knowledge in selected other natural sci- ence subjects or technical disciplines. **9.** They are able to apply their knowledge to different fields and act responsibly in their professional activity. They are moreover able to recognise new trends in their subject area and integrate the relevant methodology – possibly after appropriate qualification – into their further work. **10.** They are able to continuously and self-reliantly extend and deepen the knowledge ac- quired in the Bachelor's degree programme. They are familiar with suitable learning strategies (lifelong learning) for this; they are in particular capable of a consecutive Master's degree programme in principle. **11.** They have gained initial experience with regard to generic qualifications (e.g. time man- agement, study and work techniques, willingness to cooperate, capacity for teamwork, ability to communicate and communication techniques, rules of	diverse physical phenomena, and to draw relevant con- clusions for technical developments and scientific progress. 7. They have learnt to have the necessary persistence to cope with failures, unexpected dif- ficulties and delays in research and development projects, and still reach the target possi- bly using a modified strategy. 8. They are in a position to commence professional activity even in a field not related to the area of specialisation of the Master's degree programme, using their basic knowledge of physics together with the scientific methods and problem solving strategies acquired. 9. They are qualified to discuss complex physical issues and their own research findings within the context of current international research comprehensively and to present them in written (Master's Thesis) and oral form (presentation with free discussion). 10. They are aware of their responsibility toward science and possible consequences of their activities for the environment and society and act in accordance with the principles of good scientific practice (Deutsche Forschungsgemeinschaft 1998).

good scientific practice) in their degree programme, and are able to develop these skills further. **12.** They are familiar with the basic elements of the relevant specialised English. **13.** They are able to solve a simple scientific problem and to present their results orally (lecture) and in writing (demonstrated in a Bachelor's thesis).	

14.Medicine, Nursing

KUALIFIKASI EQF - deskriptor

MAGISTER

Knowledge

1. highly specialised knowledge, some of which is at the forefront of know- ledge in a field of work or study, as the basis for original thinking and/or research
2. critical awareness of knowledge issues in a field and at the interface between different fields

Skill

specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields

Competence

1. manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches
2. take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams