



## SUBJECT-SPECIFIC CRITERIA

*For the Accreditation of Bachelor's and Master's degree programmes in civil engineering and geodesy, architecture, interior design, and landscape architecture as well as urban and regional planning (as of 28 September 2012)*

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

### 1. Classification

#### 1.1 Function and Context

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

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

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

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

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

plines.

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

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

## **1.2 Collaboration of the Technical Committees**

The Technical Committee 03 Civil Engineering Geodesy and Architecture works together with the other Technical Committees of ASIIN, mostly to give consideration to the requirements of interdisciplinary study programmes. The higher education institutions are called upon to submit their assessment of the assignment of one or several Technical Committees in the course of the application for an accreditation procedure.

Degree programmes with a proportion of more than 50 percent of civil and geodetic engineering, architecture, interior design and landscape architecture as well as urban and regional planning contents are overseen by the Technical Committee 03 Civil Engineering Geodesy and Architecture. The latter is, as a rule, in charge of the accreditation procedure and seeks advice of auditors from other areas, if needed. When it comes to interdisciplinary study programmes with a weighted share of electrical engineering and informatics contents (below and up to and including 50%) the Technical Committee 03 Civil Engineering Geodesy and Architecture and the disciplines involved are jointly responsible or simply provide auditors.

In the field of geodesy the following criteria supplement the classification of degree programmes:

In general, all degree programmes in geodetic engineering, geodesy as well as geographic information engineering, geomatics or geoinformatics having developed from the professional activities of geodesists are to be allocated to the TC 03 Civil Engineering, if in those courses more than 40 % of all credit points are awarded for engineering contents (subject-specific fundamentals and consolidation).

For degree programmes in cartography, geographic media technology, printing technology, cross-subject geo-courses with only a small share of geodetic and surveying theory, as well as the degree programmes in geographic information engineering, geomatics and geoinformatics having developed from a more geo-scientific orientation, it is referred to the subject-specific criteria outlined by the Technical Committee Geosciences.

## **2. Educational Objectives**

The educational objectives are outlined by the description of the learning outcomes required by the graduates for practising their profession or for post-graduate studies. Such learning outcomes vary in extent and intensity, in accordance with the differing objectives of Bachelor's and Master's degree programmes. They can be subsumed in different fields of competence.

As to engineering sciences the following learning outcomes seem to be of particular relevance:

### **Knowledge and Understanding**

A thorough command of fundamental knowledge and an understanding of natural sciences, mathematics, and fundamentals of engineering sciences and their consolidation forms the basis to achieve the other education results. Graduates prove their knowledge and understanding in the field of their scientific expertise and in the context of engineering sciences.

### **Engineering Analysis**

Graduates should be able to solve problems possibly containing aspects not originating from their area of specialisation and arising in the field of engineering sciences in accordance with the level of their knowledge and understanding. The analysis may contain the identification of the problem, clarification of the specification, consideration of possible solution methods, selection of the most suitable method, and correct implementation. The graduates are to be in a position to apply various methods – such as mathematic analysis, computer-aided design or practical experiments – and should be able to recognise the relevance of the respective ecological and economic framework conditions relating to social, health and safety issues.

### **Engineering Design**

The graduates should be able to realise engineering designs in accordance with the level of their knowledge and understanding and to cooperate with engineers and non-engineers. The designs may relate to devices, processes, methods, buildings, infrastructural measures and the specifications may require consideration of other than technical aspects such as social, health, and safety issues, ecological and economic framework conditions.

### **Investigations and Assessment**

Graduates should be able to apply suitable methods to conduct investigations or detailed research as to technical problems in accordance with the level of their knowledge and understanding. Investigating can comprise literature research, designing and carrying out of projects and experiments, interpretation of data as well as computer simulation. The consulting of data bases, guidelines (e.g. standards) and safety instructions may be required in this respect.

### **Engineering Practice**

Graduates are to be able to use their knowledge and understanding to develop practical skills required for the solving of problems, the conduction of examinations, and the development of devices and processes to be applied in engineering sciences. Such skills are to comprise knowledge, use, and limitations of materials, computer-aided design, scientific processes, devices and tools, practice in workshops as well as technical literature and sources of information. Moreover, the graduates are also to recognise further non-technical consequences of practical engineering activities (such as ethical, ecological, commercial, and industrial effects).

### **Transferable Skills**

Graduates should be able to communicate adequately topics of their discipline and to work effectively in a team with diverging characteristics. They should be aware of the impact of their professional activities in various areas of life and neighbouring fields and take this into account when taking decisions.

## 2.1 Requirements for degree programmes in civil engineering

### 2.1.1 Requirements for Bachelor's degree programmes in civil engineering

Bachelor's degrees are on the one hand to facilitate professionally qualifying studies in civil engineering or geodetic engineering, together with early professional careers (professional qualification) and on the other hand are to qualify the graduates for advanced scientific degree programmes or additional degree programmes other than civil engineering.

Graduates should be able to accomplish key activities in civil engineering largely autonomously and partly on their own responsibility (for example the development of plans for design, presentation, approval, construction or process plans, the structural design of construction projects of standard difficulty level, the implementation of planning tasks in the fields of transportation or water system regulation or to work independently in construction management or construction supervision as well as on quotation tasks).

In the following, learning outcomes are listed for graduates of Bachelor's degree programmes in the field of civil engineering.

Graduates ...

- have acquired **well-founded knowledge in the fields of mathematics and natural science**, for example in the fields of mathematics, statistics, information processing, mechanics (fundamentals of statics and strength of materials), fluid mechanics.
- have acquired and deepened **well-founded knowledge of subject-specific fundamentals** in civil engineering, for example in the areas construction geology, materials science, construction physics, surveying, principles of planning, structural theory, technical design, construction informatics.
- 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 settlements.
- and have **applied** them e.g. in fields of construction economy/ construction business/ construction management, computer-aided building design, building restoration, building services engineering, finishing crafts, building permit procedure, construction contract law, facility management, design practice.
- can make use of classical and modern research methods to identify, interpret and integrate technical literature and data bases.
- can identify and formulate typical tasks by themselves, taking into account scientific evidence and methods of construction engineering.
- 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 procedures, etc.
- are able to develop methods for proof and forecast, e.g. methods for documented evidence of stability, energy efficiency, noise protection, flood protection, water supply etc.

- are able to develop concepts and plans in their area that meet the technical and professional standards. They can reflect critically on these and are able to argue for them towards others.
- are able to assess projects holistically and interdisciplinary, taking into account sustainability, environmental, ecological and economic aspects, and to perform such projects with the help of contributions from other disciplines.
- are able to pursue practice research and to establish and interpret empirical data sets by the use of qualitative and quantitative methods.
- by applying of practical experience in technical and engineering fields can
  - organize and evaluate concepts and planning procedures constructively and innovatively, theoretically soundly and well reflected,
  - develop concepts in teams and in an interdisciplinary way,
  - develop and make use of resources,
  - evaluate the usefulness of methods and their range.
- have knowledge of economics and legal sciences to be able to classify their actions economically and legally.
- are able to **communicate** on content and problems of civil engineering with both professional colleagues and individuals of a wider public in foreign languages and in intercultural relations.
- in their actions are aware of the **social and ethical responsibility** and know about business ethical principles and standards.
- 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.
- are well prepared for **socialization and work in business or scientific environment** when they enter professional life by a sufficient extent of practice relevance of the study programme.
- are capable of **lifelong learning**.

### 2.1.2 Requirements for Master's degree programmes in civil engineering

Based on a first qualification, a master's degree leads to in-depth analytical and methodological skills. At the same time knowledge and skills from the first degree programme become **amplified** and also **deepened**.

As part of the **expansion** of knowledge, graduates will be able to identify particular aspects of current problems and to solve them within a scientific frame. They also will find solutions to problems that are less common in practice, but require a technically well based handling.

Graduates **deepen** their knowledge in a way that they can consider topics that belong to the programme of bachelor studies in a new way by applying means of more sophisticated scientific techniques. Thus, new solutions occur, superior to standard solutions relating meaningfulness and degree of accuracy; or they cover areas that would not be given by means of standard

solutions.

If the HEI chooses a specific profile, Master's degree programmes with **research-oriented profiles** guarantee at least one of the following:

- advanced subject-specific consolidation with high scientific demands and comprehensive theoretical knowledge;
- scientifically-oriented education in further subjects outside classic civil engineering or geodetic engineering with a view to complex interdisciplinary and interconnected areas of work and research.

If the HEI chooses a specific profile Master's degree programmes with **practice-oriented profiles** guarantee at least one of the following points:

- advanced subject-specific consolidation in selected engineering subjects together with the imparting of special methodical knowledge;
- education in further advanced subjects outside classic civil engineering and geodetic engineering with a view to interdisciplinary and interconnected applications.

In particular, graduates achieve the following learning outcomes:

- 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.
- They can identify required information and data, determine available sources of such information, and evaluate data at a stage when the task itself is still not clear enough.
- 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.
- 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.
- ◦ 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 management of complex processes.
- They are able to face complex projects in an interdisciplinary and holistic way in light of sustainability, environmental, ecological and economic aspects, and to operate them responsibly by the help of contributions of other disciplines.
- They are capable to acquire autonomously the current state of scientific knowledge relating a research question and to examine to what extent this helps to describe, analyse and solve problems.
- They have the capacity to participate in the practical, methodical and scientific, theoretical development of the subject, to follow it, as well as to analyze, evaluate and communicate critically, in writing and orally their own or other's research results or information.
- 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.

- 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 represent them to others.
- They are able to integrate interdisciplinary research and development processes in planning and concepts.
- They are able to guide others professionally concerning the analysis of new, unclear and untypical tasks.
- 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.
- They have the capacity to undertake leading management responsibilities.
- They have adapted scientific, technical and social competences (ability to abstract, system-analytical thinking, teamwork and communication skills, international and intercultural experience, etc.) and are therefore especially prepared to take over management responsibilities.
- They acquired skills to work independently in a scientifically oriented way and to organize complex projects, implement and manage them.

## 2.2 Information for degree programmes in geodetic engineering and surveying

Degree programmes in geodetic engineering and surveying are typically offered under terms and orientations like geodetic engineering, surveying, geo-informatics, geo-information, geomatics and other related subjects.

### 2.2.1 Requirements for Bachelor's degree programmes in geodetic engineering and surveying

Through a professionally qualifying, academic-oriented programme the bachelor's degree will allow both a direct entry into professional life as well as to enable to an in-depth scientific study or to additional non-specialist studies.

In the following, learning outcomes are listed for graduates of bachelor degree programmes in geodetic engineering and surveying.

Graduates

- have acquired a **profound knowledge in mathematical and scientific areas**, e.g. in the subjects mathematics, geometry, statistics, physics, information processing.
- 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.
- have acquired **thorough knowledge of subject-specific fundamentals** of survey-

ing and geo-informatics, e.g. in the fields of surveying and geodesy, photo-grammetry and remote sensing, adjustment, cartography, computer science, geographic information systems (GIS) and spatial data infrastructure.

- 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 technologies, property management, real estate registry, land consolidation, geotopography, cartography, enhanced satellite and airborne data collection methods.
- and have **applied** them, for example in the fields of cadastral survey systems networks, building surveying, structural monitoring, land surveying, land management, information systems for geo-data, Information systems concerning professional information.
- know technical handbooks, periodicals and information systems for purposes of availability and verification of current measurement and evaluation procedures and for data collection.
- can analyze and understand **typical survey tasks and GIS requirements**, can arrange them properly, operate them efficiently and present the results.
- can also handle incompletely defined, complex problems and are able to manage risks accordingly, especially under aspects of geodesic reliability.
- 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.
- have profound professional openness and creativity, to make new applications accessible in surveying and geo-informatics and to design them in an economical way.
- have a pronounced customer-oriented and interdisciplinary 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.
- are able to lead a team independently, e.g. to operate as a survey team leader in surveying field service, as a group leader in GIS, cadastral, land consolidation, etc., or as employee or self-employed in a surveying office.
- are aware of their actions relating **ethical and social responsibility** and understand ethical principles and standards.
- are well prepared for **socialization and work in business or scientific environment** when they enter professional life by a sufficient extent of practice relevance of the study programme.
- are capable of lifelong learning.

### **2.2.1 Requirements for Master's degree programmes in geodetic engineering and surveying**

Based on a first qualification the master's degree leads to in-depth analytical and methodical



skills. At the same time knowledge and skills from the first study become deepened and expanded.

As part of the expansion of their knowledge graduates will be able to identify particular aspects of current problems and to solve them within a scientific frame. Additionally they can find solutions to problems that occur in practice less commonly, but still need a professionally sound treatment.

Graduates deepen their knowledge in a way that they can consider topics that belong to the curriculum of bachelor's studies in a new way by applying means of more sophisticated scientific techniques. Thus, new solutions occur, superior to standard solutions relating meaningfulness and degree of accuracy; or they cover areas that would not be given by means of standard solutions.

If the HEI chooses a specific profile, Master's degree programmes with a **research oriented profile**, alternatively ensure one of the following:

- further subject-specific specialization with high academic standards and extensive theoretical knowledge.
- scientifically oriented training in other subjects outside traditional geodetic engineering and surveying (as outlined in particular in 2.2.1) with respect to complex networked and interdisciplinary work and research fields.

If the HEI chooses a specific profile, Master's degree programmes with a **practice-oriented profile**, alternatively ensure one of the following:

- further subject-specific specialization in selected engineering disciplines associated with special knowledge of methods and deepened and widened methodical skills.
- training in other major subjects, which go beyond the topics of geodetic engineering and surveying mentioned in 2.2.1, relating interdisciplinary and networked applications.

Dependent on their orientation graduates have achieved the following exemplary learning outcomes:

- 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.
- 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.
- They can describe and analyze independently demanding tasks e.g. in surveying, geoinformatics 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.
- 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.

- Relating land management, they are capable to apply various principles and procedure practices within the context of tasks needs and to develop them further technically – with a safe understanding of legal, economic and social conditions.
- 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.
- They are able to develop innovative methods and strategies on the basis of scientific analysis.
- They are able to consider demanding projects in a holistic and interdisciplinary way, to bring an optimal contribution of the surveying business to bear.
- 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.
- 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.
- They are able to describe and analyze independently new, vague and unusual tasks in surveying in the background of current scientific discussion using scientific methods. They can experiment with methods, develop and evaluate them relating their scope and effectiveness.
- They can integrate interdisciplinary research and development processes in their projects and concepts.
- They are in the position to guide others professionally in the analysis of new, vague and untypical tasks.
- 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.
- 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 environment.

## **2.3 Information for degree programmes in architecture**

### **2.3.1 Professional acceptance as an architect**

Within higher education the teaching of architecture take on a special position insofar as they train in the direction of a protected profession, which is dominated by national and international standards concerning its key areas of training and its duration. These are in particular:

Germany: In Germany professional approval is accomplished by registration committees of

the federal states according to the state laws of architecture, modelled on the EU Directive on the recognition of professional qualifications. This is the precondition to enrol into the lists of architects of architectural associations.

Europe: The directive of the European Parliament and Council on the recognition of professional qualifications.

Worldwide: UNESCO/ UIA Charter for Architectural Education  
and the

UIA – Accord on Recommended International Standards of Professionalism in Architectural Practice.

In all cases the requirements for an approval procedure is a higher education degree in specific degree programmes. According to EU requirements the higher education studies need to comprise at least 4 years. In Germany, the requirements are governed by laws of the respective federal states which provide in general an altogether five-year bachelor's and master's degree or a four-year bachelor's degree. Some states, such as Bavaria and Hessen, have additionally established state specific regulations. For worldwide professional acceptance the UIA (International Union of Architects) requires a standard of a five-year's study in a bachelor's and a master's programme.

Apart from some special regulations in certain federal states, therefore the training for being an licensed architect according to the above conditions is possible in a 5-year consecutive study, during which the bachelor programme comprises 6 or 7 semesters, or in an 8-semester bachelor's degree which does not fulfil the UIA requirements.

### **2.3.2 Qualifications of architects**

In order to meet the requirements of the professional activities as an architect, graduates have acquired the following learning outcomes:

- ability to create architectural designs that satisfy both aesthetic and technical requirements;
- adequate knowledge of the history and theories of architecture and the related arts, technologies and human sciences;
- knowledge of the fine arts as an influence on the quality of architectural design;
- adequate knowledge of urban design, planning and the skills involved in the planning process;
- 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;
- 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;
- understanding of the methods of investigation and preparation of the brief for a design project;

- understanding of the structural design, constructional and engineering problems associated with building design;
- 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 climate;
- the necessary design skills to meet building users' requirements within the constraints imposed by cost factors and building regulations;
- adequate knowledge of the industries, organisations, regulations and procedures involved in translating design concepts into buildings and integrating plans into overall planning.

To ensure that this qualification objective can be achieved, students until the end of their studies acquire skills in designing and constructing, as well as knowledge and skills to enable them to fulfil their role as generalists and to coordinate interdisciplinary projects, such as e.g.:

### ***Design expertise***

Graduates

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

### ***Knowledge and skills (knowledge and understanding)***

#### Cultural and arts sciences

Graduates

- can apply their knowledge of historical and cultural references in the field of international architecture.
- can apply their knowledge concerning the influence of visual arts to the quality of architectural design.
- have developed an understanding of the heritage of built environment and of topics relating monument protection.
- have developed an awareness of the connections between architecture and philosophy, and political trends and cultural movement of other creative disciplines.

#### Social and human sciences

Graduates

- have the ability to develop programmes for construction projects and thereby to define the

needs of developers, users and the public.

- have understanding of the social context of a construction project.
- have an understanding of the ergonomic and spatial requirements of the working environment.
- have knowledge of relevant laws, rules and standards for planning, design, construction, health, safety and the handling of built environment.
- have knowledge of architecture-related content of philosophy, political science and ethics.
- can apply their knowledge to society, clients and users.
- can identify and define functional requirements for different sectors of environment.

### Environmental Sciences

#### Graduates

- 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.
- have an awareness of technology and technological consequences.
- have a sense of history and practice of landscape architecture, urban planning, regional and national planning.
- can apply their knowledge on natural systems and built environment.

### Science and Engineering

#### Graduates

- can apply their knowledge of bearing structure, materials, supply and disposal.
- have an understanding of the processes in technical design and the integration of bearing structure, civil engineering, industrial expansion into a functionally meaningful ensemble.
- have an understanding of infrastructure and of how to develop related communications, maintenance and security systems.
- have an awareness of the importance of technical infrastructure for design and implementation and are alert to the planning and control of construction cost.
- have knowledge of physical problems and technologies associated with the function of a building to create comfort and protection against influence of weather.

### Design methods

#### Graduates

- can apply knowledge of design theory and design methods.
- have an understanding of design techniques and design processes as well as knowledge in analysis and interpretation of framework.
- have information on the history of design and architecture criticism.

### Construction Economics/ construction management

#### Graduates

- can apply knowledge of professional, business, financial and legal requirements.
- 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.
- have an awareness of the potential roles of architects in new and already familiar fields of action as well as in international context.
- 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.
- 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.
- can plan and coordinate the construction process.
- can organize processes involved in building construction and its economic management.

#### ***Skills***

#### Graduates

- have the ability to work in teams and communicate ideas by means of speech, text, drawings, models and statistics.
- have the ability to apply analogue and digital, graphical and model making skills making projects to analyze and develop a construction plan and to convey this vividly.
- have an understanding of evaluation systems, which utilize manual and/ or electronic means for the diagnosis of built environment.

Students should acquire appropriate knowledge, skills and abilities in all study schemes that aim at the licensing to work as an architect.

### **2.3.3 Information for Bachelor's degree programmes for architects**

Bachelor degree programmes with 6 or 7 semesters, which would not directly aim official acknowledgement of a professional licensing, qualify for fields of activity in areas of planning and construction, in public administration, and the real estate business. These programmes only qualify students for a career as architect in connection with a master study programme of 3 or 4 semesters constitutive.

Graduates of these bachelor degree programmes have e.g.:

- knowledge and understanding of subject contents and can apply their skills in various professional fields. This includes, aside sophisticated, advanced standard knowledge, particular issues that go far beyond standard requirements.
- acquired skills in analysis and synthesis of problems and in the development of problem-solving concepts.

- competence in the scientific comprehension of all relevant statements and their interpretation and knowledge in observation of results, examining social, scientific and ethical impacts.
- gained particularly skills and sound knowledge in designing, building construction, civil engineering and construction business and developed awareness to be able to coordinate and implement projects.
- the ability to communicate and present all information, ideas, problems and solutions to specialists or laymen.

### **2.3.4 Information for Master's degree programmes for architects**

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 professional approval as an architect (see section 2.3.2).

### **2.3.5 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 master'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.