Fachausschuss Informatik

ASIIN

SUBJECT-SPECIFIC CRITERIA

Relating to the accreditation of Bachelor's and Master's degree programmes in informatics and computer science (09 December 2011)

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

1. Classification

1.1 Function

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

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

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

In their role in the accreditation process the SSC also provide a professionally elaborated basis for discussion among experts, Higher Education Institutions and bodies of ASIIN. By this they make an important contribution to the comparability of national and international accreditation procedures, since it should not be left to chance of the characters of the individual evaluators

which technical parameters find their way into discussion and individual assessment. Simultaneously the SSC enumerate those abilities, skills and competencies which may typically be considered as state of the art of a discipline, but which can always be exceeded and varied, and also should be in accordance with the objectives of the university.

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

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

1.2 Collaboration of the Technical Committees

The Technical Committee 04 – Informatics/Computer Science works together with the other Technical Committees of ASIIN, principally to give consideration to the requirements of interdisciplinary degree programmes. In the course of applying for an accreditation procedure, higher education institutions are requested to submit their assessment regarding which of the Technical Committees should become involved (possibly more than one).

The accreditation procedure for degree programmes with a proportion of more than 50 percent of informatics-specific content is generally overseen by the Technical Committee 04 – Informatics/Computer Science, which may seek the advice of auditors from other areas if needed. When it comes to interdisciplinary degree programmes with a proportional share of informatics-specific content of 50% or below, the Technical Committee 04 – Informatics/Computer Science will either share responsibility jointly with the other disciplines involved, or simply provide auditors.

2. Educational Objectives and Learning Outcomes

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

2.1 Requirements for Bachelor's Degree Programmes

The Bachelor degree is a professional qualification obtained through the completion of a scien-

tific degree programme in informatics and offers the chance to start a career forthwith. Graduates have the ability to contribute on their own responsibility in cooperation with appropriate specialists to the adequate solution of problems in nearly all fields of application. They contribute to the solution of complex problems. They are able to build on the concepts, methods, procedures, techniques and tools of informatics.

On the basis of their Bachelor degree studies, graduates will have learned to react to the dynamically evolving challenges which result from technological development or from problems in the field of application. Computer scientists with a Bachelor's degree are able to widen and deepen their competences by further training in their job or through academic studies such as consecutive Master degree programmes or by additional studies in other fields.

Specialist Competences

Computer scientists with a Bachelor's degree have acquired a fundamental understanding of central concepts and methods of their discipline; they are informed about important current developments of their field of study; they are able to integrate their knowledge and competences in a wider context.

They command the scientific foundations necessary for informatics, in particular the mathematical, logical, statistical, and physical tools.

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. They are able to assess the possibilities and constraints of algorithmic operations. They are in a position to think in abstract models, and they have mastered constructive approaches.

They are thoroughly familiar with the most important algorithms, data structures and problem-solving patterns, including central paradigms of programming. They possess a basic understanding of the composition and functioning of computers and key informatics systems such as operating systems, database systems, and communication systems.

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.

They have mastered the methods of modelling, construction, verifying and testing typically used in informatics; they are able to apply these methods to solving problems.

Graduates are familiar with important applications of informatics. They are able to develop solutions for practical problems using informatics techniques and evaluate them, having due regard to technical, ergonomic, economic, juridical, and social constraints.

Social Competences

Graduates know the history of informatics; they are aware of juridical aspects of informatics and its effects on society. They are aware of ethical questions and security problems connected with the application of information processing systems.

They possess key skills such as e.g. techniques of learning and working, the capacity for teamwork and communicating, the ability to undertake literature research and to apply new media.

They are able to independently complement and deepen the knowledge acquired during their studies and to adapt to developments in the field.

They have experience of solving application problems in teams covering all phases of system development, from analysis of requirements, specification and implementation to testing. 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. They are prepared to take on responsibility in technical as well as management roles. In particular, periods of practical training as an integral part of the curriculum help to develop the professional skills of graduates.

Ideally, they will have broadened their horizons by taking advantage of offers of mobility integrated in their study programmes; they will have made use of opportunities to extend their language skills; they will be aware of and understand international and global developments in information technology and their possible effects on business and society.

2.2 Requirements for Master's Degree Programmes

Based on a first graduate degree, the Master's programme leads to the acquisition of further analytical and methodological competences. At the same time, technical competences acquired during the first degree are deepened and extended. The Master's programme prepares graduates for scientific work and methodology, imparting theoretical and analytical abilities, and enables graduates to react openly and creatively to new, possibly unpredictable circumstances. Graduates are able to solve difficult, complex problems in informatics; they are in a position to fulfil management functions responsibly.

Graduates meet the requirements for undertaking PhD studies successfully in their respective field.

Specialist Competences

Formal, Algorithmic, Mathematic Competences

Graduates of Master's Degree Programmes

- 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;
- are able to describe and analyse problems using formal methods;
- have developed a critical awareness of the latest findings in computer sciences and are able to assess their implications;
- possess comprehensive and detailed knowledge in a specialist field of computer science, including its current state of development.

Analysis, Design and Implementation Competences

Graduates of Master's Degree Programmes

- are capable of solving problems which are unusual, incompletely defined or have more than one possible specification;
- can apply their judgement to work with complex, contradictory and incomplete information;
- are able to formulate, structure and formalise problems stemming from a new and developing field within their specialisation, develop and evaluate possible approaches, and select and implement solutions.

Technological Competences

Graduates of Master's Degree Programmes

- can combine knowledge from different fields and deal with complexity;
- have developed a comprehensive understanding of applicable techniques and methods and their limits;
- 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

- are in a position to use their knowledge and understanding to design and implement information models, systems and processes;
- are capable of applying innovative methods to solving problems;
- can make contributions to the further development of informatics as a scientific discipline.

Social Competences

Project Management Competence

Graduates of Master's Degree Programmes

- 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 informatics;
- are familiar with the opportunities arising from the non-technical effects of their practical work as computer scientists;
- are able to responsibly lead interdisciplinary groups or organizations and present the results of their work to outsiders;
- are able to define topics and objectives in professional practice as well as in academic contexts, derive assignments of tasks from these and organise and monitor the solution process.

3. Curriculum

The curriculum supports the acquisition of such learning outcomes. Different main focuses can be defined within a very broad spectrum, ranging from theoretical and algorithmic basics and the construction of hardware and software to innovative applications in numerous areas such as robotics, computer graphics, intelligent systems, computer networks, bioinformatics and others, from all areas of life.

Bachelor's Degree Programmes

To reach the learning outcomes stated in the "requirements for Bachelors´s Degree Programmes", the relevant content needs to be included in the curriculum and there must be sufficient time to acquire such competences.

Bachelor's degree programmes contain modules designed to introduce the core subjects of informatics (theoretical informatics, algorithms and data structures; databases and information systems; operating systems; communication systems; computer architecture; programming technology; software engineering; a project with a large element of software engineering).

Master´s Degree Programmes

The curriculum mirrors the profile of the location offering the degree programmes. It consists of a compulsory part with specific content extending and consolidating the basic scientific principles of the subject and a range of compulsory options specific to the location.

Cross-subject Basic Principles

Cross-subject basic principles include courses in the framework of so-called application subjects

(minor or additional fields of studies). As a general principle, they are to be coordinated carefully with the courses in informatics. While building on basic knowledge of applied sciences, these subjects focus on bringing together specific knowledge in applied sciences and computer sciences, for instance, considering how methods used in informatics can be applied to the solving of problems occurring in the area of applications. However, students should be able to enrol in any minor field of studies which is not one of the compulsory application subjects, in accordance with their own preferences, if the subject is on offer and its curriculum is appropriately coordinated.

Professionally Oriented Skills

Informatics systems are mostly developed in environments outside the subject's field of expertise. Above all, intensive and sustained communication is therefore required in collaboration with clients and users as well as within the development team. Hence a key focus of the degree programme/curriculum lies on imparting and training in communicative and interdisciplinary competence. It is therefore important how the students acquire these abilities (for instance, in placements and projects) and how it ensures that the teaching in this field is delivered by suitably qualified lecturers.

Compulsory Elective Subjects and Specialist Strands

Compulsory elective subjects must lead towards a clear goal as documented in the educational objectives and learning outcomes specified for each degree programme. Suitable model study plans support the guidance of students. If students are allowed to devise individual subject combinations, the higher education institution takes suitable steps to ensure that each student's choice of options makes sense in terms of the subject and is in keeping with the level and intended learning outcomes of the final degree.

The above paragraph applies *mutatis mutandis* where **specialist strands** or the like can be chosen.

4. Teaching, Learning and Examination Types

Exercises, Placements, Seminars

Most skills related to informatics can only be obtained through closely supervised practice. In this respect, students benefits from ample opportunities to present their personal performance so that it can be discussed with the teachers and possibly also with fellow students and assessed in detail. Therefore, groups for exercises, practical trainings and seminars are a critical aspect of informatics education.

Projects

Participating in projects is one of the main elements in the everyday working life of computer scientists. Therefore, mastery of the necessary knowledge, skills and competences described above (paragraph 2) is a mandatory requirement for the professional qualification of graduates of degree programmes in informatics. The learning outcomes are to be acquired in the course of study. Students are given the opportunity to put theoretical knowledge of the methods used in project management into practice; the ideal curriculum therefore contains enough projects so that students can learn to use their skills to contribute to the success of a team. Based on substantial competences in the field of programming and software engineering the students carry out one or more projects at the higher education institution. The project should take place under conditions as close to reality as possible, while nonetheless being supervised by university teachers, and it should have a timescale sufficient for the acquisition of the above-mentioned competences. Groups should be large enough to make sure that typical interface problems occur.

In Master's degree programmes, projects are scheduled late enough in the course to ensure that they take place at a level suitable for the degree programme.

Industry Projects

After as little as two or three semesters, degrees in informatics typically offer the opportunity to work as a student trainee with relevant companies. Increasingly, projects and especially final assignments for degree programmes with an applied sciences orientation are being carried out in close cooperation with business and industry. In periods of practical training, students acquire insights into the internal processes of companies. Also, they acquire an understanding of the interrelation between functional structures, the corresponding groups of persons, and the underlying company processes in their technical, personal and economic context. This contributes to a smooth transition into professional life, avoiding difficulties with the integration process.

Types of Oral Examinations

Computer scientists have to be in a position to present their plans and the results of their work coherently, even when speaking freely and in stressful situations. Therefore, as well as showing the ability to recall facts during their study period, they must also be able to orally demonstrate their command of subject-specific working methods and procedures as well as the findings, methods and structures of thought underlying them. Ideally, the higher education institution support teaching, learning and examination types that support the acquisition of such competences to a sufficient degree. Adequate are various forms of oral examinations, which can consist of both discussions in seminars or colloquia and subject-specific examinations.

Final Thesis

The degree programme is completed with a final thesis, the length of which ensures that students will work on a problem independently and at a level in accordance with their degree.

5. Designation of Degree Programmes

With regard to consecutive Master's degree programmes with designations such as "Informatics", "Applied Informatics", "Computer Engineering" or the like, or "Media Informatics", the industry expects graduates to have the described knowledge, skills and competences. Given that informatics is continuously combined with other subjects in newly introduced interdisciplinary study programs, it is significant to have a clear designation which reflects the intended learning outcomes of the graduates.