ASIIN Seal & Euro-Inf Label

Accreditation Report

Bachelor's Degree Programme
Informatics Engineering

Master's Degree Programmes
Informatics Engineering
Innovation and Research in Informatics

Provided by
Universitat Politècnica de Catalunya, Facultat d'Informàtica de Barcelona (FIB), Spain

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A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Grau en Enginyeria Informàtica	Informatics Engineering	ASIIN, Euro-Inf® Label,	n/a	04
Màster Enginyeria Informàtica	Informatics Engineering	ASIIN, Euro-Inf® Label,	n/a	04
Innovation and Research in Informatics		ASIIN, Euro-Inf® Label,	n/a	04
Date of the contract: 19.02.2016 (contract signed with AQU Catalunya) **Submission of the final version of the self-assessment report:** 11.03.2016 **Date of the onsite visit:** 18-19 May 2016 **at:** Universitat Politècnica de Catalunya, Facultat d'Informàtica de Barcelona (FIB), Spain				
Peer panel: Prof. Dr. Jürgen Ebert, Universität Koblenz-Landau Prof. Dr. Fritz Nikolai Rudolph, Hochschule Trier **Panel members nominated by AQU Catalunya:** Professor Isidro Ramos, Universitat Politècnica de Valencia Professor Rafael Molina, Universidad de Granada Adrià Julià, Student Universitat de Girona				
Representative of the ASIIN headquarter: M.A. Madlen Schweiger Representative of AQU Catalunya headquarter: Esther Adot Giménez				
Responsible decision-making committee: Accreditation Commission for Degree Programmes				

[1] ASIIN Seal for degree programmes; Euro-Inf®: Label European Label for Informatics
[2] TC 04 – Informatics/Computer Science

Criteria used: European Standards and Guidelines as of May 2015 ASIIN General Criteria, as of 26.06.2015 Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of 12.09.2011	
Note: The accreditation process was jointly implemented by AQU Catalunya (Catalan University Quality Assurance Agency) and ASIIN. The programmes applied also for the mandatory regional accreditation of AQU Catalunya.	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Bachelor in Informatics Engineering	Grau en Enginyeria Informàtica	• Computing • Computer Engineering • Software Engineering • Information Systems • Information Technologies	6	Full time and part time	Yes, optionally with Institut National Universitaire Jean-François Champollion, Castres, France	8 Semesters	240 ECTS	Annually, 2010
Master in Informatics Engineering	Màster Enginyeria Informàtica		7	Full time and part time	Yes, optionally with Université Blaise Pascal, Clermont-Ferrand, France	3 Semesters	90 ECTS	Annually, 2011
Master in Innovation and Research in Informatics		• Advanced Computing • Computer Graphics and Virtual Reality • Computer Networks and Distributed Systems • Data Mining and Business Intelligence • High Performance Computing • Service Engineering	7	Full time and part time	Yes, optionally with Instituto Politécnico Nacional de los Estados Unidos Mexicanos, México D.F., México	4 Semesters	120 ECTS	Annually, 2011

For the Bachelor's degree programme Informatics Engineering the institution has presented the following profile on the website:

"The bachelor's degree in Informatics Engineering provides the knowledge needed to conceive, design, develop, maintain and manage computer systems, services, applications

[3] EQF = The European Qualifications Framework for lifelong learning

and architectures and to understand and apply relevant legislation. You will also become an expert in new methods and technologies in the field of ICTs. You can choose one of five majors:

Major in Computing

You will acquire the scientific and technical fundamentals that will enable you to design efficient solutions to computing challenges, particularly in artificial intelligence, bioinformatics and virtual reality.

Major in Computer Engineering

You will be trained in the design of computers and digital devices that integrate hardware, software and communications, such as supercomputers, mobile phones, mp3 players, medical equipment, robots and image processing systems.

Major in Software Engineering

You will learn to build reliable, efficient software systems that meet user and corporate requirements and to manage the people, resources and stages in a project, from the definition of the client's needs to the construction and deployment of a system.

Major in Information Systems

You will specialise in using information technologies to improve organisational processes in ways that enable the organisation to deploy its strategies and meet its aims, making it more efficient, innovative and competitive.

Major in Information Technologies

You will be trained in the design and installation of computer networks and the applications needed to satisfy the needs of organisations in keeping with security requirements."

For the Master's degree programme Informatics Engineering the institution has presented the following profile on the website:

"The master aims to provide students with a general training in informatics an also with an additional in-depth knowledge in some areas of computer science.

The Master in Informatics Engineering promotes social and environmental values related to the computer science discipline. Moreover, its courses intend to develop abilities particularly oriented to the professional practice. Working in group, leading working groups, oral and written communication skills are also promoted. The Master in Informatics Engineering graduates are prepared and encouraged to learn throughout their professional lifes.

The Master in Informatics Engineering wants to give their graduates the set of competences needed to practice the Informatics Engineering profession, as it has been defined by the Consejo de Universidades. The master's degree equips graduates with knowledge and hands-on experience across a wide spectrum of information technology domains: from cloud computing to security and from computer graphics to information systems, with a focus on IT management and leadership. Graduates become the "Swiss Army knife" of IT in their organizations."

For the Master's degree programme Innovation and Research in Informatics the institution has presented the following profile on the website:

"Informatics has become the major driving force in many scientific and technological fields. The Master in Innovation and Research in Informatics is designed to provide a solid background in different aspects of research in informatics, while preparing its graduates to become experts in any of the fields of specialization offered, like Advanced Computing, Computer Graphics and Virtual Reality, Computer Networks and Distributed Systems, Data Mining and Business Intelligence, High Performance Computing and Services Engineering.

The Master in Innovation and Research in Informatics graduates will have a high capacity to analyse and solve complex problems. Thus they will be qualified to work in any company willing to incorporate emerging technologies in the sector, especially those with R&D centres, public and private research centres or University departments, in which they would develop new research activities. Graduates of this Master Programme also acquire the skills and knowledge to enrol in PhD programmes in Informatics."

C Peer Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- Websites of the programmes (access on June 12th 2016):

  Ba Informatics Engineering:

  - http://www.upc.edu/learning/courses/Bachelors-degrees/informatics-engineering-barcelona-fib
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau/mapes-competencies.html
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau.html
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau/competencies-assignatures.html#gen

  Ma Informatics Engineering:

  - http://masters.fib.upc.edu/masters/master-informatics-engineering
  - http://www.fib.upc.edu/en/masters/mei.html
  - http://www.fib.upc.edu/en/masters/mei/plaMEI/competencies-MEI.html

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri.html
  - http://www.fib.upc.edu/en/masters/miri/plaMIRI.html

- Self-assessment report (SAR): Objectives-Matrix for each programme (competences-modules, competences-EQANIE)
- Boletin Oficial del Estado (Official State Gazette), as of 18.02.2009
- Discussions during onsite visit

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

Preliminary assessment and analysis of the peers:

The Barcelona School of Informatics (FIB) of the Technical University of Catalonia has defined educational objectives and learning outcomes for the different degree programmes under review. Furthermore, the subject areas of the degree programmes are part of requirements set by the National Ministry of Science and Innovation for Bachelor and Master programmes leading to an official degree allowing graduates to exercise a regulated profession. The very informative websites contain brief but explicit descriptions of the programmes objectives, clearly stating the professional fields and specializations of the offered degree programmes as well as programme particularities. From these transparent descriptions the level of the programmes can be clearly deduced, being in full compliance with the standards of the EQF levels 6 for Bachelor's graduates and level 7 for Master's graduates respectively. In general, the panel was impressed and welcomed the published information on the respective programme websites.

Additionally, the university had aligned the programme objectives with the subject-specific criteria of ASIIN and the Euro-Inf® learning outcomes[5]. With respect to the Bachelor's degree Informatics Engineering, the panel approved that students should demonstrate knowledge and comprehension of essential facts, concepts, principles and theories related to informatics and their disciplines of reference. In particular students should be able to interpret, select and value concepts, theories, uses and technological developments related to computer science and its application derived from the needed fundamentals of mathematics, statistics and physics. Furthermore, students should have the capacity to solve the mathematical problems presented in engineering and they should be able to apply the knowledge about: algebra, differential and integral calculus and numeric methods; statistics and optimization. Additionally, students are expected to acquire a fundamental understanding of central concepts such as basic algorithms, data structures, problem solving patterns as well as a basic understanding of the composition and functioning of computers and key informatics systems which leads to the understanding of the principles of complex informatics systems and enables them to contribute to the solution of complex informatics problems. The peers approved that students should demonstrate knowledge and comprehension about the internal operation of a computer and about the operation of communication between computers as well as being able to evaluate and select hardware and software production platforms for executing applications and computer services. Moreover, the University sets the learning outcome that students should be able to analyze, design, build and maintain applications in a robust, secure and efficient way, choosing the most adequate paradigms and programming languages. The panel discussed with the programme coordinators whether knowledge in

[5] Cf. www.eqanie.eu

theoretical informatics (especially formal languages and automata) should form part of the Bachelor's programme objectives and intended learning outcomes. The panel learned that the National Ministry of Science and Innovation does not require knowledge of theoretical informatics for all graduates from the Bachelor degree programme but for those who choose the specialization "Computing". The panel takes the national regulations into account which stipulated the intended learning outcomes mostly and will discuss this topic further under criteria 1.3.

In terms of transversal and transferable competences, which include awareness of legal aspects of informatics and its effects on society as well as ethical questions and security problems connected with the application of information processing systems, the panel determined that the defined learning outcomes meets the EQANIE learning outcomes and ASIIN subject specific criteria. Furthermore, students shall acquire practical skills during the practical sessions related to the different fields of computer science covered by the programme. Additionally, students are also expected to acquire a number of further social competences including effective oral and written communication, English language competences as well as team working skills or the capacity to be aware of and understand international and global developments in information technology and their possible effects on business and society.

With regard to the Master's degree programme Informatics Engineering, the peers approved that students should acquire a profound knowledge and understanding of the principals of informatics rooted in mathematical theory and have the capacity for critical, logical and mathematical reasoning. The programme includes that graduates should gain analysis, design and implementation competences such as the ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study as well as the ability to integrate knowledge and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments. Furthermore, students should be able to apply mathematical and statistical and methods to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, services in embedded and ubiquitous systems, intelligent systems and knowledge-based systems networks. Besides of the technological and methodological competences student should additionally acquire project management, leadership and communication skills.

For the Master's degree programme in Information and Research in Informatics, the panel took note that all graduates irrespective of their chosen specialisation should be able to apply scientific methods to analyze phenomena and systems in any area of Com-

puter Science and should acquire competences in the conception, design and implementation of innovative and original solutions. Graduates should have the capacity for mathematical modelling, calculation and experimental designing, particularly in research and innovation in all areas of Computer Science. Students shall also be enabled to apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments. Additionally, to these general technical competences for all graduates particular analysis, design and implementation competences are defined for each specialisation. Students are expected to gain advanced knowledge as well as specialised competences in *Advanced Computing, Computer Graphics and Virtual Reality, Computer Networks and Distributed Systems, Data Mining and Business Intelligence* or *High Performance Computing*. Project Management capacities are reflected by the expectation that students have the capacity for general and technical management of research, development and innovation projects, in companies and technology centers in the field of Informatics Engineering as well as being able to lead, plan and supervise multidisciplinary teams. The ability to integrate knowledge work with incomplete information while taking into account social, legal and ethical aspects was found to be aligned with investigation skills as were the intended competences in strategic planning and carrying out research.

The peers assessed that the presented learning outcomes for the Bachelor and the two Master programmes are in line with the ASIIN subject specific criteria defined by the Technical Committees 04 – Informatics and, as a consequence, with the Euro-Inf® framework criteria. Generally, the panel acknowledged that students were taught to learn principles and methods to be able to transfer them to real working tasks and working environments. The panel also understood that transversal skills played an important role in the programmes design. In particular the stakeholders from the industry had put an emphasis on such skills which they found to be essential when dealing with students during the internships and the immersion phase into real jobs. The panel gained the impression that the learning outcomes of all study programmes and the corresponding curricula were developed jointly with stakeholders. Particularly students, alumni and industry representatives maintain close personal contact with the teaching staff members. Additionally, formal provisions ensured that stakeholders are regularly involved in the quality development and assurance procedures (see further criterion 6).

Criterion 1.2 Name of the degree programme

Evidence:

- Websites of the programmes (access on June 12th 2016):

  Ba Informatics Engineering:

- http://www.upc.edu/learning/courses/Bachelors-degrees/informatics-engineering-barcelona-fib
- http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau.html
- http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau/competencies-assignatures.html#gen

Ma Informatics Engineering:

- http://masters.fib.upc.edu/masters/master-informatics-engineering
- http://www.fib.upc.edu/en/masters/mei.html
- http://www.fib.upc.edu/en/masters/mei/plaMEI/competencies-MEI.html

Ma Innovation and Research in Informatics:

- http://www.fib.upc.edu/en/masters/miri.html
- http://www.fib.upc.edu/en/masters/miri/plaMIRI.html
- Diploma Supplement for each of the degree programmes

- Learning objectives according to the SAR (self-assessment report)

Preliminary assessment and analysis of the peers:
The panel analysed the names of the study programmes in light of the programmes' objectives and content. The name of the Bachelor and Master programme Informatics Engineering was subject to discussion. The peers learned that in Spain in general only one Bachelor degree in Computer Science with five fixed specialisations exists including the fields of Computer Science and Computer Engineering. The differentiation is done within the five specialisations namely *Computing, Computer Engineering, Software Engineering, Information Systems, Information Technologies.* Barcelona School of Informatics (FIB) of the Technical University of Catalonia is one of the few Higher Education Institutions in Spain which offers all five specializations. The panel fully understood that the name was thus pre-defined by legal stipulations in Spain and the terminology is understood by the subject-specific community. In general, the panel considered the titles of all degree programmes to adequately reflect the intended objectives and learning outcomes.

The Bachelor and Master degree programmes in Informatics Engineering are mainly taught in Catalan and/or Spanish even though some modules are also offered in English depending on the language skills of the respective student cohort. Some modules are offered in various groups in different languages or the modules can be taught in a mix of different languages by e.g. handing out English slides and giving the explanations in Catalan or Spanish. As English language skills are essential for taking up an employment the panel welcomed the department's idea to offer part of the Bachelor's curriculum in Eng-

lish in the near future. The Master programme Innovation and Research in Informatics is taught and examined in English. The panel commended that the language policy is clearly explained on the respective programme website and the degree programme titles reflect the main course language.

Criterion 1.3 Curriculum

Evidence:

- Websites of the programmes (access on June 12th 2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau/competencies-assignatures.html
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/especialitats-grau.html
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/plaMEI.html
  - http://www.fib.upc.edu/en/masters/mei/assignatures.html
  - http://masters.fib.upc.edu/masters/master-informatics-engineering

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri.html
  - http://www.fib.upc.edu/en/masters/miri/syllabus.html
  - http://masters.fib.upc.edu/

- Boletin Oficial del Estado (Official State Gazette), as of 18.02.2009
  https://www.boe.es/boe/dias/2009/08/04/pdfs/BOE-A-2009-12977.pdf
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
When analyzing the curriculum of the Bachelor programme at hand, the panel took note that the curriculum is widely prescribed by the official gazette for degrees leading to the regulated profession of an informatics engineer. In general, the FIB offers well-structured degree programmes in accordance with the national regulations of the National Ministry of Science and Innovation. Nevertheless, the curricular content for all three programmes under review was assessed with regard to its contribution to the programme objectives, also in light of the ASIIN Subject-Specific Criteria, and the level of education.

The first two years of the Bachelor's programme Informatics Engineering introduce the scientific foundations as well as core topics of the discipline of computer science to the students in order to gain fundamental understanding of central concepts and methods of the discipline. As already described in the criterion 1.1 the panel missed the impartation of fundamental knowledge and competencies in theoretical informatics especially formal languages and automata in the early stage of the curriculum. The panel learned that the National Ministry of Science and Innovation does not require knowledge of theoretical informatics (especially formal languages and automata) for all graduates from the Bachelor degree programme but only for those who choose the specialization *Computing*. Therefore, the FIB included a few selected aspects of theoretical informatics in the mandatory second year module "Data structures and algorithms". The mandatory module "Theory of Computation" of the specialization *Computing* addresses in detail theoretical informatics. This implies that only those graduates who have chosen the specialization Computing will acquire fundamental knowledge and competences in theoretical informatics. This is a clear divergence from the ASIIN Subject-Specific Criteria for Computer Science as they require all graduates from undergraduate computer science degrees to gain fundamental knowledge and competencies in theoretical informatics which is considered one of the core subjects of the discipline. However, the panel learned that the national regulations were historically stipulated by the ACM standards[6], which do not include knowledge in theoretical informatics for all graduates, but only for those of the area *Computing*. Therefore, the national Spanish learning outcomes and corresponding curricula with their fixed five specializations for the Bachelor degree in Informatics do not include knowledge in theoretical informatics for all graduates. As the curriculum is in line with the set learning outcomes for each specialization and the knowledge students gain is valued by the prospective employers and well accepted at the Spanish labour market in general the peers accepted the deviation from the ASIIN Subject Specific Criteria and do not see the need for adjustments of the curriculum.

At the end of the second year, one of the five specializations offered - *Computing, Computer Engineering, Software Engineering, Information Systems, Information Technologies* – will be chosen by the students. A programming project will be conducted by all students in the mandatory second year modules "Programming 1 and 2" while in the specializations *Information Systems* and *Software Engineering* a project in the field of software engineering will be conducted. The peers gained the impression during the discussion with the students that the software projects are conducted at different levels depending on the teaching staff. The peers advised to define some common rules concerning the content, the technical depth, and the software engineering activities to be practiced in such

[6] http://www.acm.org/education/curricula-recommendations

projects in order to harmonize the delivery of the software projects and to assure that they are conducted in the same level of depths.

With regard to the Master degree programmes "Informatics Engineering" and "Innovation and Research in Informatics" the panel noted a clear matching of the overall objectives and intended learning outcomes with curricular contents. The panel thus understood that the Master degree curricula aim to deepen and broaden students' computer science and computer engineering competences. Graduates receive a professional title allowing them to take up a profession as informatics specialists. However, as the Master programmes in addition aim to provide students with essential skills to carry out PhD studies a deep understanding of theoretical and mathematical concepts is needed. Therefore, the peers recommended strengthening the theoretical content of the Master programmes. The peers discussed with the students the possibilities to set an individual focus in their study programmes as the curriculum of the Master programme in Innovation and Research in Informatics does not seem to offer any variability. The Master students confirmed this impression and expressed that they would prefer mandatory subjects at the beginning of their studies in order to harmonize the entrance qualifications; however in the second and third semester there should be more freedom of choice by offering more elective courses to the students. The peers comprehend the students' argumentation and highly recommended exploiting synergy effects from the different Master degree programmes by offering more elective courses to the students. This freedom of choice would allow students to define an even more individual focus on their studies and prospective research activities. The peers received the feedback from the employers that the impartation of management skills should be part of the Master curricula which is the case for both Master programmes. They include modules aiming to foster general management skills.

In terms of transversal competences for the Bachelor and Master programmes under review the peers confirmed that each module has at least one general competence assigned which has to be submitted and assessed by the respective professor. In order to assure that transversal competences as well as personal/professional skills are delivered the school has set up coordinators who interact with the respective professor for each subject. The employers argued during the discussion that students have excellent technical skills and the ability for independent learning which is highly welcomed. However, they still see room for improvement when it comes to social skills. The peers welcomed the implemented monitoring process by the FIB and encouraged the school to further develop the transversal and professional skills of their students.

Criterion 1.4 Admission requirements

Evidence:

- Admission requirements (access 23.06.2016):

  Ba Informatics Engineering:

  - https://www.upc.edu/learning/courses/Bachelors-degrees/access-and-admission
  - http://universitatsirecerca.gencat.cat/en/03_ambits_dactuacio/acces_i_admissio_a_la_universitat/proves_dacces_a_la_universitat_pau/

  Ma Informatics Engineering, Ma Innovation and Research in Informatics

  - http://www.upc.edu/learning/courses/masters-degrees/access-and-admission/requirements-to-enrol-masters-degree
  - http://masters.fib.upc.edu/masters/master-informatics-engineering
  - http://masters.fib.upc.edu/masters/master-advanced-computing

- SAR, chapter 6 (Statistics about student number, progression, completion and efficiency rates)
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The admission requirements are published on the website and thereby accessible for all potential students or other stakeholders. The panel acknowledged that set rules and regulations formally stipulate the admission requirements and process.

The admission rules for the Bachelor degree programme are set by the Catalan Government (Generalitat de Catalunya) including admission regulations for prospective students with professional experience, foreign students, students aged over 25, 40 or 45 and students from other universities. The admission in general is determined by the expected PAU score (the average mark of the final high school exam applied for admission to all universities in Spain, or GPA) and available enrolment places. The peers analysed the effect of the admission requirements on the programme implementation and acknowledged that FIB offers pre-courses in mathematics and physics in order to equalize the different levels of knowledge and, thereby, to ensure that especially students with a vocational training background are able to cope with the first year modules.

For the Master programmes “Informatics Engineering” and “Innovation and Research in Informatics” specific admission criteria are defined and presented on the programmes websites. Both programmes require an undergraduate degree in Informatics Engineering. Students with degrees in Telecommunications, Electronics, Industrial Engineering or simi-

lar are assigned extra preparatory courses before they can begin the Master's programme if their background is deemed unsatisfactory by the board of examiners. The admission is denied if more than 30 ECTS are necessary. According to the panel's opinion the admission requirements fully ensure that the Master programmes can be implemented without any delays or without decreasing the overall level due to extremely different backgrounds.

In terms of language requirements the peers understood that an English B2 level certificate (CEFR) is required for the Master programme Innovation and Research in Informatics and a Spanish 2 level certificate (CEFR) for the Master in Informatics Engineering.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

1.3

The peers appreciated the information that Master degree students now have the possibility to choose some courses from another Master degree programme as electives courses. However the HEI institution already recognized that these options need to become better known to the students.

In addition, the peers proposed to analyze which courses in general might be interesting for the students. Therefore, the panel still recommends allowing further freedom of choice by offering even more elective courses to permit students to set an individual focus on their studies.

Overall, the panel considered criterion 1 to be fulfilled.

Criterion 2.1 Structure and modules

Evidence:

- Study plans and module descriptions on the websites of the programmes (access on June 12th 2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/assignatures.html
  - http://masters.fib.upc.edu/masters/master-informatics-engineering

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri/syllabus.html
  - http://masters.fib.upc.edu/
- SAR, chapter 6 (Statistics about student number, progression, completion and efficiency rates)
- Degree Coordination (access on June 12th 2016):
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/grau/grau-coordinacio.html
- Information on mobility options (access on June 12th 2016):
  - http://www.fib.upc.edu/en/erasmus.html
  - http://www.fib.upc.edu/en/erasmus/doble_titulacio.html
- Admission requirements (access on June 12th 2016):
  - https://www.upc.edu/learning/courses/Bachelors-degrees/access-and-admission
- Academic regulations for Bachelor's degrees at the UPC (access on June 12th 2016):
  - https://www.upc.edu/sga/ca/normatives/normatives-academiques-de-la-upc/fitxers-normatives-academiques-de-la-upc/naeg/naeg_2014-2015_en
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The panel welcomed the clearly presented structure of the degree programmes on the websites and considered the layout of the programmes and the individual modules as useful in order to achieve the overall intended learning outcomes. All three programmes include specialization options with a fixed curriculum as described above which allow students to set an individual focus and course of study. However, for the Master programmes especially for the Master in Innovation and Research in Informatics the panel highly recommended to allow further freedom of choice by offering more elective courses (see criterion 1.3). The panel positively noted that students are provided with sufficient information about the specialization options in all programmes.

As a general rule for Bachelor degrees at the university all first year modules (initial stage) have to be passed within two years. Additionally, several third semester courses have first and second semester courses as prerequisites. The peers considered this practice as adequate in order to ensure that students have the required fundamental knowledge to follow advanced courses.

All study programmes under review can be studied in part-time as well. Bachelor part-time students may enroll in a maximum of 36 ECTS credits per year (18 ECTS credits per semester) for the duration of the degree course. Accordingly, the duration of the Bachelor degree programme extends to 8 years in total. However, after the initial phase (60 ECTS passed), the university cannot distinguish anymore between part- and full-time students as the students pay per credit and therefore, decide on an individual basis for how many courses they enroll each semester irrespective if they are full- or part-time students. Nevertheless, the peers confirmed that rules and regulations have been defined for part-time students which they consider as adequate.

Several coordination mechanisms have been devised for the Bachelor Degree in Informatics Engineering. The academic staff responsible for the subjects constitutes the first level of coordination mechanisms, and this is usually a senior or expert professor. The common compulsory modules are divided into five areas, each of which has a coordinator. Each specialization has also been appointed a coordinator. All coordinators meet at least once a year with both Heads of studies. The ultimate responsibility for the coordination of studies lies with the Head of Studies. All Master programmes have the same coordination structure. The coordination is implemented in three different levels: at the programme year level, at the area level (i.e. group of courses in the same area) and global. The area coordinator is responsible for distributing the learning objectives and competences among the courses in the area. The global coordination ensures the coordination among areas and semesters. This global coordination is one of the tasks of the Master's Academic Committee, and there is one for each Master programme. In addition, generic competences or professional skills deserve specific coordination due to their transverse nature. The panel highly appreciated the implemented teaching coordination mechanisms and considered them as strength of the programmes. The panel was convinced that these mechanisms ensure that the modules are consistent within themselves, are matched against each other, build upon each other and consequently, viewed all together to support the intended academic level.

The three programmes also prepare the students very well for the professional life by different means: Generally, the projects for the final thesis are usually directly related to practical issues of the professional life and can be undertaken at a university research group, a company or a foreign university. There are voluntary internships and very good relations to local and international enterprises. The FIB established and maintained the relationships to future employers who offer paid internships, fellowships and trainee porgrammes. Both, employers and students seemed very satisfied with the offered internships. Within the Bachelor and Master degree programmes several projects and lab works are included in the curricula.

The school has built up a very good network of international cooperation so students are given the opportunity to do a double degree, study abroad term, summer school or international internship in order to broaden their horizon and to define a more specific focus of study. Unfortunately, students do not take very often advantage of the study aboard options due to economical reasons. Nevertheless, the panel appreciated the international activities and opportunities provided to the students.

The recognition of externally acquired competences is regulated at university, not at school level. It is stipulated in the Academic Rules of the university, published on the website. The panel considered these regulations to be in line with the expectations of the Lisbon Convention.

Criterion 2.2 Work load and credits

Evidence:

- Study plans and module descriptions on websites of the programmes (access on June 12th 2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/assignatures.html
  - http://masters.fib.upc.edu/masters/master-informatics-engineering

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri/syllabus.html
  - http://masters.fib.upc.edu/

- SAR, chapter 6 (Statistics about student number, progression, completion and efficiency rates)
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The allocation of ECTS credits to the lectures, practical sessions and self-study periods of the modules appeared plausible. The workload documentation clearly states the work load distribution between lectures and independent student work and is made transparent in the module descriptions to the students. The defined practice of continuous assessment further described in the criterion 3 avoids structure-related peaks in the work

load and enables students to complete the degree without exceeding the regular course duration.

The panel acknowledged that the estimated time budgets are reassessed in the frame of student surveys and the so called ECTS project, where students are asked to record their estimated workload on a weekly basis. The programme coordinators explained that the collected statistical data were used to plan new modules. From the feedback of Bachelor students and graduates, the panel learned that some deviations existed for the second year modules and sometimes students had the feeling that their homework is not always credited enough. The projects conducted in the Master programmes are considered by the students as very useful and interesting even if the workload seems high. However, in general students stated that the overall workload corresponded to the related ECTS credits.

The dropout rate in the first year (54.6%) of the Bachelor programme Informatics Engineering seems very high, even if students have an adequate entrance profile. Especially, the low passing rate of the modules "Physics" and "Mathematics" seem to be the reason for the high dropout rate. Both, the programme coordinators and students explained that additionally to the as difficult considered modules students are not always mentally well prepared and that they need to adapt to the new learning environment. The peers positively noted that the school implemented one week preparation courses in Physics and Mathematics prior to the studies, however it might be necessary to offer longer and more intense pre-courses in order to increase the passing rates. The peers encouraged the school to identify the reasons for the rather high drop-out rates during the first semester courses to possibly implement additional measures (see criterion 6). Despite the first year dropout rates of the Bachelor degree, the peers assessed that the progression and completion rates of all study programmes under review did not indicate any significant deviations from the expected regular course duration as the estimated time budgets and overall workload seemed realistic in general.

Criterion 2.3 Teaching methodology

Evidence:

- Module descriptions on websites of the programmes (23.06.2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/assignatures.html

- http://masters.fib.upc.edu/masters/master-informatics-engineering

Ma Innovation and Research in Informatics:

- http://www.fib.upc.edu/en/masters/miri/syllabus.html
- http://masters.fib.upc.edu/

- SAR
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The teaching staff of the school uses a range of educational methods and training tools which reflect the good practices of teaching in informatics engineering programmes by involving theory classes, lab work, teamwork-projects, video lectures, presentations, reading, analysis and problem solving tasks in the every day's teaching activities. In addition an online teaching platform (Atenea and Raco) with specific teaching support tools is implemented allowing students to receive online feedback on their programming codes. Projects are conducted in several modules in the Bachelor and Master programmes as well as the Bachelor and Master thesis are intended to familiarise students with independent academic research and writing. Also the labs, which are well equipped (see also criterion 5.3), allow for adequate and state-of-the-art teaching. Generally, the students were also satisfied with the teaching as such. Overall, the panel considered the teaching methods used for implementing the didactical concept as appropriate and the ratio of contact hours to self-study time seems to support the achievement of the intended learning objectives.

Criterion 2.4 Support and assistance

Evidence:

- SAR
- Discussions on-site with lecturers, students and graduates
- HEI's website (Access: 23.06.2016):
  - http://www.fib.upc.edu/en/serveis.html
  - http://www.fib.upc.edu/en/erasmus/sessions_info.html
  - https://www.upc.edu/rsu/en/social-responsibility-at-the-upc-1/functional-structure/Sustainable%20Management%20and%20Equal%20Opportunities
- Tutorial Action Plan (Access: 23.06.2016): http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/acces/accio-tutorial.html

Preliminary assessment and analysis of the peers:

The relation between lecturers and students was considered to be one of the strong points of the programmes. The panel gained the impression that close relations exist between students and teachers. They also positively acknowledged that teaching staff and programme coordinators were very accessible for students' requests. In addition, academic support service involved an optional mentoring program, which students unfortunately are not familiar with or are currently not using. The peers recommended the implementation of a new tutoring/mentoring concept e.g. by assigning senior students to freshmen in order to reduce the drop-out rate especially in physics and mathematics. In general, students felt very well informed by having regular information sessions at the end of each study year.

As mentioned above (criterion 1.4), FIB offers pre-courses in mathematics and physics in order to equalize the levels of knowledge and, therefore, ensure that especially students with a vocational training background are able to follow the first year modules. Orientation weeks for Spanish as well as international students provide a solid base for good integration of young students into the academic life and ensure a meaningful composition of individual course schedules.

General advice and guidance is covered by the UPC Office for Equal Opportunities, the International Relations Office and the Career Center. The wide range of support and service initiatives taken by the FIB positively influences the study success of the students.

The employability of the school's graduates is rather high also due to a variety of networking activities organized by the school itself. Employers offer paid internships to senior students and both, employers and graduates also demonstrated a high level of satisfaction with the support provided by the teaching staff.

The peers positively acknowledged that all information is published on the programs websites and thus made transparent to all stakeholders. The allocated advice and guidance (both technical and general) on offer assist the students in achieving the learning outcomes and in completing the course within the scheduled time.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

2.2.

The school pointed out that dropout rates have been an important concern since the new Bachelor degree in Informatics Engineering (GEI) was introduced during the academic year 2010-2011. In addition, to the one week preparation courses in Physics and Mathematics prior to the studies the school introduced and consolidated re-evaluation mechanisms and other complementary plans (tutorial plan, revision of the planning and assessment method of some subjects). Another measure is to better inform and prepare prospective students about the necessary requirements in order to complete studies in Informatics Engineering.

The school explained that the set target of a dropout rate under 38% has not been accomplished yet, however, due to the above mentioned measures the students' performance at the initial phase has increased. This positive trend, together with the increase in the admission cut-off mark, leads the school to believe that it is feasible to accomplish the target dropout rate for the following cohorts, since the statistical studies show a clear correlation between the performance at the initial phase and the admission mark (possibly related with better motivated and prepared students).

The peers thanked the school for the additional information. Based on the recently presented drop-out figures which show a clearly decreasing trend and the further explanations they are convinced that the school is effectively monitoring the drop-out rates and implementing measures in order to reduce them.

2.4

The panel highly appreciated that the school starts a mentoring tutorship (by assigning senior students to freshmen) besides the teacher tutorship in September 2016. In July 2016 30 senior students have been selected, trained, and each one will be in charge of a subgroup of new enrolled students. They will start working with the subgroup in a fixed timetable scheduled during the enrollment.

The panel considered this criterion to be fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Module descriptions on websites of the programmes (23.06.2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/assignatures.html
  - http://masters.fib.upc.edu/masters/master-informatics-engineering

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri/syllabus.html
  - http://masters.fib.upc.edu/

- Admission requirements (access on June 12th 2016):
  - https://www.upc.edu/learning/courses/Bachelors-degrees/access-and-admission
- Academic regulations for Bachelor's degrees at the UPC (access on 23.06.2016):
  - https://www.upc.edu/sga/ca/normatives/normatives-academiques-de-la-upc/fitxers-normatives-academiques-de-la-upc/naeg/naeg_2014-2015_en
  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/matricula/normativa.html
- Academic regulations for Master thesis (access on 23.06.2016):
  - http://www.fib.upc.edu/en/masters/mai/TFM/mainColumnParagraphs/03/document/MAI_TFM_ACADEMIC%20RULES.pdf
- Exemplary course documentation, exams, final thesis
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:

The examination practice in place is clearly and transparently described in the syllabi, including the examination forms, the weighting of the examination parts as well as the calculation of the final grade. The evaluation methods include, depending on the subject and the expected module learning outcomes, exams, assignments, lab sessions, projects, and presentations and are in their concept and variety fully satisfactory. Oral examinations do

occur in the form of presentations (in project works, for instance) and as part of the Bachelor and Master thesis. The panel welcomed this assessment method as it tests practically whether students are able to present computer engineering tasks in a professional manner.

The university management defined the practice of continuous assessment as the mandatory examination. Summarizing, the concept of examination consists of a mix of mid-term examinations, final examinations and subject-specific assignments. The panel appreciated this kind of continuous learning assessment as it allows a close monitoring of the students' learning progress and encourages students' learning throughout the semester. By way of helping students to consciously assess their actual state of knowledge, the assessment procedure at the same time contributes to an adequate exam preparation.

The organization of the exams guarantees examinations that accompany study and avoids delay to student's progressions. The relevant rules for examination and evaluation criteria are transparently put into a legal framework, as both students and lecturers confirmed in the audit discussions. The date and time of the exams are announced in due time in the Academic calendar of the university. Except for the first year modules no re-examinations are offered to the students. However, all mandatory modules are offered every semester, so students may register again in the next semester. The peers confirm that rules have been defined for disability compensation measures, illness and other mitigating circumstances.

All programs include a final thesis/project which ensures that students work on a set task independently. The Master students and graduates gave the feedback that the thesis is supervised by a tutor and advisor who do not form part of the evaluation committee. The students would prefer if the supervisor would form part of the committee as they have the feeling that the composition of the evaluation committee is not always familiar with their Master thesis content. By revising the Master thesis regulations the peers acknowledged the general rules, however they advised the school to ensure that an expert of the respective thesis topic is part of the evaluation committee.

During and after the visit, the panel analyzed a number of theses and exam papers and gained the impression that, in general, the academic level was adequate.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

The peers appreciated the additional information regarding the composition of the evaluation committees for the Master thesis. In the Master programme Innovation and Research in Informatics the evaluation committees are designated within the staff of each

specialization and are validated by the specialization coordinator in order to have committees familiar with the thesis content. As the Master degree programme in Informatics Engineering doesn't have areas of specialization the evaluation committees are multidisciplinary teams with at least one member close to the topic usually. The peers support the criteria for composition of the evaluation committees; however the school should ensure that set criteria are put into practice.

The panel considered criterion 3 to be fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- CVs of the staff members
- Information about allocation of teaching staff to modules
- Information about administrative staff
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:

The panel gained an impression of the staff qualifications as well as lecturers research activities during the discussions and the provided CVs. The panel deducted that the overall composition of the teaching staff team was adequate for the successful implementation of the Bachelor and Master programs. The panel learned that full-time and associate professor with an average teaching load of 24 ECTS per academic year are deeply involved in the management and administration of the programmes and the school. In order to assess if there is sufficient teaching staff to carry out the programmes the peers ask the school to provide a teaching load table of each professor involved in the programmes. However, the school copes with recent decreasing resources despite their coinciding with the deployment of new EHEA degrees, which implies important teaching demands related to the rising number of students and number of ECTS. Last recession and investments reductions are a worrying situation according to the peers, especially because of the decreasing academic and support staff. Therefore, they recommended increasing the financial resources for teaching staff in the medium term in order to ensure the implementation of the study programs.

Research activities are carried out by the teaching staff and evaluated by external agencies. FIB staff research is carried out by means of different groups of research and investigation bodies, where international outstanding projects are being developed. In theory it is possible to take sabbaticals, however, as the budgets were decreasing university-wide, no sabbaticals were taken within the last years.

Criterion 4.2 Staff development

Evidence:

- SAR, chapter 4.3
- Information about staff development (access on 23.06.2016)
  http://www.upc.edu/ice/ca/professorat-upc
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The ICE (in Catalan, Institut de Ciències de l'Educació) of the Polytechnic University of Catalonia offers training courses for teaching staff who wish to further develop their professional and teaching skills. FIB actively supports and encourages their teaching staff to attend the training offers. The school also has academic staff participating in research and projects on innovation in teaching methods, as well as the use of modern educational technologies in accordance with the EHEA framework. The teaching staff confirmed that the offered trainings are useful and well received. All in all, the panel considered the measures taken for staff development as adequate and beneficial for the implementation of the programmes.

Criterion 4.3 Funds and equipment

Evidence:

- SAR (chapter 4)
- On-site visit
- Labrotarios/Library:
  - https://www.upc.edu/prevencio/ca/seguretat-higiene/laboratoris/llistat-laboratoris-tallers
  - https://www.upc.edu/seguimentdetitulacions/ca/fitxers-visita-externa-2016/270-fib/evidencies-270-fib/dades-dus-de-la-biblioteca-bgfr-fib/view
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:

The panel discussed the financial perspectives of the Polytechnic University of Catalonia (UPC) taking into account the fact that the Catalan Government (Generalitat de Catalunya) since 2011 has significantly reduced the financing of the public universities which shall be compensated by student fees (currently 35 Euro per 1 ECTS) and public student grant programmes. The UPC's budget is managed at two levels: a centralized budget includes the teaching and support staff salaries, major investments and financial operations and a delegated budget for each school and department for teaching and lab materials. In addition, the school has incomes for specific investments from industry funding programs and governmental (national or international) funding programs. For example AGAUR grants for the Master's programmes, specific projects (IT Forum, inLab Talent, inLab crowdfunding) and industry donations (Everis, Google, Social Point). As already mentioned the FIB copes with recent decreasing resources, therefore the peers repeat their recommendation to increase the financial resources in order to ensure the implementation of the study programs.

The panel confirmed that the resources for teaching and learning, in particular classrooms, computer rooms, laboratories and library were considered to be sufficiently well maintained. In particular, they appreciated that students had access to the hard- and software in the labs around the clock when requested. They also confirmed that access to the necessary software resources and library access was possible also from their private computers.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

According to the presented teaching load tables the peers assessed that UPC still has sufficient teaching staff to carry out the Bachelor and Master degree programmes under review. However as mentioned above, the school copes with recently decreasing resources despite their coinciding with the deployment of new EHEA degrees, which implies important teaching demands related to the rising number of students and number of ECTS. Therefore, the peers recommended increasing the financial resources for teaching staff in the medium term in order to strengthen the implementation of the study programs.

The panel confirmed its preliminary analysis that this criterion was met.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module descriptions on websites of the programmes (23.06.2016):

  Ba Informatics Engineering:

  - http://www.fib.upc.edu/en/estudiar-enginyeria-informatica/assignatures.html

  Ma Informatics Engineering:

  - http://www.fib.upc.edu/en/masters/mei/assignatures.html
  - http://masters.fib.upc.edu/masters/master-informatics-engineering

  Ma Innovation and Research in Informatics:

  - http://www.fib.upc.edu/en/masters/miri/syllabus.html
  - http://masters.fib.upc.edu/

- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
As mentioned previously, the panel commented the level of public information. The module descriptions generally include all elements necessary to allow stakeholders, in particular students, to gain full information about a module's objectives and content, its link to the programme objectives as well as prerequisites, workload, teaching methodology, exam requirements, literature and teaching staff.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Model of Diploma Supplement for each programme
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:
The documents provided by FIB did not include a programme specific Diploma Supplement, therefore the school is asked handing in one sample for each study programme under review.

Criterion 5.3 Relevant rules

Evidence:

- Regulations on website (access on 23.06.2016):
  - http://www.fib.upc.edu/en/tramits.html
- Admission requirements (access on 23.06.2016):
  - https://www.upc.edu/learning/courses/Bachelors-degrees/access-and-admission
  - https://www.upc.edu/learning/courses/masters-degrees/innovation-and-research-in-informatics-miri
  - https://www.upc.edu/learning/courses/masters-degrees/informatics-engineering
- Academic regulations for Bachelor's degrees at the UPC (access on 23.06.2016):
  - https://www.upc.edu/sga/ca/normatives/normatives-academiques-de-la-upc/fitxers-normatives-academiques-de-la-upc/naeg/naeg_2014-2015_en
- Academic regulations for Master thesis (access on 23.06.2016):
  - http://www.fib.upc.edu/en/masters/mai/TFM/mainColumnParagraphs/03/document/MAI_TFM_ACADEMIC%20RULES.pdf
- Exemplary course documentation, exams, final thesis

Preliminary assessment and analysis of the peers:

The panel acknowledged that all rules and regulations governing a student's life-cycle, i.e. admission, progression and graduation, are available on the university and the school website in Catalan or/and English.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

5.2

The peers assessed the provided Diploma Supplement which does not fully comply with European standards. The Diploma Supplement should contain in the section "programme requirements" (4.2) information about the competence profile of the graduates/programmes in terms of learning outcomes (as recommended by the European model). The peers learned that the Diploma Supplement for new EHEA degree programmes, which include the competence profiles, will be provided next academic year in Spain. They positively acknowledged that FIB provides students with a specific certificate

to highlight the social/generic competences in the meantime. However, the school has to ensure that the Diploma Supplement for each degree programme contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model). The Diploma Supplements must be handed out to the students of all programmes.

The panel considered this criterion to be partly fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Information about quality assurance on website (access on 23.06.2016):
  - http://www.fib.upc.edu/en/centre/qualitat.html
  - http://www.fib.upc.edu/fib/centre/govern/organs-colegiats/actes.html?actes_de=CP
  - http://www.fib.upc.edu/en/centre/presentacio.html
- Monitoring reports (access on 23.06.2016): https://gpaq.upc.edu/sat/Mostra_informes_genweb.php?codi_unitat=270&tipus_mostrar=seguiment
- Verification reports (access on 23.06.2016): https://gpaq.upc.edu/sat/menu_unitat_genweb.asp?unitat=270
- Stakeholder Survey (access on 23.06.2016): http://www.aqu.cat/doc/doc_69192241_1.pdf
- SAR
- Discussions during onsite visit

Preliminary assessment and analysis of the peers:

The adaptation of the FIB degrees to the EHEA was considered by the school as an opportunity to design and implement an internal Quality Assurance System (QAS). The Quality Assurance System was successfully implemented since, and received a positive global evaluation by AQU Catalunya in June 2009. The panel deemed the QAS to be mature and to incorporate all the relevant processes for the successful programme implementation and development. Two evaluation methods for the Bachelor degrees modules were im-

plemented. Students complete the voluntary online questionnaire at the end of each module; additionally in every course one student is appointed to write two reports on the course quality, the first at the middle of the semester and second at the end of the semester. These results will be discussed in class and lecturers have to possibility to immediately introduce changes if necessary. Master students give formal feedback by completing online questionnaires. The discussion with lecturers, programme coordinators and students also showed that the results of regular module evaluations were effectively analyzed in biannual committee meetings and steps for improvements were taken. Equally, students and employers are represented in the Quality Committee which specifically ensures continuous enhancement of programme quality through the analysis of objective data. The committees responsible for the design of the degree programmes took into account stakeholders' needs by consulting graduates, employers, informatics professional association and technology sponsors. Regularly employer surveys ask for the perceptions of the employability and skills of recent graduates. The peers positively noted that the information gained is made transparent to all stakeholders.

Regarding the drop-out rates in the first year (54.6%) of the Bachelor programme Informatics Engineering the peers encouraged the FIB to take advantage of the implemented quality assurance instruments in order to identify the reasons for the rather high drop-out rates during the first semester courses to implement additional measures if necessary (see criterion 2.2).

In addition to the formal and systematic quality assurance mechanisms, the panel commended that the close relation between students and teachers contributed to an atmosphere of confidence.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

The peers thanked the school for the additional information. Based on the recently presented drop-out figures which show a clearly decreasing trend and the further explanations they are convinced that the school is effectively monitoring the drop-out rates and implementing measures in order to reduce them.

The panel considered criterion 6 to be fulfilled.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

1. Diploma Supplement for each study program
2. Teaching load table

E Comment of the Higher Education Institution (29.07.2016)

The institution provided a detailed statement as well as the following additional documents:

1. Diploma Supplement for each study program
2. Teaching load table

F Summary: Peer recommendations (12.08.2016)

Taking into account the additional information and the comments given by UPC the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Engineering Informatics	ASIIN	Euro-Inf	30.09.2021
Ma Engineering Informatics	ASIIN	Euro-Inf	30.09.2021
Ma Innovation and Research in Informatics	ASIIN	Euro-Inf	30.09.2021

Requirements

For all degree programmes

A 1. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model). Ensure that the Diploma Supplement is handed out to the student.

Recommendations

For all degree programmes

E 1. (ASIIN 4.1, 4.3) It is recommended to increase the financial resources for teaching staff to ensure the implementation of the study programmes.

For the Master programmes

E 2. (ASIIN 1.3) It is recommended to strengthen the contents of theoretical informatics.

E 3. (ASIIN 1.3, 2.1) It is highly recommended to allow further freedom of choice by offering more elective courses to permit students to set an individual focus on their studies. Additionally, students should be better informed about the existing options.

G Comment of the Technical Committee – 04 Computer Sciences/Informatics (07.09.2016)

Assessment and analysis for the award of the ASIIN seal:

The technical committee discusses the missing impartation of fundamental knowledge and competencies in theoretical informatics especially formal languages and automata in the early stage of the curriculum of the Bachelor's programme Informatics Engineering. As mentioned in the peer's report the national regulations set by the National Ministry of Science and Innovation for Informatics programs were historically stipulated by the ACM standards, which do not include knowledge in theoretical informatics for all graduates, but only for those of the specialization/area Computing. Therefore, the national Spanish learning outcomes and corresponding curricula with their fixed five specializations for the Bachelor degree in Informatics do not include knowledge in theoretical informatics for graduates from all five specialization but from the specialization Computing. Accordingly, the FIB addresses theoretical informatics in detail only in their offered specialization Computing. This is a clear divergence from the ASIIN Subject-Specific Criteria for Computer Science as they require all graduates from undergraduate computer science degrees to gain fundamental knowledge and competencies in theoretical informatics which is considered one of the core subjects of the discipline. However, the technical committee accepts this deviation from the ASIIN Subject Specific Criteria as the necessary knowledge and competencies in theoretical informatics form part of the learning outcomes and the curriculum of the specialization *Computing*.

Nevertheless as the ASIIN Subject-Specific Criteria require certain knowledge in theoretical informatics for all graduates and the ACM standards for graduates of the specializations Computer Engineering and Software Engineering the technical committee suggests adding a corresponding recommendation (see below recommendation E2). In particular, in view of the fact that concepts of theoretical informatics are considered as fundamental knowledge in order to understand the field of Computer Science.

Assessment and analysis for the award of the Euro-Inf® Label:

The Technical Committee deems that the intended learning outcomes of the degree programmes comply with the Subject-Specific Criteria of the Technical Committee 04 - Informatics.

The 04 - Informatics recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Engineering Informatics	ASIIN	Euro-Inf	30.09.2021
Ma Engineering Informatics	ASIIN	Euro-Inf	30.09.2021
Ma Innovation and Research in Informatics	ASIIN	Euro-Inf	30.09.2021

Requirements

For all degree programmes

A 1. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model). Ensure that the Diploma Supplement is handed out to the student.

Recommendations

For all degree programmes

E 1. (ASIIN 4.1, 4.3) It is recommended to increase the financial resources for teaching staff to ensure the implementation of the study programmes.

For the Bachelor programme

E 2. (ASIIN 1.3) It is recommended that knowledge of the theoretical principles of Computer Science is part of the education in the early stage of the curriculum, irrespective of the chosen specialization.

For the Master programmes

E 3. (ASIIN 1.3) It is recommended to strengthen the contents of theoretical informatics.

E 4. (ASIIN 1.3, 2.1) It is highly recommended to allow further freedom of choice by offering more elective courses to permit students to set an individual focus on their studies. Additionally, students should be better informed about the existing options.

H Decision of the Accreditation Commission (30.09.2016)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The accreditation commission discusses the procedure regarding the divergence from the ASIIN Subject Specific Criteria of the Bachelor's degree programme Engineering Informatics. The accreditation commission follows in all aspects the judgment of the technical committee 04 - Informatics/Computer Science. In this particular case, the missing impartation of fundamental knowledge and competencies in theoretical informatics especially formal languages and automata in the specializations Computer Engineering, Software Engineering, Information Systems and Information Technology are acceptable as the respective learning outcomes in general match with the curricula content of each specialization.

Nevertheless the accreditation commission recommends (see below E2) to include certain knowledge in theoretical informatics for all graduates irrespective of the chosen specialization as the ASIIN Subject-Specific Criteria and the ACM standards for graduates of the specializations Computer Engineering and Software Engineering require these.

Assessment and analysis for the award of the Euro-Inf® Label:

The Accreditation Commission deems that the intended learning outcomes of the degree programmes overall comply with the Subject-Specific Criteria of the Technical Committee 04 - Informatics.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	**ASIIN-seal**	**Subject-specific label**	**Maximum duration of accreditaiton**
Ba Engineering Informatics	with requirements for one year	Euro-Inf	30.09.2021
Ma Engineering Informatics	with requirements for one year	Euro-Inf	30.09.2021
Ma Innovation and Research in Informatics	with requirements for one year	Euro-Inf	30.09.2021

Requirements

For all degree programmes

A 1. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model). Ensure that the Diploma Supplement is handed out to the student.

Recommendations

For all degree programmes

E 1. (ASIIN 4.1, 4.3) It is recommended to increase the financial resources for teaching staff to ensure the implementation of the degree programmes.

For the Bachelor programme

E 2. (ASIIN 1.3) It is recommended that knowledge of the theoretical principles of Computer Science is part of the education in the early stage of the curriculum, irrespectively of the chosen specialization.

For the Master programmes

E 3. (ASIIN 1.3) It is recommended to strengthen the contents of theoretical informatics.

E 4. (ASIIN 1.3, 2.1) It is highly recommended to allow further freedom of choice by offering more elective courses to permit students to set an individual focus on their studies. Additionally, students should be better informed about the existing options.

I Fulfilment of Requirements

Comments of the peers and the Technical Committee (20.09.2017)

Requirement

For all degree programmes

A 1. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model). Ensure that the Diploma Supplement is handed out to the student.

Initial Treatment	
Peers	fulfilled Justification: the Diploma Supplement contains information about the competence profile of the programme in terms of learning outcomes (as recommended by the European model) and the Diploma Supplement is handed out to the student. Vote: Unanimous
TC 04	fulfilled Vote: unanimous Justification: The TC agrees with the assessment oft he peers.

Decision of the Accreditation Committee (31.03.2017)

Assessment: The Accreditation Committee follows the recommendations given by the peers and the Technical Committees and considers the requirement 1 to be fulfilled.

The Accreditation Committee decides to award the label as follows:

Degree programme	**ASIIN-label**	**Subject-specific label**	**Accreditation until max.**
Ba Engineering Informatics	All requirements fulfilled	Euro-Inf®	30.09.2021
Ma Engineering Informatics	All requirements fulfilled	Euro-Inf®	30.09.2021
Ma Innovation and Research in Informatics	All requirements fulfilled	Euro-Inf®	30.09.2021

Appendix: Programme Learning Outcomes and Curricula

According to the website of the Barcelona School of Informatics (FIB) of the Technical University of Catalonia the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Informatics Engineering:

Generic or Transversal Competences

G1 To know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

G2 To know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

G3 To know the English language in a correct oral and written level, and accordingly to the needs of the graduates in Informatics Engineering. Capacity to work in a multidisciplinary group and in a multi-language environment and to communicate, orally and in a written way, knowledge, procedures, results and ideas related to the technical informatics engineer profession.

G4 To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G5 To be capable to work as a team member, being just one more member or performing management tasks, with the finality of contributing to develop projects in a pragmatic way and with responsibility sense; to assume compromises taking into account the available resources.

G6 To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.

G7 To detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

G8 To have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

G9 Capacity of critical, logical and mathematical reasoning. Capacity to solve problems in her study area. Abstraction capacity: capacity to create and use models that reflect real situations. Capacity to design and perform simple experiments and analyse and interpret its results. Analysis, synthesis and evaluation capacity.

Common Technical Competences

CT1 To demonstrate knowledge and comprehension of essential facts, concepts, principles and theories related to informatics and their disciplines of reference.

CT2 To use properly theories, procedures and tools in the professional development of the informatics engineering in all its fields (specification, design, implementation, deployment and products evaluation) demonstrating the comprehension of the adopted compromises in the design decisions.

CT3 To demonstrate knowledge and comprehension of the organizational, economic and legal context where her work is developed (proper knowledge about the company concept, the institutional and legal framework of the company and its organization and management)

CT4 To demonstrate knowledge and capacity to apply the basic algorithmic procedures of the computer science technologies to design solutions for problems, analysing the suitability and complexity of the algorithms.

CT5 To analyse, design, build and maintain applications in a robust, secure and efficient way, choosing the most adequate paradigm and programming languages.

CT6 To demonstrate knowledge and comprehension about the internal operation of a computer and about the operation of communications between computers.

CT7 To evaluate and select hardware and software production platforms for executing applications and computer services.

CT8 To plan, conceive, deploy and manage computer projects, services and systems in every field, to lead the start-up, the continuous improvement and to value the economical and social impact.

Technical Competences of each Specialization

COMPUTER SCIENCE SPECIALIZATION

CCO1 To have an in-depth knowledge about the fundamental principles and computations models and be able to apply them to interpret, select, value, model and create new concepts, theories, uses and technological developments, related to informatics.

CCO2 To develop effectively and efficiently the adequate algorithms and software to solve complex computation problems.

CCO3 To develop computer solutions that, taking into account the execution environment and the computer architecture where they are executed, achieve the best performance.

COMPUTER ENGINEERING SPECIALIZATION

CEC1 To design and build digital systems, including computers, systems based on microprocessors and communications systems.

CEC2 To analyse and evaluate computer architectures including parallel and distributed platforms, and develop and optimize software for these platforms.

CEC3 To develop and analyse hardware and software for embedded and/or very low consumption systems.

CEC4 To design, deploy, administrate and manage computer networks, and manage the guarantee and security of computer systems.

SOFTWARE ENGINEERING SPECIALIZATION

CES1 To develop, maintain and evaluate software services and systems which satisfy all user requirements, which behave reliably and efficiently, with a reasonable development and maintenance and which satisfy the rules for quality applying the theo-

ries, principles, methods and practices of Software Engineering.

CES2 To value the client needs and specify the software requirements to satisfy these needs, reconciling conflictive objectives through searching acceptable compromises, taking into account the limitations related to the cost, time, already developed systems and organizations.

CES3 To identify and analyse problems; design, develop, implement, verify and document software solutions having an adequate knowledge about the current theories, models and techniques.

INFORMATION SYSTEMS SPECIALIZATION

CSI1 To demonstrate comprehension and apply the principles and practices of the organization, in a way that they could link the technical and management communities of an organization, and participate actively in the user training.

CSI2 To integrate solutions of Information and Communication Technologies, and business processes to satisfy the information needs of the organizations, allowing them to achieve their objectives effectively.

CSI3 To determine the requirements of the information and communication systems of an organization, taking into account the aspects of security and compliance of the current normative and legislation.

CSI4 To participate actively in the specification, design, implementation and maintenance of the information and communication systems.

INFORMATION TECHNOLOGY SPECIALIZATION

CTI1 To define, plan and manage the installation of the ICT infrastructure of the organization.

CTI2 To guarantee that the ICT systems of an organization operate adequately, are secure and adequately installed, documented, personalized, maintained, updated and substituted, and the people of the organization receive a correct ICT support.

CTI3 To design solutions which integrate hardware, software and communication technologies (and capacity to develop specific solutions of systems software) for distributed systems and ubiquitous computation devices.

CTI4	To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.	

The following **curriculum** is presented:

Compulsory

Full name	**Open 2016-2017**	**Teaching Language**
F - Physics	Q1, Q2	Catalan
FM - Mathematical Foundations	Q1, Q2	Catalan Spanish
IC - Introduction to Computers	Q1, Q2	Catalan Spanish
PRO1 - Programming 1	Q1, Q2	English(Q1) Catalan Spanish
EC - Computer Organization	Q1, Q2	Catalan
M1 - Mathematics 1	Q1, Q2	English(Q2) Catalan Spanish
M2 - Mathematics 2	Q1, Q2	English(Q2) Catalan Spanish
PRO2 - Programming 2	Q1, Q2	Catalan Spanish
BD - Databases	Q1, Q2	Catalan
CI - Computer Interfacing	Q1, Q2	Catalan Spanish
EDA - Data structures and algorithms	Q1, Q2	English Catalan
PE - Probability and Statistics	Q1, Q2	Catalan Spanish
SO - Operating Systems	Q1, Q2	English(Q1) Catalan Spanish
AC - Computer Architecture	Q1, Q2	Catalan Spanish
EEE - Business and Economic Environment	Q1, Q2	Catalan Spanish
IES - Introduction to Software Engineering	Q1, Q2	Catalan
PROP - Programming Projects	Q1, Q2	Catalan Spanish
XC - Computer Networks	Q1, Q2	English Catalan

Full name	**Open 2016-2017**	**Teaching Language**
IDI - Interaction and Interface Design	Q1, Q2	Catalan Spanish
PAR - Parallelism	Q1, Q2	English(Q1) Catalan

Specialization subjects

Full name	**Type**	**Open 2016-2017**	**Teaching Language**
Computing			
A - Algorithmics	Compulsory	Q1, Q2	Catalan Spanish
G - Graphics	Compulsory	Q1, Q2	Catalan Spanish
IA - Artificial Intelligence	Compulsory	Q1, Q2	Catalan Spanish
LI - Logic in Information Technology	Compulsory	Q1, Q2	Catalan Spanish
LP - Programming Languages	Compulsory	Q1, Q2	Catalan
TC - Theory of Computation	Compulsory	Q1, Q2	Catalan Spanish
AA - Advanced Algorithmics	Complement	Q2	Catalan
APA - Machine Learning	Complement	Q1	Catalan
CAIM - Searching and Analysis of Massive Information	Complement	Q1	Catalan Spanish
CL - Compilers	Complement	Q2	Catalan
CN - Numerical Computation	Complement	Q2	Catalan
IO - Operations Research	Complement	Q1	Catalan Spanish

Full name	Type	Open 2016-2017	Teaching Language
SID - Distributed Intelligent Systems	Complement	Q2	Spanish
Computer Engineering			
AC2 - Computer Architecture II	Compulsory	Q1, Q2	Catalan Spanish
DSBM - Design of Microcomputer-Based Systems	Compulsory	Q1, Q2	Catalan
MP - Multiprocessors	Compulsory	Q1, Q2	Spanish
PEC - Computer Engineering Project	Compulsory	Q1, Q2	Catalan
SO2 - Operating Systems II	Compulsory	Q1, Q2	Catalan Spanish
XC2 - Computer Networks II	Compulsory	Q1, Q2	Spanish
CASO - Advanced Concepts on Operating Systems	Complement	Q1, Q2	Catalan Spanish
CPD - Data-Processing Centers	Complement	Q1, Q2	Catalan
PAP - Programming and Parallel Architectures	Complement	Q2	Catalan Spanish
PCA - Awareness of Architecture in Programming	Complement	Q2	Catalan Spanish
PDS - Digital Signal Processing	Complement	Q1	Catalan
STR - Real-Time Systems	Complement	Q2	Catalan
VLSI - VLSI	Complement	Q1	Catalan
Software Engineering			
AS - Software Architecture	Compulsory	Q1, Q2	Catalan
ASW - Web Services and Applications	Compulsory	Q1, Q2	Catalan

Full name	Type	Open 2016-2017	Teaching Language
DBD - Database Design	Compulsory	Q1, Q2	Catalan
ER - Requirements Engineering	Compulsory	Q1, Q2	Catalan
GPS - Software Project Management	Compulsory	Q1, Q2	Catalan
PES - Software Engineering Project	Compulsory	Q1, Q2	Catalan
CAP - Advanced Programming Concepts	Complement	Q1	Catalan
CBDE - Concepts for Specialized Databases	Complement	Q1, Q2	Catalan
CSI - Information Systems Concepts	Complement	Q1	Spanish
ECSDI - Knowledge Engineering and Intelligent Distributed Systems	Complement	Q2	Catalan
SIM - Simulation	Complement	Q2	Catalan
SOAD - Operating Systems for Distributed Applications	Complement	Q1	Catalan Spanish
Information Systems			
ADEI - Data Analysis and Information Exploitation	Compulsory	Q1, Q2	Catalan Spanish
DSI - Diseño de Sistemas de Información	Compulsory	Q1, Q2	Catalan
ER - Requirements Engineering	Compulsory	Q1, Q2	Catalan
NE - E-Business	Compulsory	Q1, Q2	Catalan Spanish
PSI - Information Systems Project	Compulsory	Q1, Q2	Catalan
SIO - Information Systems for Organizations	Compulsory	Q1, Q2	Catalan
ABD - Database Administration	Complement	Q2	Catalan
CAIM - Searching and Analysis of Massive	Complement	Q1	Catalan

Full name	Type	Open 2016-2017	Teaching Language
Information			Spanish
EDO - Digital Strategy on Organizations	Complement	Q1	Spanish
IO - Operations Research	Complement	Q1	Catalan Spanish
MI - Marketing on Internet	Complement	Q1, Q2	Catalan Spanish
VPE - VIABILITY OF BUSINESS PROJECTS	Complement	Q1, Q2	Catalan Spanish
Information Technologies			
ASO - Operating Systems Administration	Compulsory	Q1, Q2	Catalan Spanish
PI - Internet Protocols	Compulsory	Q1, Q2	Catalan Spanish
PTI - Information Technologies Project	Compulsory	Q1, Q2	Catalan Spanish
SI - Security in Information Technology	Compulsory	Q1, Q2	Catalan Spanish
SOA - Advanced Operating Systems	Compulsory	Q1, Q2	Catalan Spanish
TXC - Computer Networks Technologies	Compulsory	Q1, Q2	Catalan Spanish
AD - Distributed Applications	Complement	Q1	Catalan Spanish
CASO - Advanced Concepts on Operating Systems	Complement	Q1, Q2	Catalan Spanish

Full name	Type	Open 2016-2017	Teaching Language
CPD - Data-Processing Centers	Complement	Q1, Q2	Catalan
IM - Mobile Internet	Complement	Q2	Catalan Spanish
SDX - Distributed Network Systems	Complement	Q2	Catalan Spanish
TCI - Information Transmission and Encoding	Complement	Q1	Catalan Spanish

According to the website of the Barcelona School of Informatics (FIB) of the Technical University of Catalonia the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Informatics Engineering:

Generic or Transversal Competences

CTR1 Capacity for knowing and understanding a business organization and the science that rules its activity, capability to understand the labor rules and the relationships between planning, industrial and commercial strategies, quality and profit. Capacity for developping creativity, entrepreneurship and innovation trend.

CTR2 Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.

CTR3 Capacity of being able to work as a team member, either as a regular member or performing directive activities, in order to help the development of projects in a pragmatic manner and with sense of responsibility; capability to take into account the available resources.

CTR4 Capability to manage the acquisition, structuring, analysis and visualization of data and information in the area of informatics engineering, and critically assess the results of this effort.

CTR5 Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

CTR6 Capacity for critical, logical and mathematical reasoning. Capability to solve problems in their area of study. Capacity for abstraction: the capability to create and use models that reflect real situations. Capability to design and implement simple ex-

periments, and analyze and interpret their results. Capacity for analysis, synthesis and evaluation.

CB6 Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

CB7 Ability to integrate knowledg and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB8 Capability to communicate their conclusions, and the knowledge and rationale underpinning these, to both skilled and unskilled public in a clear and unambiguous way.

CB9 Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

Generic Technical Competences

CG1 Capability to plan, calculate and design products, processes and facilities in all areas of Computer Science.

CG2 Capacity for management of products and installations of computer systems, complying with current legislation and ensuring the quality of service.

CG3 Capability to lead, plan and supervise multidisciplinary teams.

CG4 Capacity for mathematical modeling, calculation and simulation in technology and engineering companies centers, particularly in research, development and innovation tasks in all areas related to Informatics Engineering.

CG5 Capacity for the development, strategic planning, leadership, coordination and technical and financial management of projects in all areas of Informatics Engineering, keeping up with quality and environmental criteria.

CG6 Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.

CG7 Capacity for implementation, direction and management of computer manufactur-

ing processes, with guarantee of safety for people and assets, the final quality of the products and their homologation.

CG8 Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.

CG9 Capacity to understand and apply ethical responsibility, law and professional deontology of the activity of the Informatics Engineering profession.

CG10 Capacity to apply economics, human resources and projects management principles, as well as legislation, regulation and standardization of Informatics.

Technical Competences of each Specialization

CDG1 Capability to integrate technologies, applications, services and systems of Informatics Engineering, in general and in broader and multicisciplinary contexts.

CDG2 Capacity for strategic planning, development, direction, coordination, and technical and economic management in the areas of Informatics Engineering related to: systems, applications, services, networks, infrastructure or computer facilities and software development centers or factories, respecting the implementation of quality and environmental criteria in multidisciplinary working environments .

CDG3 Capability to manage research, development and innovation projects in companies and technology centers, guaranteeing the safety of people and assets, the final quality of products and their homologation.

ESPECIFICS

CTE1 Capability to model, design, define the architecture, implement, manage, operate, administrate and maintain applications, networks, systems, services and computer contents.

CTE2 Capability to understand and know how to apply the operation and organization of Internet, technologies and protocols for next generation networks, component models, middleware and services.

CTE3 Capability to secure, manage, audit and certify the quality of developments, processes, systems, services, applications and software products.

CTE4 Capability to design, develop, manage and evaluate mechanisms of certification

	and safety guarantee in the management and access to information in a local or distributed processing.
CTE5	Capability to analyze the information needs that arise in an environment and carry out all the stages in the process of building an information system.
CTE6	Capability to design and evaluate operating systems and servers, and applications and systems based on distributed computing.
CTE7	Capability to understand and to apply advanced knowledge of high performance computing and numerical or computational methods to engineering problems.
CTE8	Capability to design and develop systems, applications and services in embedded and ubiquitous systems .
CTE9	Capability to apply mathematical, statistical and artificial intelligence methods to model, design and develop applications, services, intelligent systems and knowledge-based systems.
CTE10	Capability to use and develop methodologies, methods, techniques, special-purpose programs, rules and standards for computer graphics.
CTE11	Capability to conceptualize, design, develop and evaluate human-computer interaction of products, systems, applications and informatic services.
CTE12	Capability to create and exploit virtual environments, and to the create, manageme and distribute of multimedia content.

The following **curriculum** is presented:

Curriculum

The master's degree is divided into two modules: **Direction and Management and Information Technologies**. Click on the course unit details below for more information.

These courses are not taught every semester. Check FIB website for course availability.

Direction and Management Module (12 ECTS)

Mandatory | Elective

- Viability of innovative Business Projects (4.5 ECTS) — Mandatory
- Strategic Planning & IT Governance (4.5 ECTS) — Mandatory
- Financing for Innovative Business Projects (1.5 ECTS) — Elective
- Embodying the know-how into the Decision Process (1.5 ECTS) — Elective
- The EFQM Excellence Model & Management of Quality (1.5 ECTS) — Elective
- Sustainability, Economics & Social Commitment (1.5 ECTS) — Elective

Information Technologies Module (48 ECTS)

- High Performance Computer Architecture (6 ECTS) — Mandatory
- Development & Managment of Information Systemes (6 ECTS) — Mandatory
- Internet, Security & Multimedia Contents Distribution (6 ECTS) — Mandatory
- Computing & Intelligent Systems (6 ECTS) — Mandatory
- Embedded & Ubiquous Systems (6 ECTS) — Mandatory
- Interactive Graphic Systems (6 ECTS) — Mandatory
- Digital Identity (3 ECTS) — Elective
- Realistic Animation of Articulated Bodies (3 ECTS) — Elective
- Interface & Accesibility (3 ECTS) — Elective
- Internet of Things (3 ECTS) — Elective
- Cloud Computing (3 ECTS) — Elective
- Computer Games (3 ECTS) — Elective
- Programming of Cell Phones & Mobile Autonomous Devices (3 ECTS) — Elective
- Development of Software for Geographic & Spatial Information (3 ECTS) — Elective
- Business Integration of Information Systems (3 ECTS) — Elective
- Data Mining Techniques (3 ECTS) — Elective
- Techniques & Tools for Bioinformatics (3 ECTS) — Elective
- Informatic Technologies for Automation (3 ECTS) — Elective
- Final Master Thesis (30 ECTS)

According to the website of the Barcelona School of Informatics (FIB) of the Technical University of Catalonia the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme in Innovation and Research in Informatics:

Generic or Transversal Competences

CTR1 Capacity for knowing and understanding a business organization and the science that rules its activity, capability to understand the labour rules and the relationships between planning, industrial and commercial strategies, quality and profit. Capacity for developping creativity, entrepreneurship and innovation trend.

CTR2 Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.

CTR3 Capacity of being able to work as a team member, either as a regular member or performing directive activities, in order to help the development of projects in a pragmatic manner and with sense of responsibility; capability to take into account the available resources.

CTR4 Capability to manage the acquisition, structuring, analysis and visualization of data and information in the area of informatics engineering, and critically assess the results of this effort.

CTR5 Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

CTR6 Capacity for critical, logical and mathematical reasoning. Capability to solve problems in their area of study. Capacity for abstraction: the capability to create and use models that reflect real situations. Capability to design and implement simple experiments, and analyze and interpret their results. Capacity for analysis, synthesis and evaluation.

CB6 Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their

area of study.

CB7 Ability to integrate knowledge and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB8 Capability to communicate their conclusions, and the knowledge and rationale underpinning these, to both skilled and unskilled public in a clear and unambiguous way.

CB9 Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

Generic Technical Competences

CG1 Capability to apply the scientific method to study and analyse of phenomena and systems in any area of Computer Science, and in the conception, design and implementation of innovative and original solutions.

CG2 Capability to lead, plan and supervise multidisciplinary teams.

CG3 Capacity for mathematical modeling, calculation and experimental designing in technology and companies engineering centers, particularly in research and innovation in all areas of Computer Science.

CG4 Capacity for general and technical management of research, development and innovation projects, in companies and technology centers in the field of Informatics Engineering.

CG5 Capability to apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments.

Technical Competences of each Specialization

COMPUTER GRAPHICS AND VIRTUAL REALITY

CEE1.1 Capability to understand and know how to apply current and future technologies for the design and evaluation of interactive graphic applications in three dimensions, either when priorizing image quality or when priorizing interactivity and speed, and to understand the associated commitments and the reasons that cause them.

CEE1.2 Capability to understand and know how to apply current and future technologies for the evaluation, implementation and operation of virtual and / or increased reality environments, and 3D user interfaces based on devices for natural interaction.

CEE1.3 Ability to integrate the technologies mentioned in CEE1.2 and CEE1.1 skills with other digital processing information technologies to build new applications as well as make significant contributions in multidisciplinary teams using computer graphics.

COMPUTER NETWORKS AND DISTRIBUTED SYSTEMS

CEE2.1 Capability to understand models, problems and algorithms related to distributed systems, and to design and evaluate algorithms and systems that process the distribution problems and provide distributed services.

CEE2.2 Capability to understand models, problems and algorithms related to computer networks and to design and evaluate algorithms, protocols and systems that process the complexity of computer communications networks.

CEE2.3 Capability to understand models, problems and mathematical tools to analyze, design and evaluate computer networks and distributed systems.

ADVANCED COMPUTING

CEE3.1 Capability to identify computational barriers and to analyze the complexity of computational problems in different areas of science and technology as well as to represent high complexity problems in mathematical structures which can be treated effectively with algorithmic schemes.

CEE3.2 Capability to use a wide and varied spectrum of algorithmic resources to solve high difficulty algorithmic problems.

CEE3.3 Capability to understand the computational requirements of problems from non-informatics disciplines and to make significant contributions in multidisciplinary teams that use computing.

HIGH PERFORMANCE COMPUTING

CEE4.1 Capability to analyze, evaluate and design computers and to propose new techniques for improvement in its architecture.

CEE4.2 Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

CEE4.3 Capability to analyze, evaluate, design and manage system software in supercomputing environments.

SERVICE ENGINEERING

CEE5.1 Capability to participate in improvement projects or to create service systems, providing in particular: a) innovation and research proposals based on new uses and developments of information technologies, b) application of the most appropriate software engineering and databases principles when developing information systems, c) definition, installation and management of infrastructure / platform necessary for the efficient running of service systems.

CEE5.2 Capability to apply obtained knowledge in any kind of service systems, being familiar with some of them, and thorough knowledge of eCommerce systems and their extensions (eBusiness, eOrganization, eGovernment, etc.).

CEE5.3 Capability to work in interdisciplinary engineering services teams and, provided the necessary domain experience, capability to work autonomously in specific service systems.

SPECIFIC

CEC1 Ability to apply scientific methodologies in the study and analysis of phenomena and systems in any field of Information Technology as well as in the conception, design and implementation of innovative and original computing solutions.

CEC2 Capacity for mathematical modelling, calculation and experimental design in engineering technology centres and business, particularly in research and innovation in

all areas of Computer Science.

CEC3 Ability to apply innovative solutions and make progress in the knowledge that exploit the new paradigms of Informatics, particularly in distributed environments.

The following **curriculum** is presented:

Compulsory

Acronym	Full name	Open 2016-2017
AMMM	Algorithmic Methods for Mathematical Models	Q1, Q2
CPDS	Concurrence, Parallelism and Distributed Systems	Q1, Q2
SIRI	Seminars of Innovation and Research in Informatics	
SMDE	Statistical Modeling and Design of Experiments	Q1, Q2
TMIRI	Techniques and Methodology of Innovation and Research in Informatics	Q1, Q2

Specialization subjects

Acronym	Full name	Type	Open 2016-2017
Advanced Computing			
ADS	Advanced Data Structures	Specialization Compulsory	Q2
CC	Computational Complexity	Specialization Compulsory	Q2
CPS	Combinatorial Problem Solving	Specialization Compulsory	Q2
RA	Randomized Algorithms	Specialization Compulsory	Q1
ADM	Algorithmics for Data Mining	Specialization	Q2

Acronym	Full name	Type	Open 2016-2017
		Complement	
AGT	Algorithmic Game Theory	Specialization Complement	Q1
AVLSI	Algorithms for VLSI	Specialization Complement	Q1
CSN	Complex and Social Networks	Specialization Complement	Q1
Computer Graphics and Virtual Reality			
AM	Advanced Modeling	Specialization Compulsory	Q2
FRR	Fast Realistic Rendering	Specialization Compulsory	Q1
GTCG	Geometric Tools for Computer Graphics	Specialization Compulsory	Q1
VAR	Virtual and Augmented Reality	Specialization Compulsory	Q1
EA	Elements of Animation	Specialization Complement	Q1
GP	Geometric Processing	Specialization Complement	Q1
RRMM	Real-time Rendering of Massive Models	Specialization Complement	Q2
VV	Volume Visualization	Specialization Complement	Q1
Computer Networks and Distributed Systems			
CN	Computer Networks	Specialization	Q1

Acronym	Full name	Type	Open 2016-2017
		Compulsory	
INM	Introduction to Network Modeling	Specialization Compulsory	Q1
MGTN	Mechanisms and Game Theory in Networks	Specialization Compulsory	Q2
SNM	Stochastic Network Modeling	Specialization Compulsory	Q1
CLC	Cloud Computing	Specialization Complement	Q2
DS	Decentralized Systems	Specialization Complement	Q2
FINE	Future Internet Networks	Specialization Complement	Q1
IAS	Internet Applications and Security	Specialization Complement	Q1
Data Mining and Business Intelligence			
DAKD	Data Analysis and Knowledge Discovery	Specialization Compulsory	Q1
DW	Data Warehousing	Specialization Compulsory	Q1
ML	Machine Learning	Specialization Compulsory	Q2
MVA	Multivariate Analysis	Specialization Compulsory	Q2
OD	Open Data	Specialization Compulsory	Q2

Acronym	Full name	Type	Open 2016-2017
ADM	Algorithmics for Data Mining	Specialization Complement	Q2
ANLP	Advanced Natural Language Processing	Specialization Complement	Q2
ASM	Advanced Statistical Modeling	Specialization Complement	Q1
BSG	Bioinformatics and Statistical Genetics	Specialization Complement	Q1
IR	Information Retrieval	Specialization Complement	Q1
KMLMM	Kernel based Machine Learning and Multivariate Modeling	Specialization Complement	Q1
OTDM	Optimization Techniques for Data Mining	Specialization Complement	Q1
SNLP	Statistical Natural Language Processing	Specialization Complement	Q1
*SOBI	Service Oriented Business Intelligence	Specialization Complement	Q1
High Performance Computing			
MA	Multiprocessors Architecture	Specialization Compulsory	Q2
OS	Operating Systems	Specialization Compulsory	Q1
PA	Processor Architecture	Specialization Compulsory	Q1
APA	Advanced Processor Architecture	Specialization	Q2

Acronym	Full name	Type	Open 2016-2017
		Complement	
CHPC	Compilers for High Performance Computers	Specialization Complement	Q1
NCD	Nanoelectronic Circuit Design	Specialization Complement	Q2
PD	Processor Design	Specialization Complement	Q1
PPTM	Parallel Programming Tools & Models	Specialization Complement	Q2
SA	Supercomputers Architecture	Specialization Complement	Q1
SCA	Supercomputing for Challenging Applications	Specialization Complement	Q1
Service Engineering			
BIP	BI Project	Elective	Q1
SEAIT	SOCIAL AND ENVIRONMENTAL ASPECTS OF INFORMATION TECHNOLOGY	Elective	Q1
VBP	VIABILITY OF BUSINESS PROJECTS	Elective	Q1
EB	e-Business	Specialization Compulsory	Q2
RES	Requirements Engineering for Services	Specialization Compulsory	Q2
SM	Service Management	Specialization Compulsory	Q1
SOA	Service Oriented Architecture	Specialization Compulsory	Q2

Acronym	Full name	Type	Open 2016-2017
ASE	Advanced Software Engineering	Specialization Complement	Q1
DW	Data Warehousing	Specialization Complement	Q1
*SOBI	Service Oriented Business Intelligence	Specialization Complement	Q1
*WS	Web Services	Specialization Complement	Q1