

# MASTER IN COMPUTER ENGINEERING

## HIGHER TECHNICAL SCHOOL OF COMPUTER ENGINEERING

(ESCUELA TECNICA SUPERIOR –ETS- DE INGENIERÍA INFORMÁTICA)

### PREFACE

Since October 1989, the University of Valladolid has offered studies leading to the practice of computer engineering. From the academic year 2013-14 on, the University of Valladolid will offer a Master in Computer Engineering that provides and completes the profession of computer engineers with adequate training in professional practice and in the research and academic scope, which has been spread and consolidated all over Spain and other reference countries in the EU and the rest of the world.

The development of computing, his impact and penetration in all areas of activity of our society are key elements to understand the socioeconomic advance of the second half of the 20<sup>th</sup> century. In recent years, Computing Engineering not only has fueled scientific and technological development but also all spheres of science, engineering and many other disciplines. It has allowed the interpretation of scientific and social data, contributing to the understanding of the world around us, the living beings, the human beings and the society. Computer engineering holds a relevant position as a scientific and technological field and its own character as a discipline is articulated around investigation, development and innovation, oriented mainly to construct and design systems, solutions and computer services with software and hardware. Its undeniable character of cross-discipline provides it with an added key value, that is, a tool to establish synergy with other fields of scientific and technological activity.

On the one hand, it is the natural continuation of computing engineer graduates and computer systems engineer graduates.

The professional interest in this master is based on the excellent job expectations that graduates have. This title will provide them with the capacity of active involvement in research, development and innovation in the fields of Information technologies, and the adequate qualification to analyze, conceive, develop and direct computer engineering projects in different fields (social and life sciences, engineering, finances, advising, etc.) as well as all kind of services related to the Society of Information and Knowledge. It will professionally prepare graduates for his/their insertion in interdisciplinary equipments oriented to research as well as to exploitation of computing applications.

Relevance and necessity of professionals in this field has been internationally accepted by the European Council and the Council of European Professional Informatics Societies (CEPIS):

- Professional profiles skilled in training and technical knowledge will be highlighted.
- Quality professionals able to develop those products which satisfy clients' expectations.
- Professionals with awareness and knowledge of ethic implications that limit relationships with social and working environment.

- Professionals with responsibility, as a sign of commitment to quality and efficacy in the execution of the profession in general and in the development of products and services in particular.

The Master Degree in Computer Engineering substitutes the second-cycle undergraduate studies in Computer Engineering in the University of Valladolid. Those studies were valid since 1993 and successful according to the point of view of the students and the business group of information technologies. From the students' scope, relevance is measured by the high prices of the registration fees that have been maintained and by the diverse geographical origin of the students. From the business area it has to be stated that the introduction of the engineers in the labor market was complete, 100% shortly after the end of their studies. This extensive experience allows students and companies to get confidence in this master degree.

Another significant element is the interest of companies and research departments in this master's degree. Innovation and development are present in the autonomous region of Castilla y León with a special emphasis on those located in Valladolid. It must be highlighted that many associations, companies and research institutes of Castilla y León have been consulted in the working process of this draft. Many of those entities are involved in numerous research projects and development plans of regional, national and international nature. For that reason, they require highly qualified staff from the Computing School and they stand out that the development of those studies-will allow students to obtain those necessary abilities for it. This demand of specialized professionals in the field of computing engineering with the master level is increasing and one can foresee that it will grow more in the following years.

Moreover, it should be highlighted that this master degree offers an integrating perspective from teachers and research groups, innovation and development which belong to many different departments and knowledge areas with proved experience and trajectory in R+D+I (research-development-innovation).

Students of this Master degree must achieve the following competences throughout the development of subjects and courses.

#### **General competences**

- CG1. Ability to plan, calculate, design products, processes and installations in all fields of computer engineering.
- CG2. Ability for the execution of works and computer system installations according to the regulations, ensuring service quality.
- CG3. Ability for the management, plan and supervision of multidisciplinary equipment.
- CG4. Ability in mathematical modeling, calculus and simulation in technological centers and engineering companies, especially in research tasks, development and innovation in all fields related to computer engineering.
- CG5. Ability for the production, strategic planning, management, coordination and technical and economic management of projects in all areas of computer engineering. Always following the quality and environmental criteria.
- CG6. Ability for the supervision of general, technical and research projects. The development and innovation in the field of computer engineering in companies and technological centers.
- CG7. Ability for the implementation, direction and management of the computer equipment manufacturing processes ensuring security of people and goods, final quality of the products and its official approval.
- CG8. Ability to apply the acquired knowledge and solve problems in new environments or little known and multidisciplinary contexts.
- CG9. Ability to understand and apply ethic responsibility and legislation to the profession of computer engineer.
- CG10. Ability to apply economy principles and management of human resources as well as legislation, regulation and computer standardization.

#### **Specific Competences:**

##### **Direction and Management:**

- CG11. Ability in the technology incorporation, applications, services and systems proper of computer engineering with general nature and in wider and multidisciplinary contexts.
- CG12. Ability for strategic planning, production, direction, coordination and technical and economic management in the fields of computer engineering related to among others systems, applications, services, networks, infrastructures, computer installations and centers or software development factories. Always respecting the adequate fulfillment of quality, environmental and multidisciplinary work environment criteria.

CG13. Ability to supervise research, development and innovation projects in companies and technological centers, ensuring security of people and goods, final quality of the products and its official approval.

**Computer technologies:**

CG14. Ability to model, design, define architecture, introduce, manage, operate and support applications, networks, systems, services and computer contents.

CG15. Ability to understand and implement the working and organization of Internet, the technologies and conventions of new generation networks, models of components, intermediate software and services.

CG16. Ability to ensure, manage, audit and certify quality of the developments, processes, systems, services, applications and computer products.

CG17. Ability to design, develop, manage and evaluate certification mechanisms and security guarantee in the process and access to information in a local or distributed processing system.

CG18. Ability to analyze the information necessities considered in an environment and implement the process of building an information system in all its stages.

CG19. Ability to design and evaluate operative systems and servers, applications and systems based on distributed computing.

CG20. Ability to understand and apply advanced computer knowledge of high performance and numeric or computational methods to engineering problems.

CG21. Ability to design and develop systems, applications and computer services in embedded and ubiquitous systems.

CG22. Ability to apply mathematic, statistical and artificial intelligence methods to model, design and develop applications, services, intelligence systems and knowledge-based systems.

CG23. Ability to use and develop methodologies, methods, techniques, specific use programs, rules and standards of computer graphics.

CG24. Ability to conceptualize, design, develop and evaluate interaction person-computer of products, systems, applications and computer services.

CG25. Ability in the creation and exploitation of virtual environments. As well for the creation, management and distribution of multimedia contents.

**Projects development:**

CG26. Once obtained all credits of the study plan, the students must develop, present and defend an original and individual exercise before a university court. It consists in a computer engineering comprehensive project of a professional nature in which the acquired competences are synthesized.

## **Additional Competences of Direction and Management**

- CAG1. Ability to manage resources and skills and favor technological innovation in an organization.
- CAG2. Ability to know the peculiarities of technological-based companies regarding investment and finance decisions.
- CAG3. Ability to understand the organizational and economical context in which the work will be developed.
- CAG4. Ability in the knowledge of basic financing concepts that allow to judge costs and benefits of projects or alternatives. It can also help in the budgeting and costs control.
- CAG5. Ability to analyze and identify the possibilities of use and benefits that the applications of different computer technologies can provide to business processes.

### **Cross competences:**

- CT1. Control of time management.
- CT2. Ability to work under pressure.
- CT3. Ability to face critical tasks and situations.
- CT4. Control of oral and written expression in the mother language.
- CT5. Knowledge of other languages, especially English.
- CT6. Ability in autonomous work and decision making.
- CT7. Skills associated to group work: cooperation, leadership, listening.
- CT8. Analytic, critical and synthesis abilities.
- CT9. Ability in interpersonal relationships.
- CT10. Ability to adapt to changing conditions. Flexibility. Readiness to change.
- CT11. Creativity
- CT12. Initiative and enterprising spirit.
- CT13. Quality motivation

### *Access requirements and admission criteria*

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Basically the requirements are those presented in the section 4.2 of the University Council Agreement, which establishes recommendations for the university proposal for applications of official degrees in the fields of computer engineering (resolution of the secretary general of Universities June 8<sup>th</sup> 2009).

The access profile is:

- A. Computer engineering graduates, computer systems engineer graduates and all those graduates in computer engineering or in any equivalent qualification verified in the criteria of the section 4.2.1 of the previously mentioned agreement.
- B. Those graduates in any specialization of computer engineering can directly access to any official Master in Computer Engineering. The Master's Academic Commission will establish the complementary formative program for each of those graduates to implement what it is

established in section 5 of the mentioned agreement in terms of the length of the technical engineering training and the master (300 ECTS).

- C. Those graduates who verify the requirements in the previously mentioned section 4.2.2.
- D. Those who fulfill the requirements of section 4.2.3. Once they are admitted and enrolled in the course, they will have to take the complementary training established by the Master's Academic Commission. This training will be personally established to each student once confirmed his/her competences, so that they acquire those determined in Appendix II of the University Agreement Council.

### **Admission board and merit assessment criteria**

Access to the Master will be regulated by UVa regulations for degrees with limited number of students. It will be according to the general selection criteria established by the university. The general criteria of selection for the case in which the number of pre-enrolled exceeds the number of annual places offered is added to that rules and general criteria explained before. The order of preference in the criteria's application of access will be indicated in the Access Profile to the case when the number of solicitudes exceeds the offered places.

The treatment of the student's cases with specific educative necessities derived from disability will be coordinated with the Direction of Area of Social Subjects. Its technicians, in coordination with the Academic Commission of the Master, will evaluate the necessity of possible curricular adaptations, itineraries or alternative studies. The Service offers support to students with disability, study of curricular adaptations, a program of accommodation for disabled students, and a program of structural barriers removal.

### **Support and orientation to students once enrolled**

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The University of Valladolid has defined a procedure of support and orientation for students once enrolled. This procedure is established in two differentiated moments depending on the student to whom it is directed:

1. Support and orientation for first-year registered students.
2. Support and orientation for the rest of students.

As it is a Master's title, we will focus on the section 2. The procedure of support, orientation and tutorial for this kind of qualifications has the following aims:

- \* Supporting and taking students into the learning and development process of the proper competences of his degree.
- \* Allowing students to actively participate in the university life as well as in the approach to the job market to which the elected qualification is oriented.

\*Making students aware of professional outlooks related with his graduation and making easier the access to their career advancement once they have been graduated.

\* Evaluating the balanced evolution in formative programs supporting the decisions-making.

The support procedure, orientations and tutorial are carried out through the following actions:

a) Knowledge and information about the functioning of the University of Valladolid, “Know the UVa”. While this is an action directed to new access students, information is given with a general character allowing any student, independently of the year he is doing, to know deeply the university environment and the opportunities offered.

b) Information Services of activities at the University of Valladolid. “UVa up to the date”. In this epigraph we can find all institutional means of information, services or organisms related. Students can consult these activities through different channels like: media of the university, UVa’s Web, physical information systems of the centers, etc.

c) Guidance Systems and academic and competency tutorials. This system is developed through two coordinated and complementary tutorial models that simplify the evolution of students through the chosen formative program. It will also help in the development of related competences, either specific or transverse, with the aim of simplifying knowledge achievement and competences that will capacitate the student professionally at the end of the formative program. Two kinds of tutorials have been designed for that, one of accompaniment towards the qualification of the student and another of specificity on the subject.

-Guidance Systems of qualifications: this orientation is offered through academic tutors of the qualification. It consists on a transverse figure which goes with and advises the student all through his academic trajectory. Tutors detect when there is an obstacle or difficulty and work together with the rest of tutors to find some concrete solutions. The aim of this model is to simplify the tools to students and the necessary help for them in order to achieve successfully both academic and professional goals. It consists in helping them on their university integration, exploitation of the chosen curricular itinerary and with the academic decisions taken, in particular the ones oriented to the realization of the practices and complementary activities.

-Guidance Systems of the subject: this orientation is made by the teacher in charge of each subject with the enrolled students in the same subject. The aim of this orientation is to plan,

guide, invigorate, look and evaluate the learning process of the student taking into account his profile, his interests, his necessities, his previous knowledge, etc.

The plan of tutorial action, inside the general setting described by the university, will be developed by the center, which is the responsible of the formative program, and of the results achievement by his pupils.

The tutorial, either of one kind or the other, whether the formation has an in-person or a virtual character, will be carried out either in an in-person way or based on the technologies that allow the virtual communication.

#### d) System of complementary academic tutorial

Mentoring Systems by the pupils enrolled in upper years through the program of “Voluntary support among the Uva Students” AVaUVa. This system, already described among those directed to first year students, can be used to support the students with specific difficulties that will need a special support, becoming a useful tool that the general tutor of the qualification can choose to strengthen some solutions to one or more groups of concrete students.

e) Specific professional guidance among the formative program. The formative program carries its useful development as well as an approach to the professional development by the established competences. Therefore, the useful and professional approach must have a place through the practices of approach and knowledge of the professional areas in which the future graduate will have to work at.

-Tutorial system of external practices for students, academic or not, national or international. The practical formation aimed to develop the corresponding established competences in the formative program are made through systems of external and academic practices. This way, the students develop a traced, planned and tutelary program, by external agents. They check if this program is being carried out in the correct way and if the results are the expected ones. In the same way, through continuous relationship with students in practices and between the two tutors, or by the different fixed systems of evaluation, formative problems can be detected and concrete solutions can be found.



-Specific courses of professional orientation that present different professional scenarios and possibilities that our students must take into account when planning their employment future. There are professionals and experts in numerous sectors working in these courses.

f) Generic professional guidance. If the aim of our formative programs is to develop competences which can qualify in an academic and professional way our students, it is logic to consider a series of actions within the guidance system to help the entrance into the job market.

For this, we have designed a number of building actions and services, which can be used by our students as:

-Courses of professional guidance: short length courses that put in contact students with the necessary tools in the job market such as how to write a curriculum, how to face an interview...

-Courses of business foundation: meant to strengthen entrepreneurship through short courses that simplify the necessary tools to put into practice some enterprising ideas.

-Professional information service and guidance of the University of Valladolid: Throughout this service some information about the job market is given to students, as well as the professional opportunities they may access, there is also a direct and personal treatment given and the tools and information the student asks for are provided.

-Job fair of the University of Valladolid: Uva job and FiBest. The University of Valladolid makes an annual job fair that allows contacting students with some enterprises and institutions. As well it develops a number of activities which aim is to improve the knowledge of this by our students and to simplify the access to their first job.

g) Professional guidance and employability support. The University of Valladolid counts with a job center that, beyond the assistance to students, is in charge of giving service to our university graduates. It allows closing the cycle with the support for the quality employability. This way, the following services are provided:

-Tutorial system of the practices of employability for graduated, either with a national or an international character. As well as the practices for the students, they allow the development of professional practices with the aim of simplifying the employability of them. They also count

with the support of the academic tutors and external agents that ensure the proper development of the program of practices described according to the proper competences of the qualification, promoting quality employability.

-Professional orientation and support in the search of a job: Supporting, orienting and informing service for those graduated which are searching a job, either by himself or with some help, through the personalized services and the tools of information about offers, tools for the search of a job, etc.

The Higher Technical School of Computer Engineering counts with administrative staff and competent services with experience. It also has its own system of web information and quality that provide services of support and orientation to students when carrying out their habitual activities in the Centre (use and access to the lab resources, regulations, processing procedures, etc.).

## 5. LESSON PLAN

### **COMPLEMENTARY TRAINING**

It is composed of lessons of subjects from the Grade in Computer Engineer of the University of Valladolid. They have been chosen in order to complete the candidates' formation without computing degree. The aim is to facilitate them the access to the Master in Computer Engineering. The subjects of the Grade are the following ones:

- Object-oriented programming
- Database design
- Programming Languages
- Software systems modeling
- Knowledge Engineering

### *General description of the Lesson Plan:*

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The lesson plan of the Master in Computer Engineering is based in four modules with a similar structure to that proposed in the University Council agreement on the Master's Degree which lead students to the Computer Engineering profession as published in BOE (Official bulletin of the State) 4<sup>th</sup> August 2009. Those modules are: Direction and management (Module1, 12 ECTS), Computer Technology (Module 2, 48 ECTS), external internship (Module 3, 15 ECTS) and Master thesis (Module 4, 15 ECTS).

Each student is supposed to take those modules in 3 months. In the first two semesters the student will do Module 1 Direction and Management and Module 2 Computer technologies. The next year there is going to be only one semester in which the internship (Module 3) and the Master Thesis (Module 4) will be done.

What is intended with this organization is to divide the studies into two periods. In the first one, made up of two semesters, the student will learn direction and computer projects management competences associated to professional computer engineering profiles. This first period is built with different in-person subjects. The second period in the spring term will consist in internships in companies whose activity is related to computer technologies studied in the master. Finally, it is required to do the Master Thesis that can be a continuation of the paper done in the internship in a company provided that the teacher assigned to the master co-directs it.

The relationship between modules and competences of the University Council about computer engineering studies (BOE – Official Bulletin of Spain- August 4<sup>th</sup> 2009) and those of the master's proposal is described in the chart below:

Module 1: Direction and Management (first and second semester)						<b>12 ECTS</b>
Subject 1.1			Subject 1.2			
Module 2: Computer Technologies (first and second semester)						<b>48 ECTS</b>
Subject 2.1	Subject 2.2	Subject 2.3	Subject 2.4	Subject 2.5	Subject 2.6	
Module 3: External Internship (third semester)						<b>15 ECTS</b>

**Module 1: Direction and Management (12 ECTS)**

**Subject 1.1: ICT Environment Financial Management**

CEG1, CEG2 y CEG3

**Subject 1.2: Organizations and Technology Management**

CEG1, CEG2 y CEG3

**Module 2: Computer Technologies (48 ECTS)**

**Subject 2.1: Auditing, Quality and Safety**

CET3 y CET4

**Subject 2.2: Intelligent Knowledge-Based Systems**

CET5 y CET9

**Subject 2.3: Embedded, Ubiquitous and High Performance Systems and Services**

CET6, CET7 y CET8

**Subject 2.4: Engineering Services and Interactive Systems// Interactive systems engineering**

CET1, CET2, CET5, CET10 y CET11

**Subject 2.5: Internet Services, Systems and Applications**

CET1, CET2, CET6 y CET9

**Subject 2.6: Computational Vision and Multimedia Systems**

CET10, CET11 y CET12

**Module 3: External Internship (15 ECTS)**

CT1, CT2, CT3, CT4, CT5, CT6, CT7, CT8, CT9 y CT10

**Module 4: Master Thesis (15 ECTS)**

CEP1

The following chart lists the temporary distribution of subjects that may be taken by the students:

TERM	SUBJECT	ECTS
<b>FIRST TERM (WINTER TERM)</b>	Auditing, Quality and Safety	6 compulsory ECTS
	Intelligent Knowledge-Based Systems	6 compulsory ECTS
	Computational Vision and Multimedia Systems	6 compulsory ECTS
	Interactive systems engineering	6 compulsory ECTS
	Internet Services, Systems and Applications	6 compulsory ECTS
	<b>Total ECTS:</b>	<b>30 ECTS</b>
<b>SECOND TERM (SUMMER TERM)</b>	Embedded, Ubiquitous and High Performance Systems and Services	6 compulsory ECTS
	ICT Environment Financial Management	6 compulsory ECTS
	Organizations and Technology Management	6 compulsory ECTS
	Optional ECTS (4 subjects of any area)	12 optative ECTS
	<b>Total ECTS:</b>	<b>30 ECTS</b>

<b>THIRD TERM (WINTER TERM)</b>	<b>External Internship</b>	15 compulsory ECTS
	<b>Master Thesis</b>	15 compulsory ECTS
	<b>Total ECTS:</b>	<b>30 ECTS</b>

<b>FIRST YEAR</b>		<b>TOTAL ECTS</b>	<b>12</b>
FB:Basic training; OB:Compulsory; OP: Optional; TF:Final Year Project; PE: External Internship; MX:mixed			
<b>Module's name:</b>		<b>ECTS</b>	<b>TYPE</b>
1	Direction and Management	12	OB
<b>Subject's Name:</b>			
1.1	ICT Environment Financial Management	6	OB
<b>Subjects related:</b>			
1.1.1	Economic and financial administration of companies and technology-based projects	6	OB
<b>Subject's Name:</b>			
1.2	Organizations and Technology Management	6	OB
<b>Subjects related:</b>			
1.2.1	Strategic Management of Technology and Innovation	6	OB

The following chart describes the list of specific subjects:

<b>FIRST YEAR</b>		<b>TOTAL ECTS</b>	<b>12</b>
FB:Basic training; OB:Compulsory; OP: Optional; TF:Final Year Project; PE: External Internship; MX:mixed			
<b>Module's name:</b>		<b>ECTS</b>	<b>TYPE</b>

2	Computer Technologies	48	MX
<b>Subject's Name:</b>			
2.1	Quality, auditing and security	18	MX
<b>Subjects related:</b>			
2.2.1	Quality, Auditing and Process Safety, Services, Resources and Software Products	6	OB
2.2.2	Products and processes quality evaluation	3	OP
2.2.3	Advanced learning methods and data extraction	3	OP
2.2.4	Multivariate data analysis	3	OP
2.2.5	Physical design of big data storage aimed at knowledge representation	3	OP
2.2.6	Semantic Web and Information Extraction	3	OP
<b>Subject's Name:</b>			
2.3	Embedded Systems And Services, Ubiquitous And Of High-Performance	18	MX
<b>Subjects related:</b>			
2.3.1	Parallel Computing and Emerging Models	6	OB
2.3.2	Ubiquitous Computing	3	OP
2.3.3	Practical Development of Applications in Embedded Systems	3	OP
2.3.4	Software Development Infrastructure For High-Performance Computing	3	OP
2.3.5	Computer Science Basics in Industry	3	OP
<b>Subject's Name:</b>			
2.4	Service Engineering and Interactive Systems	15	MX
<b>Subjects related:</b>			
2.4.1	Interaction Engineering	6	OB
2.4.2	Interaction Multimodal Systems	3	OP
2.4.3	Advanced Paradigms of Interaction	3	OP
2.4.4	Production of Audiovisual Content	3	OP
<b>Subject's Name:</b>			



2.5	Internet Applications, Systems and Services	15	MX
<b>Subjects related:</b>			
2.5.1	Advanced Internet Applications and Systems	6	OB
2.5.2	Information Retrieval from Websites	3	OP
2.5.3	Web Application Development	3	OP
2.5.4	Mathematical Methods Applied to Systems Development and Internet Services	3	OP
<b>Subject's Name:</b>			
2.6	Computer Vision and Multimedia Systems	15	MX
<b>Subjects related:</b>			
2.6.1	Hardware Systems, Capture Software and Image Display	6	OB
2.6.2	Emergent Technologies for Multimedia Applications	3	OP
2.6.3	Digital Video-Based Interactions: Standards, Contents And Industrial Applications	3	OP
2.6.4	3d Videos: Capture, Fusion and Production Of 3d Content by Means of Synchronized Cameras	3	OP

<b>SECOND YEAR</b>		<b>TOTAL ECTS</b>	15
FB:Basic training; OB:Compulsory; OP: Optional; TF:Final Year Proyect; PE: External Internship; MX:mixed			
<b>Module's name:</b>		<b>ECTS</b>	<b>TYPE</b>
3	Internship	15	OB

<b>SECOND YEAR</b>		<b>TOTAL ECTS</b>	15
FB:Basic training; OB:Compulsory; OP: Optional; TF:Final Year Proyect; PE: External Internship; MX:mixed			
<b>Module's name:</b>		<b>ECTS</b>	<b>TYPE</b>
4	Master Thesis	15	OB

## **Description of training activities.**

- In-person activities
  - Theoretical lessons: participative master and explanatory lectures.
  - Practical class lessons: participative classes case studies and problem-based learning.
  - Laboratories: supervised practices problem-based learning, cooperative learning, case studies and project-based methods.
  - Seminars: problem-based learning, case studies, cooperative learning and project-based methods.
  - Active tutorials: participative classes cooperative-based learning.
  - Evaluation: tests along the academic period in the context of continuous assessment.
- Distance activities:
  - Autonomous study and individual work: learning of the theoretical and practical aspects.
  - Group study and work: cooperative learning, project based methods and problem-based learning.

## **Description of the assessment methods that will be used**

In order to ensure a correct evaluation of the results got after the learning process and the development of competences in each subject, the following assessment procedures are generally established:

1. Tests to evaluate competences related to comprehension, analysis and expression of information:
  - a. Objective tests
  - b. Semi-objective short questions tests
  - c. Essay-type tests
  - d. Oral interview
2. Tests to evaluate competences related to techniques application, intervention procedures and problems solving.
  - a. Problem solving
  - b. Case analysis
  - c. Systematic observation records of activity
3. Tests to evaluate competences such as doing research, thinking or acting with creativity and communicating verbally.
  - a. Individual and group projects and Works.
  - b. Oral interviews in active tutorials
4. Tests to evaluate professional, social and personal competences.
  - a. Execution tests
  - b. Problem solving
  - c. Case analysis

#### d. Oral interview

The percentage of each one will be determined when creating the annual syllabus of each subject. The type of subject, the main activities during the learning process and the master degree committee recommendations based on the analysis of annual monitoring reports will be taken into account.

In all cases the timing of the tests must be perfectly organized to ensure a fair distribution of students' work and to provide punctual and continuous information of the level of participation and the achievement of the objectives throughout the teaching activity development. In those subjects in which this evaluation schema is modified, it will be indicated in the corresponding file.

As a general reference, it is proposed that those activities with continuous assessment have a percentage no less than 30% of the grade. Those subjects with final assessment are proposed not to exceed the 70% of the grade. The determination of the percentage will be specified in the **study guides** where it will also be described the typology, methods and evaluation system for each subject.

### **External Internship**

The internship will consist in practical work by the students in one or more companies for 300 hour in order to obtain 15 ECTS. The master's supply of internships will be based on the current External Internship Program managed by UVa in the field of Computer Engineering.

The companies of the ICT sector which collaborate with the University of Valladolid are established and continue being established in the local and regional environment and collaborate with the University of Valladolid through agreements of internships in companies and collaboration agreements in R+D+I. Through these tools they give form to their interest in keeping a collaboration relationship with the center incorporating students in internship regime. As an example, we add a list of companies in which our students have done during the last year an internship.

The Higher Technical School of Computer Engineering promotes regular meetings with regional and national technological companies. Those meetings have been named EI/EI (Computer Company/ Computer School). Their aim is to favor the contact between students and companies for the realization of internships as well as to introduce them in the job market.

**b. Planning and management of the mobility of proper and foster students:**

**b.2 Acknowledgement system and accumulation of ECTS**

To select the subjects that are going to be taken during the mobility period, the exchange students both international and from the UVA, will be informed of the regulations and advised by the coordinator of the mobility of each degree. According to a Learning Agreement, the secretaries from the corresponding faculties state the credits that the students have received. This regulation allows the acknowledgement of subjects and establishes the equivalences between them. It is considered appropriate to establish a parallelism between the recognition processes and the current studies' adaptation of subjects and the acknowledgement of ECTS in undergraduate studies, provided that they correspond to subjects or fields of similar content. The parallelism is extended to the competent organ of requests solving: the dean or director of the center.

The Higher Technical School of Computer Engineering of the University of Valladolid has established mobility for its students and teachers as a priority action. Our center has agreements with other universities that appear in the following chart. Thanks to those agreements, our students can obtain the reference qualification through this University if they fulfill the requirements, that is a series of subjects during one or two academic years in these universities. The staying is made in the framework of other exchange programs as ERASMUS and other international ones.

The agreements shown in the chart correspond to a strategic decision of the center in relation to the kind of the host university and the adaptation of the studies in them. In the following chart the data relating to the agreements for the academic year 2012-13 is shown.

Country	University	Nº of vacancies offered
Germany	Universität Münster *	2
Germany	Univ. Duisburg-Essen	2
Germany	Fach. Braunschweig – Wolfenbüttel	3
Belgium	Univ. Libre de Bruxelles	2
Belgium	Katholieke Hogeschool Brugge-Oostende	2

Belgium	Katho. Zuid-West-Vlaanderen	3
Denmark	Aalborg Universitet	2
Denmark	It Univ. of Copenhagen	2
Denmark	Uni.of Southern Denmark	2
Slovenia	University of Maribor	3
Finnland	Savonia University	2
France	Université d'Orleans	1
France	Université Nancy II	2
France	Univ. de Tech. de Troyes	2
Greece	Technological Educational Institute of Crete	2
Holland	Tech. Univ. Delft	1
Italy	Politecnico di Milano	4
Italy	Univ. degli Studi di Pisa	2
Portugal	Inst. Politéc. de Leiria	2
Portugal	Inst. Politéc. do Porto	2
Portugal	Universidade do Porto	2
Portugal	Ins.Pol. Viana de Castelo	2
Czech republic	Brno Univ. of Technology	3
Switzerland	FHZ-HSW (Luzern)	2

**6.1 Academic free staff:**

This master has got full support from the **academic doctor staff of the University of Valladolid**. It guarantees the adequate implementation and continuation of the subjects. In fact we count on 39 doctor teachers from the following **teaching departments**:

- 4 University professors
- 2 University professors accredited by ANECA
- 22 University tenured professors
- 1 College professor
- 7 Employed doctors, one of them accredited by ANECA University tenure professor
- 1 Assistant teacher with doctorate
- 2 Assistant teacher with doctorate, accredited by ANECA

The academic staff belongs to the **following departments**:

- Computing
- Algebra, Geometry and Topology.
- Applied Mathematics
- Electricity and Electronics
- Accounting and Finance.
- Business Organization and C.I.M.
- Automatic and Systems Engineering

The academic staff primarily teaches in the Higher Technical School of Computer Engineering and similar centers (Higher Technical School of Telecommunication Engineering, School of Industrial Engineering, School of Sciences, and School of Business and Economics), in graduate and postgraduate degrees and they have a wide experience in supervising final degree projects and M.A. thesis and tutoring internships.

The faculty staff have got an intense research activity and of technological transfer activity. It is proved by indicators such as possession of research complements (six years), possession of teaching complements (five years), positive assessment of the DOCENTIA program accredited by ANECA, coordination and participation recognized research groups (GIR), direction and involvement in competitive research projects of European, national and regional nature, research stays in prestigious research centers, supervision of Phd thesis, attendance to national and international conferences, invited lectures, authorship of research articles with impact factor (JCR), contracts and agreements established with companies, patent rights, etc.

## 7 Material resources and services

Research and formative spaces

### Classrooms and seminars

Type of room	Nº	Description	Adaptation
Big Classrooms ( 144 Maximum students)	4	Provided with blackboard, computer, video projector, projection screen and laptop line-in Jack.	Development of teaching activities with large groups.
Small classrooms (60 Maximum students)	5	Provided with blackboard, computer, video projector, projection screen and laptop line-in Jack.	Development of teaching activities with small groups.
Medium-sized classrooms (96 Maximum students)	1	Provided with blackboard, computer, video projector, projection screen and laptop line-in Jack.	Development of teaching activities with medium-sized groups.
Department Rooms	2	Redistributable furniture according to necessities, blackboard, digital interactive blackboard, 2 video projectors, 1 PC.	Development of teaching activities with small groups. Teaching activities that require special resources.
Center Rooms	4	Redistributable furniture according to necessities, blackboard, digital interactive blackboard, 2 video projectors, videoconferencing system.	Development of teaching activities with small groups. Teaching activities that require special resources. Group activities. Research seminars. Presentation and defense of papers.
R+D+i room	1	16 PCs. Video projector. Big screen projector. Process server. GPU dual via server. Office material.	R+D+i activities in collaboration with companies. External specialized formative activities.

### Teaching laboratories

Type of room	Nº	Description	Adaptation
PC Laboratories 1	4	20 Windows/Linux PCs, 1 teacher's place. Mobile board. Video projector. Interconnection high-speed systems.	Subjects of degrees and master computer practices. Standard groups.
PC Laboratories 2	1	18 PCs Windows/Linux, 1 teacher's place Mobile board. Video projector. Interconnection high-speed systems.	Subjects of degrees and master computer practices. Reduced groups.
White Laboratories	1	20 Seats provided with monitor, network link for students' laptop. 1 teacher's place. Mobile board. Videoprojector. Interconnection high-speed systems.	Subjects of degrees and master computer practices. Reduced groups.
General Computer Room	1	40 PCs. Mobile board. Interconnection high-speed systems.	Controlled Access free to students for development of practical assignments. Open 14 hours a day.
LAR Laboratories	1	4 PCs. 2 Switches, 1 router, 2 WiFi access points	Laboratory of networks expansion. Configuration and evaluation of local networks.
Servers' Room	1	12 Intel/AMD servers. 1 Sun multiprocessor server.	Files service, access control, configuration and network services, process servers for teaching practices. Access to all students, teachers and PAS.

### Research Laboratories

Type of room	Nº	Description	Adaptation
R+D Common laboratory	1		
GIRO laboratory	1		
ECA-SIMM laboratory	1	2 Intel SMP servers. 16 PCs	Support to research activities (doctorate activities, PFC, development of financed projects) related with:  ✓ Speech technologies.



		<p>2 iris cameras.</p> <p>4 Fingerprint reader</p> <p>3 network cameras.</p> <p>4 Web camera.</p> <p>1 high-quality scanner.</p> <p>1 DAT digital recorder.</p> <p>Varied audio materials.</p> <p>2 Telephony Cards with DSP.</p> <p>Ibervox recognition and speech synthesis</p> <p>Loquendo recognition and speech synthesis, VoiceXML speaker</p> <p>Telephone applications.</p>	<ul style="list-style-type: none"> <li>✓ Computer graphics.</li> <li>✓ Computer-Person Interaction.</li> <li>✓ Networks and systems security.</li> <li>✓ Recognition Biometric of People</li> <li>✓ Parallel Computing</li> </ul>
GSI laboratory	1		
GRINBD laboratory	1		
ATC laboratory	1		

### Learning rooms and services

Type of room	Nº	Description	Adaptation
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Room for group works	1	<p>8 Persons maximum capacity.</p> <p>Equipped with blackboards and WI-Fi.</p> <p>It is also possible to use the laptops and memories borrowed by the Library.</p>	Room for group work and academic activities.
Videoconference Room	1	<p>Equipped with TV screen, network videoconference with camera, microphone and driver to connect a PC.</p>	Holding video conference sessions
Conference Room	1	<p>Equipped with video projector and big screen, sound system with audio and video switching matrices, TFT screens for the presidential table, wireless microphones (two or three), DVD player/recorder, possibility of pc's connection to the system and network (Internet) via cable and wireless.</p> <p>Capacity of 130 people.</p>	Videoconference Room, TFM presentations, celebration of academic acts.

Boardroom	1	Equipped with video projector and screen. Laptop connection.	Meetings of collegiate organisms. Presentations and seminars with companies and associations.
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Additional dependencies and installations.

Type of room	Nº	Description	Adaptation
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Cafeteria	1		
Reprography	1		
Centre Management	1		
Sport service	1		
Students delegation	1		
WIFI	1	Network infrastructure	Wireless connection to the corporative Uva network, EDUROAM Access and to all networks of special services of the centers.
Study areas distributed over the 1 <sup>st</sup> and 2 <sup>nd</sup> floor corridors	2		

Concerning the library service, it is worth mentioning the availability of Campus Miguel Delibes library. The new building is set as a Learning and Research Resource Centre that satisfies the library services of the School of Computer Engineering and Telecommunication, School of Industrial Engineering, School of Sciences, and School of Education and Social work. It has flexible study spaces (individual and group), diverse computer positions (computer room, fixed stations, Wi-Fi), multimedia room and teaching room for users training courses.

### **Progress evaluation and results for each subject**

Students' knowledge evaluation is done through a final exam or continuous evaluation. As established in the article 11 of the Regulation of Academic University Planning "teachers responsible of subjects are the ones that will decide in each subject's project the characteristics, type of exam and assessment criteria, according to the criteria stated in the teaching program".

The Teaching Program of the Subject is the tool that defines the organizing model of the subject. The Teaching Program is public and can be checked in the University intended spaces for academic dissemination.

### **Continuous assessment regime**

By continuous assessment is understood the set of processes, instruments and didactic strategies described in the Teaching Program of the Subject applicable, in a progressive and integrated way, throughout the learning-teaching process. The collected texts must facilitate students and teachers relevant and regular indicators of the evolution and progress of competences achievement that have been stated as learning goals of the subject. The continuous assessment includes the subjects foreseen in the Teaching Program.

Those subjects that include continuous assessment will specify the elements that provide information to the process. Those elements of learning achievement, the progress indicators, the assessment criteria of each activity and their percentage in the final grade must be specified in the degree report. They have to be free and available in any moment for students and academic responsible.

Information related to percentages (in final qualification) of the continuous assessment mechanisms used must be explained in great detail in the Teaching Program.

Continuous assessed subjects will follow the general qualifications system fixed by the University of Valladolid in its Regulation of Academic University Planning.

### **Final exams regime**

Oral and written exams must be done at the end of the teaching period and in the fixed period for that purpose in the academic calendar.

- Call: Students from the University of Valladolid have a maximum of six calls to pass each subject of the teaching plan they are taking, as established in the Social Council of May 5<sup>th</sup> 2003. In addition, the students have two exam calls per subject and academic year, one regular and one extraordinary.

- Oral exams: The exams are public and recorded in audio by the teacher. Exceptionally and to the extent that the legal provisions allow it, they can be recorded in other means depending on the exam. The concerned department will provide the teachers with the necessary means.

The results obtained by students will be expressed in numbers according to the established scale in the Royal Decree 1125/2003 of September the 5<sup>th</sup>. There it is established the European system of ECTS and marks of official and valid university degrees throughout the national territory. The assessment of transcripts and the certification of marks will be done according to the marks regulation approved by the Governing Council.

## 9 Quality guarantee system

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These Master studies are subject to a monitoring and quality improving system. It is done through elements as the Quality UVa Commission.

In order to develop the Internal Quality Assurance System in the ETSI, the Quality Guarantee Commission of the center (CGCC) has been founded. In addition, there exists the Degree Committee named by the Board Center to guarantee the quality of the different study plans apart from the teaching competences and others that can be assigned in relation to the official degree.

The assessment procedures include methods as the teacher survey, performance analysis and academic scores done by the UVa consultancy.

Quality Commissions propose from these data the necessary actions to strengthen and reduce weaknesses. Each commission draws a yearly improvement plan in terms of their competences.