ORDEM DOS ENGENHEIROS
ENGINEERS PORTUGAL

QUALITY ASSESSMENT TO AWARD THE EUR-ACE LABEL

(FIRST CYCLE - BOLOGNA PROCESS)

to

Licenciatura em Engenharia Informática
from

Instituto Superior de Engenharia do Porto
Instituto Politécnico do Porto

September 2013

SUMMARY

PART I - CONFORMITY ANALYSIS REPORT

1 PRELIMINARY DATA

1.1 Process identification

The Assessment Process for the first cycle programme (*Licenciatura*) in Informatics Engineering of the School Instituto Superior de Engenharia do Porto of the Instituto Politécnico do Porto has been submitted to OE- Engineers Portugal on 1st October 2012 in the framework of the Informatics Engineering College.

The previous assessment before the implementation of the Bologna directive had the following decision: accreditation was granted for a period of six years to the pre-Bologna programme (dual cycle degree in Informatics Engineering) on 11th May 2006.

1.2 Procedure

The Review Team is constituted by

Eng.º Gabriel de Sousa Torcato David (president);
Eng.º José Manuel Barbosa Dias Ribas;
Engª Maria Fernanda de Lemos Pedro;
Eng.º Ricardo Jorge Silvério de Magalhães Machado

and supported by Eng.ª Susana Elisabete Rocha Campos (from OE Qualification Office).

The visit took place on 25th and 26th February 2013.

This process is a first submission of the 1st cycle programme to the EUR-ACE Assessment. The Informatics Engineering Master Degree (2nd cycle programme) was awarded with the EUR-ACE label on 2012 for a period of six years.

The pre-Bologna programmes in the area have already been assessed under the previous OE accreditation framework.

The School's delegates who intervened in the visit were:

- João Manuel Simões da Rocha (President of ISEP)
- Maria João Viamonte (Vice-President of the Technical-Scientific Board)
- Ana Maria Neves Almeida Baptista Figueiredo (Director of the Informatics Engineering Departement)
- Ângelo Manuel Rego e Silva Martins (Programme Director)
- António Cardoso Costa (Programme Accreditation Coordinator).

1.3 Recommendations made by the OE in previous assessments

On the 2006 process the final recommendations were:

There were three main recommendations of the last accreditation report of LBEI (the pre---Bologna programme) by Ordem dos Engenheiros (11 May 2006):

1. To improve in number and in quality the human and materials resources used in the programme;
2. To reduce contact class hours and excess workload associated with courses' projects and homework, proposing the creation of interdisciplinary project courses;
3. Reduction of the excessive number of years to graduate.

2 PREREQUISITES (PR)

PR 1 – LEGITIMACY OF PROGRAMME OPERATION

PREOCUPAÇÕES FUNDAMENTAIS: Identificar aspetos que eventualmente não estejam cobertos na discriminação apresentada pela Escola.
AÇÕES DA COMISSÃO: Verificar a satisfação de todos os passos processuais para a criação do Curso. Questionar a Escola sobre os elementos em falta.

PR1.1 – The School has presented the following elements to certify the legitimacy of Programme operation:

The 1st cycle Bologna programme on Informatics Engineering (Licenciatura em Engenharia Informática, LEI) was created by Despacho nr. 4140/2008 of Instituto Politécnico do Porto, and published in the 2nd series of Diário da República nº. 33, in 15 February 2008. It was later rectified by the Declaração de Retificação nr. 2204/2010, in the 2nd series of Diário da República nº.211, on the 29th October 2010.

Minor changes in contact/class hours, in order to fully support 12+4 week semesters, were introduced in the academic year 2010/2011, as published in the 2nd series of Diário da República nº. 223, on the 17th November 2010. This resulted in a total contact hours reduction from 2227 to 2160 for the whole programme.

PR1.2 – The legal and regulatory aspects that the School considers as not yet satisfied but that do not inhibit the Programme operation are:

(N/A – not applicable)

PR1.3 – The service supplied and the responsibilities assumed by other institutions supporting the School in the pedagogic and scientific sectors are formally stated in documents:

The 1st cycle programme is fully supported by ISEP. There is however an agreement for cooperation at the 3rd cycle level with the University of Trás-os-Montes e Alto Douro and there is also colaboration in a PhD at the Faculty of Engineering of the University of Porto.

Review Team statement on PREREQUISITE 1:

The School demonstrated the satisfaction of all the legal and regulatory requirements for the Programme operation. The responsibilities of the institutions supplying complementary educational services to the School are clearly defined.

PR 2 – PROCESS ORGANIZATION

PREOCUPAÇÕES FUNDAMENTAIS: Identificar falhas na informação e deficiências na organização do processo.
AÇÕES DA COMISSÃO: Leitura de todo o processo para verificar se todos os elementos necessários estão presentes. Avaliação da organização do processo apresentado.

The submitted documentation has a high quality presentation, is well organised and clearly written and has been sent to OE both in paper and digital supports.

PR2.1 – On its organisation and existence of a table of contents:

The document structure follows the one proposed in the guidelines and there is an active table of contents.

PR2.2 – On its sufficiency for the analysis:

The presented information is complete and largely sufficient for the analysis.

PR2.3 – On the identification of its origin:

It is clearly identified.

PR2.4 – On being supported by evidences:

The document is rich in factual references that support the statements produced including the subject and staff sheets.

Review Team statement on PREREQUISITE 2:

The submitted documentation allows for an easy reading; all the volumes possess a table of contents and the cover letter clearly states all the enclosed elements.

PR 3 – QUALIFICATION AWARDED

PREOCUPAÇÕES FUNDAMENTAIS: Clarificar a qualificação conferida pelo curso.
AÇÕES DA COMISSÃO: Identificar a designação do curso constante nos diplomas.

PR3.1 – Qualification awarded:

The Programme awards the qualification of Licenciado in Informatics Engineering.

PR3.2 – The Programme is composed by the following cycles:

The Informatics Engineering study area is organised, according to the Bologna Declaration, in a two cycles model, 3+2, that was already in use at ISEP since the previous reform. The Programme under review is the 1st cycle programme.

PR3.3 – The admission criteria:

The candidates are selected through a nationally organised competition requiring approval in High School and 10/20 in the national exam on Mathematics.

Review Team statement on PREREQUISITE 3:

After successfully following the Programme the education acquired by the graduate complies with the qualification recognised by OE.

3 REQUISITES

3.1 PROGRAMME FRAMEWORK

REQUISITE 1 – SCHOOL STRATEGY CONCERNING THE PROGRAMME

PREOCUPAÇÕES FUNDAMENTAIS: Clarificar a integração do Curso na estratégia da Escola
AÇÕES DA COMISSÃO: Questionar a Escola sobre a sua estratégia na reunião com os Corpos Diretivos com responsabilidade administrativa, científica e pedagógica na altura da visita. Avaliar o impacto que o Curso tem no funcionamento da Escola através dos dados apresentados complementados e de informações obtidas na entrevista com a Direção da Escola.

Q1.1 – Programme statute and starting date:

The 1st cycle in Informatics Engineering (*Licenciatura em Engenharia Informática* – LEI) is a programme adequate to the Bologna model. It started on 2006/2007. There are no branches or specializations.
There is no reformulation undergoing.

Q1.2 – Programme alignment with the strategy of the School:

Q1.2.1 – The School bets on the following Programme characteristics to enforce its offer in the Engineering education market:

What is the current strategy of the School and in particular wrt to LEI?
Is the adoption of CDIO recommendations a global School commitment or is it just something for the Programme or the Department?
What is the organisational relationship between the Department and the Programme?

The goal of the Polytechnic is the insertion in the labour market with a direct professional concern. In the case of Engineering, its problem solving nature closely matches the goals of the Polytechnic. The Programme mission is thus to prepare engineers that are competent, technologically updated and able to integrate the complex labour world. The intended profile for these graduates is that expected from a 1st cycle programme in the Informatics area. There are more differences from institution to institution than between the University and the Polytechnic subsectors.
Informatics has been a core programme of the School for many years. It has begun in 1985, with the bachelor degree. Later, in 1999, it adopted the form of a two-stage licenciatura that has naturally evolved into a licenciatura plus master in line, with the Bologna reform. Both LEI and MEI are the largest programmes of the respective cycle at ISEP. Informatics Engineering is thus one of the main crossbeams in ISEP's strategy.

Q1.2.2 – The School has expressed their view on the market and has mentioned the following opportunities it profits from and the following threats it faces with respect to its approach to Engineering education:

How many students are accepted each year?
Which is the ratio candidates/numerous clausus?
How did the economic crisis impact the demand?

The opportunities versus threats analysis (p.23) mentions the less expensive training obtained while at the same time saying that due to the large number of working students the time to graduation is high. Isn't this contradictory? How much costs a graduate?

ISEP knows the market of Informatics Engineering as it has been one of the first schools to offer Higher Education degrees in the area. Both LEI and MEI are the largest programmes of their cycles, as an answer to the market needs that rapidly absorb the graduates. This implies that most master students are working students. The yearly admission of more than 200 new students in LEI means that ISEP is profiting from the market opportunity on professionals focused on knowing how to do what the economic tissue of the Northern region of Portugal needs. There are more than 3 candidates per opening and more than 50% of the students choose LEI-ISEP as the first option. LEI is in the top 5 student attracting programmes in its area.
The traineeship in companies at the end of the Programme paves the way into the market labour, reinforcing the mission of the Polytechnic as defined by Law.
Though the School management does not see much difference between the university and the polytechnic approaches to teaching informatics engineering the more applied nature of its curriculum differentiates LEI from the competition by nearby universities.

Q1.2.3 – The School has presented the following financial, pedagogic and institutional guaranties that ensure the Programme sustainability:

The relatively long tradition of Informatics Engineering education at ISEP and the high position it occupies in ISEP's strategy are the main sustainability guarantees of the Programme, along with the consistency of the pedagogic goals, especially well established in the sequel of ISEP's integration in the CDIO international schools network. The Programme demand has been staying at a high level. Several Portuguese, European and American prospects indicate an increasing need of Informatics Engineers. Finally, the existence of strong R&D centres in the Informatics Engineering area induces a continuous update required for the long term sustainability of the Programme.

Review Team statement on REQUISITE 1

Offering the Programme is in line with the School's strategy and mission. The School's offer is made credible by its market view and the threats it faces. The Programme sustainability has been demonstrated.

REQUISITE 2 – PROGRAMME EVOLUTION

PREOCUPAÇÕES FUNDAMENTAIS: Rastrear a evolução do curso identificando as razões das alterações realizadas, das designações adotadas e deslocação para outras instalações.
AÇÕES DA COMISSÃO: Analisar a lógica da evolução do programa ao longo dos últimos anos. Obter justificações para avaliar a oportunidade das alterações apresentadas.
(Esta informação pode ser retirada do conjunto de informação associada ao Pré-Requisito 1)

Q2.1 – Current designation:

Licenciatura em Engenharia Informática (Informatics Engineering Bachelor).
Starting year – 2006/2007

The designation corresponds to the Programme's goals and learning outcomes, both in scope and in depth, and coincides with the designation of the specialty at OE.

Q2.2 – Previous designation

The Programme is a follow-up of the Bachelor in Informatics Engineering, part of the two-stage pre-Bologna licenciatura in Informatics Engineering, although substantially reorganised.

Q2.3 – Foreseen modifications:

There are no plans for modifications.

Q2.4 – Future designation:

(not applicable)

Q2.5 – Other important changes that the Programme may have gone through:

There was a change in the syllabus in 2010 to accommodate an organization of the semester in two parts, a first one with 12 weeks of lectures on four courses, and a second one with 4 weeks on an integrated lab project. The overall contact hours have been reduced, in accordance with the previous OE assessment conclusions.

Review Team statement on REQUISITE 2

The changes introduced in the Programme were in the direction of a more clear and up-to-date Programme contents, and of an improved pedagogic effectiveness. The Programme got adapted to the current post-Bologna legal framework.

REQUISITE 3 – COOPERATION WITH OTHER INSTITUTIONS

PREOCUPAÇÕES FUNDAMENTAIS: Identificar a cooperação com outras instituições nos seguintes âmbitos (âmbito pedagógico, âmbito científico, âmbito profissional):
AÇÕES DA COMISSÃO: Caracterizar o tipo de ligações dominantes que a escola evidencia. Identificar as vantagens das ligações da escola a outras instituições nacionais e estrangeiras no âmbito do curso.

Q3.1 - Total number of relevant projects:

How many relevant R&D projects have been running in the last five years? And led by ISEP?

The teachers in the Informatics Engineering Department organize their research mainly in four research units: CISTER - Research Centre in Real-Time Computing Systems (excellent), GECAD – Research Group in Knowledge Engineering and Decision Support (good), GILT - Graphics, Interaction and Learning Technologies (not assessed) and LSA – Autonomous Systems Laboratory (not assessed). These research units participate in a number of projects with other European, American, and Portuguese institutions. Beside knowledge creation and researchers/teachers update these units maintain a set of activities relevant for students' education and good Programme performance: supervising projects and internships, offering starting research scholarships, R&D seminars, and developing the students' competences on research and communication.

Q3.2 – Total number of relevant projects led by the School:

Some of the above mentioned projects are led by the ISEP R&D research units.

Q3.3 – Total number of relevant partnerships:

There is an intense relationship with the employers and companies in the region, manifesting mainly on the above 300 internship proposals for 150 trainees yearly available. The feedback from these internships at the final assessment is a valuable means of bond strengthening with the local employers.
There is a partnership with INESC TEC to host CISTER and LSA research units.
GECAD has regular cooperation with CENTRIA, the Center for Artificial Intelligence of the New University of Lisbon.
There are protocols with IT companies to offer professional certification like CISCO, Microsoft and Linux Professional Institute.
There are more than 120 Erasmus agrements with European HE institutions.

Review Team statement on REQUISITE 3:

The cooperation with national and foreign institutions shows a moderate projection of the institution in the country and abroad. The level of the partners is considered medium.

3.2 PROGRAMME OPERATION

REQUISITE 4 – SPECIFIC COMPETENCES AND MINIMUM REQUIREMENTS

PREOCUPAÇÕES FUNDAMENTAIS: Verificar se âmbito da formação está de acordo com o anunciado pela escola e satisfaz aos mínimos exigidos para a prática da profissão.
AÇÃO DA COMISSÃO: Verificar se a formação é suficiente para a prática profissional de acordo com o perfil de Engenheiro definido pela OE e com os objetivos definidos pela Escola.

Describe the intended profile for the graduate from LEI? Is it a broad spectrum profile or are you planning to create narrower scope programs like Bioinformatics, Digital Games, Software Engineering, Information Systems, Information Technology, etc.?
What is the rate of LEI graduates that register for the master programme, on the next year and in a 5 year span?
What is the relationship with the five computing curricula of ACM (Computer Science, Computer Engineering, Information Technology, Software Engineering and Information Systems)?Never been computer science but they have been introducing software engineering topics gradually

ISEP is part of the international CDIO (Conceive-Design-Implement-Operate) consortium devoted to improving Engineering education through a method of competence specification in each area along the four perspectives of conception, design, implementation and operation, typical of the Engineering practice. ISEP is the sole Portuguese member and the largest Informatics programme of the consortium. The effort to organise the syllabus along the CDIO principles and the continuous participation in its activities, including teachers training on course sheets elaboration, resulted in a high quality Programme dossier that is easy to analyse from the viewpoint of the competences acquired by the students.
One of the structuring decisions of the LEI syllabus that proves the central concern of getting the students to develop application competences of the theoretical knowledge acquired in the

several courses in an integrated approach with realistic problems, has been to split the semester into a period of 12 weeks of lectures of four courses and a period of 4 weeks exclusively devoted to a laboratory project integrating the knowledge previously obtained. The students arrive at the final project/internship with a significant exposure to real size problems, developing their know-how ability.
The Programme does not contain options or branches, in line with the broad spectrum chosen for this Programme.
The curricular structure has been designed according to the principles of CDIO approach. This approach is based on the identification of learning processes which organise groups of courses along a coherent line of development. In the case of LEI the courses have been grouped in three main processes (23 courses) and some propaedeutic and complementary courses (7). The three learning processes are: Modelling and Programming; Networks and Computing Systems; and Software and Systems Engineering.
There are several inconsistencies between the diagram in figure 2 and the list in section 9, of the application form. The diagram seems an improvement over the list that corresponds to the official syllabus. There is also a set of differences between the Portuguese and English versions of the course names, the English version usually better.
The course sheets should have more space to describe in more detail the course contents.

Q4.1 – SCIENTIFIC AREA: Propaedeutic courses

The amount and objectives of the propaedeutic courses cover the minimum requirements, with 4 courses on Mathematics (20 credits) and one in Physics (5 credits). However, there is a shortage of credits in the following areas: calculus (not including systems of first order differential equations), statistics, and numerical analysis (the last two in the same course). The topics of operations research and signal processing are not approached.

Q4.2 – SCIENTIFIC AREA: Modelling and Programming

The sequence of course names in this learning process is rather opaque. The differences between the Portuguese and English versions are perhaps a consequence of this.

- Algoritmia e Programação – Introduction to Programming. This course is based on Java and includes a chapter on classes and objects.
- Paradigmas da Programação – Programming Paradigms. This is a course on OO programming (Java) with an introduction to data structures. From its name one would expect a course comparing the several programming paradigms.
- Estruturas de Informação – Information Structures or Data Structures. Repeats OO programming basics (now in C++); repeats basic data structures; repeats complexity of algorithms; repeats graph algorithms, now with an implementation; only after that covers the trees topic.
- Bases de Dados – Data Bases. Normalization is not here but in Software Engineering.
- Engenharia de Aplicações – Applications Engineering. Why is it in this learning process? It repeats the basics of software engineering, of UML and focuses on patterns.
- Arquitetura de Sistemas – Systems Architecture or Web Systems. It is a mix of programming for the Web with some topics on software systems architecture and distributed systems. The components part and the model-view-control would be better on the Application Engineering course. The distributed systems component deserves a better treatment.

- Algoritmia Avançada – Advanced Algorithms. This is an AI course, based on Prolog. To be a standard advanced algorithms course it should include sorting, dynamic programming, linear programming, backtracking, etc. that are missing.
- Inteligência Artificial – Artificial Intelligence. It covers expert systems, natural language processing, and data mining. This is a rather specialized course that could be moved onto the 2nd cycle.

Q4.3 – SCIENTIFIC AREA: Networks and Computing Systems

Why is the Programming Languages course, on formal languages, included in the Networks and Computing Systems learning process instead of the Modelling and Programming?

Although the overall contents of this set of courses are considered appropriate, some of their names are especially misleading, for example, Principles of Computation for Introduction to Computer System or Computer Systems for Operating Systems or Advanced Computation for Real-time Computer Systems.

- Princípios da Computação – Introduction to Computing Systems. This is not a typical introductory course on computer systems. It mixes a virtual computer presentation with an introduction to networks and HTML. It is not clear whether it encompasses an introduction to digital systems. (The contents description in this course sheet is too short.)
- Arquitetura de Computadores – Computer Architecture. This course seems to have some overlap with the previous one. The structure aspect of a CPU, ALU, the several organizations of computers, the evolution of hardware, peripherals, etc. seem to be missing.
- Redes de Computadores – Computer Networks. This course seems to represent too short time for network services and for hands on configuration of routers and other network devices, firewalls, and load balancing.
- Sistemas de Computadores – Computer Systems. This is a classical operating systems course with an accent on concurrent programming. Where are the file system and input/output systems studied? And shell scripting?
- Administração de Sistemas – Systems Administration. It covers the core aspects of systems administration, including network services. Although ITIL is not mentioned in the course sheet, it has been said to be covered.
- Sistemas Gráficos e Interação – Computer Graphics. This is a standard course.
- Computação Avançada – Advanced Computer Systems or Real-time Systems. This is a course on parallel programming. It covers some aspects of concurrent programming already dealt with in Computer Systems. It could increase the chapter on concurrent programming to allow more space for OS topics in Computer Systems. It includes two chapters on real-time systems, perhaps more appropriate for the master level.
- Linguagens e Programação – Programming Languages. It focuses on compilers and formal languages plus XML, XSL, and language processing. It seems that this course should be in the Modelling and Programming process but it isn't due to personal constraints.

Q4.4 – SCIENTIFIC AREA: Software and Systems Engineering

The name of this learning process is rather misleading. Systems Engineering has a different semantics.
The courses here are mostly part of other processes making this just another view on the same topics, except for the inclusion of LAPR.

The key objective of these 5 Lab-Project (LAPR) courses is learning, practicing, the software development process, including best practices and associated professional competencies (teamwork, test/validation, documentation and production of technical reports, customer contact, etc.). This is a place to learn software engineering in practice and also to acquire transferable skills with no need to have specific courses on that, except for short presentations. The learning by doing approach seems especially suited to these competences.
There is no course specifically devoted to Information Systems, planning and implementation though the program started as an information systems programme and only later changed into the current design.
The Software Engineering course is weak and disarticulated, overlooking several important aspetcs of standard courses including metrics, detailed software developing methods, testing, etc. Several of these aspects are reviewed in the LAPR courses but a systematic deeper coverage of SE topics could be beneficial for the learning process.
The Management and Organizational Behaviour courses are needed to prepare the students to operate in real organisations.

Review Team statement on REQUISITE 4:

The minimum requirements are in general guaranteed. The acquired competences are in the scope of the Informatics Engineering College and concentrate on the following areas (according to the ACM/IEEE curricula): Computer Science, Information Technology, and Software Engineering. Some aspects of Information Systems and Computer Engineering are also touched but to a lesser extent.

REQUISITE 5 – CURRICULAR STRUCTURE AND PEDAGOGICAL PLAN

PREOCUPAÇÕES FUNDAMENTAIS: Identificar as descontinuidades e falhas na transmissão do conhecimento.
AÇÕES DA COMISSÃO: Verificar a consistência e coerência da informação contida na Ficha F9 (Guia de Candidatura para Submissão de Cursos). Procurar apreender a linha condutora da transmissão das competências e conhecimentos.

The Programme consists in 180 credits with the following distribution (the official credits do not completely match the course credits distribution in the S9. Programme Plan - R5 on page 31):

Scientific Area	**Official credits**	**Informal credits**
Basic Sciences	42	25
Engineering Sciences	52	17
Specialized	65	117
Complementary	21	21
Total	*180*	*180*

These credits correspond to about 24 contact hours per week, for a total of 2160 contact hours and 5040 hours of workload in three years. The column “Informal credits” is a different course classification where B means basic sciences, C means core courses for engineering but not specialized in the subject area, S means courses specialized in the subject area, and P means complementary courses. The conclusion is that, although the basic sciences and engineering sciences are enough for an engineering programme, the Programme as a strong

accent in specialized courses, as expected from the institutional strategy and the Programme goals.
What is the meaning of OT (Tutorial orientation) hours?

Q5.1 – The following discontinuities in the knowledge acquisition sequence have been detected:

The Programme is well designed and no major discontinuities have been detected. The main suggestions are on moving the topics on components and model-view-control from Systems Architecture into Application Engineering and the topics on concurrent programming from Computer Systems into Advanced Computer Systems. Some overlaps seem to exist in the pairs Programming Paradigms/Information Structures, Software Engineering/Applications Engineering, and Computer Systems/Advanced Computer Systems. As there are no optional courses, the expectable set of programme outcomes is very homogeneous.

Q5.2 – Insufficiencies have been detected in the presentation of the subjects related with the following areas:

In the propaedeutic area, the following topics should get more attention: systems of differential equations, numerical analysis and statistics. In the modeling and programming process, we feel that the distributed systems component needs a more in-depth approach and there is a lack of coverage in standard algorithms. In the Networks and Computing Systems process some operating systems components like file systems and I/O are not mentioned. In the Software and Systems Engineering process several aspects common in Software Engineering courses are not clearly studied in the theoretical courses although some are reviewed in the laboratory courses. A more systematic study of information systems classification, evolution, planning, and implementation would give more consistency to this process.

Q5.3 – Insufficiencies have been detected in the execution of experimental work:

One of the strong points of the Programme is the execution of experimental work, with a month in each semester concentrated on integrated lab projects, supported by an extensive participation of teachers from several areas and thus being able to tackle real-size problems and to develop design and problem solving competences of a multi-disciplinary nature.

Q5.4 – The following isolated topics with no continuity have been identified:

No isolated topics have been detected. The coherence of the syllabus is a natural consequence of the reflection on curricula contents triggered by the decision to integrate the CDIO consortium.

Q5.5 – The complementary pedagogic activities like study visits, seminars and conferences by external speakers have the following effects:

There is a sustained effort of external and internal invited speakers on emerging topics which open perspectives to the students and update opportunities to the staff. There is also a regular offer of hands-on workshops, which are repeated according to demand, on specific topics that complement the official courses.

Q5.6 – The results of the application of the pedagogic methods display the following efficiency degree:

The application of the pedagogic methods is effective, according to the testimony of the employers on the graduates. The efficiency of these methods seems to be increasing in the first curricular year. The evolution from 603 enrolled in the first year in 2007 to 371 in 2011, for an average of 240 new students per year, is a good sign. However, neither the total number of students in the Programme (1198 in 2011) nor the number of graduates (123 in 2011) follow that evolution but, on the contrary, remain stable. The completion ratio of about 52% may be seen as too inefficient though the problem is very complex and probably as no single solution.

Q5.7 – Systems of precedence or limitation of registrations:

How many students have suffered from the limitation on registrations?

There is a system of precedence based on requiring the student to be approved in the practical component of the course, instead of requiring approval on the full course. This does filter students not able to succeed in subsequent courses without artificially increasing the time to graduation. This way, the School answered to one of the recommendations in the previous OE assessment.
The limitation on registrations for students who repeatedly fail is the legal one.

Review Team statement on REQUISITE 5:

The curricular structure displays an adequate articulation and corresponds to the competences that the School presents as the programme objectives. The curriculum could be improved by a better coverage of some topics like numerical analysis, statistics, distributed systems, standard algorithms, file systems and I/O components in operating systems, and information systems.

REQUISITE 6 – CHARACTERIZATION OF THE CONTENTS OF ACADEMIC ACTIVITY

PREOCUPAÇÕES FUNDAMENTAIS: Caracterizar os temas que contribuem para a formação técnica e científica dos alunos.
AÇÕES DA COMISSÃO: Analisar as Fichas de Disciplina F10 e F11 (Guia de Candidatura para Submissão de Cursos) dando especial atenção aos objetivos, enquadramento e fundamentação das competências adquiridas. Avaliar a profundidade, âmbito e aplicações das atividades pedagógicas contempladas no curso em coerência com os objetivos definidos.

The coherence between the Programme objectives and the courses pedagogical goals raise the following comments:

Q6.1 – On the existence of design courses as well as courses with an integrating perspective:

Every student is required to finish a project, with internship or not, research oriented or in an industrial environment. It may be an individual or a group project. About 75% students go through an internship, few fail, and 16 is the average mark. There is a questionnaire answered by the company supervisors, mostly on soft skills and another questionnaire answered by the

ISEP supervisors on the technical competences actually used. Most of the mark is coming from the report contents.
The decision to keep a capstone project in a three years programme is paying off because the laboratory (LAPR) courses prepare the students to get into an organization and give the students the maturity they did not use to have. And this is very important to reach the goal of delivering students ready for the profession, because the company environment teaches a lot to those students.
The capstone project is the first feedback from the market. The Programme management is in the jury of the capstone reports and directly apprehends the feedback. This has had a direct impact on the contents of Software Engineering and Applications Engineering courses, for instance. The quality of the project became a central issue, besides just getting a working prototype. The quality of the report and other documentation has more weight because this is essential in the market.
In order to filter the proposals for appropriateness and quality, there is a website where the proposals are collected and analysed by the capstone project coordinator to assess their informatics engineering contents. The company supervisor is not part of the jury but give live or written feedback on the internship. The students are given an oral feedback at the end of the presentation and there is also a formal document. Group projects are relatively few and reports may be individual or common.
LAPR goal is always developing a complete product, so the students are exposed to the complete lifecycle of product conception, design, implement and document.
In summary, both LAPR courses and the capstone project focus on design and integration, the latter in a real world environment.

Q6.2 – On the existence of activities to develop transferable skills like communication competences, pedagogic ability and leadership:

The LAPR courses include modules to develop personnal competences of research, communication, project management, team work, and leadership, including productivity tools like Office, Latex, and vi. The organization and participation in the invited talks and in the activities (Hands-on, Workshops, Instalation parties) contribute also to the improvement of social and organizational competences.

Q6.3 – On the motivation to resort to foreign languages for the consultation of specialised documents:

Some technical LAPR documents are required to be written in English. The students are also tutored in writing CV's and abstracts in English. Most of the technical documentation needed to use software tools and to support the development of new systems is also in English. ISEP offers language courses in 9H modules under the scope of the program ISEP for Globe.

Q6.4 – On voluntary engineering activities developed by students with the active support of the School:

Students are stimulated to engage in volunteer activities. ISEP students have created the site for the "Millenium objectives" initiative. ISEP has been chosen for the first non USA project in the initiation to engineering world contest led by the IEEE. The students participate in programming contests like Microsoft Imagine Cup, MIUP, ACM local contest, and SAPO. There is also a regular participation in entrepreneurship contests.

Q6.5 – On the ability to manage difficult situations demanding presence of mind and persistence:

The programming contests and the entrepreneurship initiative Poliempreende are opportunities for the students do deal with complex situations under strict time constraints and unforeseen challenges that force them to build strategies and to find solutions.
The LAPR assignments, in a more realistic time frame, also propose complex and often partially undefined problems to be solved in one month and then subject to assessment by a jury. This progressively creates an engineering attitude in the students.

Review Team statement on REQUISITE 6:

The academic activities meant to knowledge acquisition and to capability training are enough for the intended Engineering education and match the Programme proposed goals.

REQUISITE 7 – OUTCOMES

PREOCUPAÇÕES FUNDAMENTAIS: Caraterizar os efeitos da formação e verificar se ela é adquirida.
AÇÕES DA COMISSÃO: Identificar os testes, exercícios e análise ao comportamento e desempenho dos alunos que possam aferir se esses resultados foram atingidos.

Comments on the following Learning Outcomes:
Q7.1 – KNOWLEDGE AND UNDERSTANDING

Evidences	***Documents:*** *Courses contents, technical exercises, case studies, exams.*	***Personal interviews:*** *Attraction to knowledge, technical interest, basic knowledge, engineering talent.*
Comments	Most non laboratory courses, 4 each semester, are devoted to specific knowledge acquisition and understanding of systems and methodologies as can be seen in the course sheets and in the example exams.	Several employers have mentioned the solid programming abilities and education in informatics that ISEP graduates regularly possess.

Q7.2 – ENGINEERING ANALYSIS

Evidences	***Documents:*** *Courses contents; technical exercises; case studies; stimulated discussions; tests.*	**Personal interviews:** *Structured mind; ability to analyze, select and apply knowledge.*
Comments	In the three learning processes around which the syllabus is organized it is possible to find courses where engineering analysis is a major concern. However, some aspects of more sophisticated algorithms, of statistical analysis and of software engineering conceptual tools should be considered.	The employers mentioned the facility with which the graduates were able to integrate a new project and become productive.

Q7.3 – ENGINEERING DESIGN

Evidences	***Documents:*** *Courses contents; technical exercises; case studies; stimulated discussions; tests.*	***Personal interviews:*** *Documentation skills; capability to apply and develop knowledge of Engineering; objectiveness; structured mind.*
Comments	Engineering design is developed at the module or program level in LAPR5. The students have a bidding contract without a full implementation but with a demo prototype and they have to produce a document that may be implemented later.	

Q7.4 – INVESTIGATIONS

Evidences	***Documents:*** *Research projects; documentation access tools; documentation organization tools.*	***Personal interviews:*** *Attraction to learning, attraction to innovation, objectiveness, persistence, laboratory skills, openness to discovery.*
Comments	The students are encouraged to find a solution by themselves and not having a complete solution beforehand. One may use code from outside but with explicit source identification so they are encouraged to assess the reliable sources of information. Looking at the state of the art of a problem is something that is not required in LAPR courses but is required in capstone projects. This is guaranteed by the supervisor.	Researchers in the associated research centres like CISTER said that the research competences are not very worked out but that the ability to innovate and to apply knowlege is patent.

Q7.5 – ENGINEERING PRACTICE

Evidences	***Documents:*** *Courses contents; technical exercises; case studies; stimulating discussions; field visits, laboratory work.*	***Personal interviews:*** *Application experience, knowledge selection ability, practical skills, sinthesis ability, objectiveness, persistence.*
Comments	The pracice of Engineering is stressed from the first semester with the LAPR courses and reaches a real world context with the capstone project.	The capstone project reports show the diversity of areas in which the students are able to apply their knowledge.

Q7.6 – TRANSFERABLE SKILLS

Evidences	***Documents:*** *Group work reports; individual reports; work presentations; group work courses; communication techniques courses; management courses.*	***Personal interviews:*** *Group work skills; communication skills and competences; life-long learning attraction; foreign languages skills.*
Comments	The transferable skills were not sufficiently valued in the 2006/2007	There are many group works, so the students learn how to deal with different

	design but slowly they have been introduced in the actual contents.	goals and perspectives. Part of the assessment in any laboratorial or group work is about the written report and the oral presentation.

Q7.7 – INDIVIDUAL ATTITUDE

Evidences	***Documents:*** *Group work reports; discussion group reporting; oral presentation of activity; seminar organization.*	***Personal interviews:*** *open mindedness; capacity to adapt to new environments; understanding of other cultures*
Comments	Graduates from ISEP are proud of their School and have a professional attitude.	The graduates and the employers confirmed the maturity of the Programme graduates.

Review Team statement on REQUISITE 7:

The Programme outcomes have been produced. The main weakness lies in the analysis skills which have space for improvement under the general framework of the Programme objectives.

3.3 TEACHING STAFF

REQUISITE 8 – TEACHING ADEQUACY

PREOCUPAÇÕES FUNDAMENTAIS: Avaliar a maturidade, experiência e perfil dos docentes.
AÇÕES DA COMISSÃO: Avaliar o perfil dos docentes através dos elementos disponibilizados e dos contactos durante a visita.

The survey on the Teaching Staff suggests the following comments:

Q8.1 – On the Teaching Staff qualification:

43% of the 93 teachers are PhD and 38% are PhD students, because by law the number of PhD must increase to 70%. 53% are active in R&D groups.
The criteria to assign teachers to specific courses is not easy, depends on negotiation, motivation and interests. It involves the department director and the Programme director. Formally there is a committee to approve the assignment of teachers to courses including all the department directors.
The proportion of people coming from industry is about 35% although just 15% are still working with the industry. The connection with companies is done mainly through R&D projects.
There are some formal actions to develop pedagogic competences of the teachers but they are mostly learning from experience in LAPR courses.
The main problem is not related with the qualification of the teaching staff but with the institutional recognition of this qualification. There are 32 assistants, 54 adjoint professors and 7 coordinator professors. The disproportion between adjoint and coordinator professors (about 8/1) is a sign of blockade in the career.
However, in the courses on databases and on software engineering, there seems to be a deficit of specific up-to-date qualification of the current coordinators.

Q8.2 – On the number of teachers still in a qualification phase:

38% of the teachers are PhD students, induced by the Higher Education legal framework.

Q8.3 – On the age of the teaching staff:

The average age is 42.8 with 57% in the 40-49 range and 30% in the 30-39 range. This means that renovation has been difficult and probably will not happen in the next 10 years, due to the very small number of teachers above 50 (12%).

Q8.4 – On the availability of teachers to support students:

The atmosphere in the department is very informal and students are always welcome when they look for support from teachers, mostly outside the formal tutorial periods. The fact that nowadays students ask for more support and the research requirements of the career are driving the reduction of part-time industry teachers and so teacher are usually present in the premises.

Review Team statement on REQUISITE 8:

The coordinations of each course staff are considered globally adequate. The teaching staff is progressing towards a highly qualified team. The main problems (naturally conditioned by the Ministry of Education's policy) with the teaching staff are the uneven age distribution, a very low staff renovation rate, and a strong bottleneck on the carrer.

REQUISITE 9 – TEACHERS IMPLICATION IN PROGRAMME DIRECTION

PREOCUPAÇÕES FUNDAMENTAIS: Avaliar em que medida a opinião e sensibilidade dos docentes é utilizada no aperfeiçoamento do Curso.
AÇÕES DA COMISSÃO: Verificar através de atividades como reuniões discussões e debates qual a participação dos docentes na vida da escola. Completar com o testemunho dos docentes. Procurar evidências da influência dos docentes no aperfeiçoamento do curso nomeadamente em entrevista.

The teachers panel was composed by

Name	Degree	Category	Position	Courses	Dedication
Adriano Lhamas	Lic Chemical Engineering, MSc Information Systems	Professor Adjunto		Computer Networks and System Administration	100
Eduarda Pinto Ferreira	PhD Optimization	Professor Adjunto	Pedagogic Council, Mathematics Department	Computational Mathematics, Algebra	50
Luis Lino Ferreira	PhD in Electrical and Computer Engineering	Professor Adjunto	CISTER R&D	Computer Systems, Principles of Computing, LAPR1 and 4	50
Paulo Sousa	PhD Informatics Engineering	Professor Adjunto	owns a software engineering company	LAPR5, Computer Graphics and Application Engineering	100
Nuno Silva	PhD Computer	Professor	GECAD R&D	Application	100

	and Electronic Engineering	Coordenador		Engineering	
Pedro Fortuna	MSc Computer and Networks Engineering	Assistente Convidado		Computer Architecture Security	50
Nuno Bettencourt	Lic Informatics Engineering	Assistente		Applications Engineering and Computer Architecture	100

Q9.1 – Teachers testimony highlight the following aspects:

The teachers confirmed that the course Software Enginering covers neither CMMI nor metrics, topics that should be considered at the second cycle. However ITIL is covered. An introduction to software quality and to software processes is required but not formally addressed. PMBOK is the competence model of LAPR4. The taxonomy of information systems is actually dealt with, although it may be not clear in the course sheet.
A part-time teacher stated that running a company at the same time he teaches is good because it is a way of bringing direct market needs into his courses.

Q9.1.1 – Quality of the admitted students:
The general opinion is that students don't like math; abstraction is hard, linear transformations are badly understood and they are needed in the computer graphics course. There used to be a big difference between students admitted with an exam of Mathematics A and Mathematics B. Now the Mathematics A exam is required.

Q9.1.2 – Student learning:
The values of attitude are enforced by all the professors mainly in the LAPR courses.
The students usually fail at least one year because they are from low income families: increased social support for the students is needed.
There is a communication deficit that does not pass the good image that the Programme has among the employers to the families and the candidates.

Q9.1.3 - Funcionality and quality of the facilities and pedagogical means:
The quality of the facilities have improves substantially in the last five years. The virtualization of operating systems that has been implemented on the main servers resulted in improved flexibility and more efficient management of virtual labs.
Suggestions: reduce the number of students in exercise solving classes (it can be 37 per class), Computational Math should be in a lab.
The course of Computer Systems should change technology.
The table layout in LAPR should be more like an open space and access during the night should be easier.

Q9.1.4 – Programme coordination:
There is a good opinion on how the Programme board coordinates the pedagogical activities.
There are meetings on the general organization of the Programme. There are coordination meetings in the beginning/end of the semester. The meetings by scientific area to coordinate the contents of related courses happen informally and organically. Changes in the course contents are the initiative of the teacher. The personality of the programme is a conscious construction of the whole department.
There is a formal report in the end of every course. The information is passed by informal contacts. The pedagogic council double check the course sheets on the assessment part. The creation of the programme is analysed.
The ISO9001 certification effort has helped to setup feedback and reflection procedures still in place.

Q9.1.5 – Implemented actions by suggestion of teachers or students:
The management takes the suggestions by teachers and students into consideration. Two suggestions mentioned are: as the number of students enrolled in each course is sometimes very large, a way to reduce the impact of the problem could be to have such courses repeated in both semesters; the number of effective weeks in LAPR should be increased, leaving the assessement out of the 4 weeks.

Q9.1.6 – Use by the students of the tutorial periods:
The students use the tutorial periods less than they could, partly because they feel the teachers are available to answer questions at any time and partly due to the increasing use of email and learning management systems (Moodle).

Q9.1.7 – Pedagogical assessment by the students:
The teachers are informed in detail about their own assessment and in aggregated form about the other teacher's assessment. The opinion is that the pedagogical assessments are not very accurate and that harder courses usually get a lower grade. The impact on the teachers is not very noticeable and there is no systematic analysis of the results.

Q9.1.8 – Support for scientific and pedagogical updating:
Career opportunities for teachers are scarce. Assistants can be asked to finish a PhD to be able to progress although not automatically, but with a teaching workload of 12/15H per week with no teaching service reduction, possibly with part time contracts. Sabbatical periods apply only to permanent staff. The work of staying in the labs and supporting the students is highly demanding and leaves little space for pursuing a PhD.

Q9.2 – The teachers' commitment to the School's educational project showed:

Q9.2.1 – The existing kind of cooperation.
The high number of extracurricular initiatives and the good results obtained in some of them testifies the participation and involvement of a large number of teachers in the educational project.

Q9.2.2 – The working conditions.
The working conditions have been progressively improving though some scarcity of office space remains a problema. The effort to create good research conditions is obvious, through the attribution of space and equipment to R&D groups, both established and in formation.

Q9.2.3 – The financing and teachers availability for research and publication.
The existence of large research units with good assessment (one excellent and one good) evidences the scientific production of the researchers. The creation of new R&D units and the association with existing R&D units will enable to increase the number of teachers active in research that is now about 53%.

Review Team statement on REQUISITE 9:

The teachers' involvement and participation in the School causes are adequate.

3.4 STUDENTS

REQUISITE 10 – ADMISSION, MONITORING AND EVALUATION OF THE STUDENTS

PREOCUPAÇÕES FUNDAMENTAIS: Avaliar em que medida a qualidade dos alunos influencia a sua seleção; apreciar se os alunos são devidamente acompanhados e estimulados; obter dados sobre a eficácia do ensino.
AÇÕES DA COMISSÃO: Obter dados sobre o ingresso dos alunos e procurar identificar alternativas veladas às condições de ingresso. Apreciar o relacionamento docente-aluno, entrevistar os alunos e avaliar o seu desempenho ao longo do curso. Identificar a existência ou não de regime tutorial. Identificar o posicionamento da escola face ao insucesso escolar.

Q10.1 – Admission of candidates to Engineering Higher Education

Q10.1.1 – Admission conditions on the last 5 years:
Admission to the Programme is done through a national contest based on the grade of high school plus the grade of a specific exam. It has been Mathematics A or B but now it is just Mathematics A and a minimum of 10 is required. The reference numerus clausus during the last 5 years has been 175, resulting in an average of 238 new students each year. The minimum grade has been 13.15 (3rd place of the national ranking) in 2011/2012.
These requirements are considered appropriate for a Programme in Informatics Engineering.

Q10.1.2 – Weaknesses in the students' previous knowledge:
A deficit in Mathematics education is seen as a sign of future bad performance in the Programme. Difficulties in foreign languages, especially in English, are counteracted through the offer of foreign language modules.

Q10.1.3 – Transfer conditions of students from other schools:
Transfer conditions are mainly regulated by law. Some care is taken in guaranteeing enough Mathematics education.

Q10.1.4 – Criteria to fill the available places:
The sorting criteria are established by the national law and are based on a combination of the high school grade and the Mathematics A exam grade. Some special groups of candidates have specific criteria and places.

Q10.2 – Student follow-up and support

Q10.2.1 – Student follow-up:
The student follow-up is mainly done through informal contacts between the teachers and the students in each course. At the end of the semester there is a formal course report where the main trends in the results obtained are analysed. The semestral teachers meetings are also an opportunity to discuss some more problematic situations.

Q10.2.2 – Optional foreign language courses and artistic and leisure activities:
The program ISEP for Globe offers short language modules that the students may take to improve their ability. There are regular cultural initiatives in the campus.

Q10.2.3 – Internal dissemination of information on academic and cultural activities:
The dissemination is done by email and at the department's Web portal.

Q10.2.4 – Activities stimulating the professional exercise:

The department organizes regular invited talks by external or internal speakers in a series called “Wednesday Afternoons at DEI” on emerging technical topics. There are also some professional education centers at ISEP (Cisco Academy, Pearson and Prometric centers) where students are stimulated to get professional certifications at a discount price.

Q10.2.5 – Assessment of student expectation satisfaction:
The main formal means of assessing student satisfaction is through the semestral pedagogical questionnaire. The collected data is processed and the results are communicated to the teachers.

Q10.2.6 – School answer to student expectations:
Specific student expectations are mainly transmitted directly to the relevant teachers. Their suggestions are discussed with the Programme board.

Q10.3 – Student assessment

Q10.3.1 – Student assessment system:
Most courses have a mixed distributed plus final exam assessing system. 27 courses include an exam or test. Only 2 courses do not have assignments along the semester. The assessment of theoretical aspects and of specific exercises is done by each of the four theoretical courses in each semester.
Exams are collected in an official site and they are accessible to future students. The opportunity to improve group assignments is just on the next year. Exams or individual assignments may be improved in the same year.

Q10.3.2 – Assessment of design or integration assignments:
The assessment of applied aspects, especially those involving integration and design, is done in the LAPR courses, through larger projects, and is done by a jury to avoid bias. Programming projects use a software version control system for monitoring individual contributions and the progress of development, called GIT.

Q10.3.3 – School failure:
There is a low percentage of students concluding in the standard three year schedule. There is a group of students taking 3/4 years and another group taking 5/6 years. For a more or less steady input of 240 new students each year, the number of students enrolled in the first year is showing a positive evolution (from 603 enrolled in the first year in 2007 to 371 in 2011). However, neither the total number of students in the Programme (1198 in 2011) nor the number of graduates (123 in 2011) follow that evolution but, on the contrary, remain stable, pointing to a completion ratio of about 52%. The oral information of 217 graduates in 2012 may be a change in the trend. Despite recognizing that some effort has been made in the sequel of the previous OE recommendations, the number of dropouts is still very large (103 in 2012). This can be the effect of the Programme keeping high standards but more likely it is the result of a mix of causes. One can be the relatively low income from the students’ families. Another can be the poor studying habbits from high school.
Some measures may help in the situation: reduce the number of students in exercise-solving classes; offer the most problematic courses in both semesters; suggest the part-time enrollment to working students; early identification of delayed students and specific tutoring actions; creation of an alternative professional programme (a two years CET) with lower requirements where to poor performance students could be driven, avoiding dropout.

Q10.3.4 – Student assessment in nontraditional contexts:

The assessment of internships in the context of the capstone project is done by a jury including the ISEP supervisor and the Programme director. The company supervisor is asked to produce a written information o the work done.

Review Team statement on REQUISITE 10:

The criteria for student admission and the follow-up and assessment systems are adequate. Continuing effort in the reduction of school failure is needed.

REQUISITE 11 – PROGRAMME EVALUATION BY STUDENTS, RECENT GRADUATES AND EMPLOYERS

PREOCUPAÇÕES FUNDAMENTAIS: Avaliar em que medida as expetativas dos alunos e empregadores são satisfeitas.
AÇÕES DA COMISSÃO: Entrevistar alunos recém-diplomados e empregadores e apreciar a vocação profissional dos alunos. Avaliar a credibilidade do sistema de avaliação dos alunos durante o curso.

Q11.1 – Assessment by students

The students present in the panel were:

Year	Average	Name	Number
1	--	Alessandro Santos (D) Scince	1120198
2	13,98	Nuno Vinha da Silva (N)	1960142
2	15,05	Jorge Neto (D)	1110156
3	12,76	Diogo Pereira (D), 23, Technologic programme 12º, 3rd	1101007
3	14,87	Sara Santos (D) Social Science degree, 3rd	1101171
3/F	12,54	Pedro Carvalho (D) Scholarship	1080726
3	12,55	Diogo Palhais (D)	1080644

Some students said their first choice has been ISEP. Other asked for transfer because the teaching at ISEP is seen as having a practical approach.
The general feeling is that teachers are always available to help students and that compensates the fact that students must work hard. Teachers even answer emails. They know the names of the students and provide out of class support.
There are no light courses, implying there is always the need to work at home. The work is too heavy. The exams should weight less in the final grade.
The assessment is fair even in the case of group work.
In LAPR different competences are being trained, for example there is a project manager.
There are student sports teams. There is a health club but it is payed.
Some students have participated in seminars.
There is a new initiative of giving scholarships to projects so that the students are able to go on developing the work done in the internship. During the internship, the teacher has meetings with the local tutor. The internship functions a bit like a job market.
In terms of social support, there are student residences and social scholarships but even so there are students quitting by financial reasons.
Suggested change: Systems Architecture (Web systems) is very hard, with a lot of work and a lot of technologies and topics and the exam is too heavy. Each class is one subject. Physics is considered very difficult because it is too theoretically oriented.

Q11.1.1 – Consequences of the assessment of teachers by students:
The students said that the pedagogical questionnaire is too extensive and should be simpler. Some students just fill in the part on teachers and not the part on the course, because the former is simpler. The students do not see the impact of the questionnaire in concrete actions. There are neither year delegates nor representatives, so the students are represented just by the student union. Complaints are directly addressed to teachers.

Q11.1.2 – Safety measures in the exams:
The exams are stored in a repository and can be accessed by the future students. The assessment of programming projects use a software versions control system for monitoring individual contributions and the progress of development, called GIT.

Q11.1.3 – Pedagogical questionnaire results dissemination:
The results are disseminated just in aggregated form. This impacts negatively the perception of utility of the pedagogical questionnaire.

Q11.2 – Assessment by former students

The panel of former students:

Name	**Company**	**Position**
Virgínia Liliana Rodrigues do Nascimento	GECAD – ISEP/IPP	Fellowship researcher
André Filipe Silva Correia	ARMIS – Sistemas de Informação	Software engineer
Miguel Angel Rodrigues Silva	NOESIS SA	Quality consultant
Paulo Ferreira	GLINTT – Healthcare Solutions	Software developer
António Vaz	Kant Consulting	SAP consultant

Q11.2.1 – Graduates influence in the School:
Just through informal contacts.

Q11.2.2 – Graduates opinion:
The graduates are very positive about the Programme and consider that they were well equiped to face the professional world in several areas of software development and systems administration. The applied and practical approach followed by ISEP pays off when it comes to integrate an existing team, learn a new technology or solve a problem.

Q11.3 – Assessment by employers

The employers present were:

Name	**Company**	**Position**
Cláudia Sofia Macedo Ribeiro da Silva	Gisgeo	Business manager
Jorge António de Sousa Miranda	COR&FIA Portugal	Managing director
Eduardo Nogueira	myPartner	CEO

They employ significant numbers of LEI graduates sometimes along with graduates from other schools.

Q11.3.1 – Participation of employers in their graduate employees' assessment:
The employers are asked to participate in the School boards and they express their opinion informally in common projects or in graduate performance follow-up surveys.

Q11.3.2 – Employers opinion:
The comments on the profile of the graduates from LEI at ISEP were that they cover several aspects of Informatics Engineering and that they are product developers. It is easy to get a multitasking engineer out of ISEP. The DNA of the School is to give the tools but let them to learn by themselves. Graduates from ISEP are energetic, hard workers and they try to find solutions for the problems. The practical component of the Programme is high so in a few

months they are fully integrated in any job. The theoretical component is weaker. ISEP is preparing prograamers, not managers and middleman. No recent graduate is able to research complete solutions by himself and are sometimes very immature. ISEP graduates are good as consultants too. However ISEP is not preparing consultants but software developers. The graduates are not immediately project managers. Sometimes they are systems technicians.
Some direct observations on the Programme have been produced. The employers do not consider that there is an ISEP method for SE. Instead, the graduates adapt themselves to the software process in use in the employer. They did not study testing methods. Some education on management would be useful.
One opinion on the capstone project is that it is really important and the company is keeping half of the trainees. The company defines projects with a specific goal according to its own interests and then professors are present during the internship.
Updating technology every year requires a permanent institutional dialog between the companies and the Programme.
There is the need of an information systems master to be able to produce graduates with a systems view on software architecture.

Review Team statement on REQUISITE 11:

The assessment of the Programme by students, graduates and employers is credible and enables objective conclusions on the profile of the graduates and on suggestions for improvement.

3.5 FACILITIES AND RESOURCES

REQUISITE 12 – SUITABILITY OF FACILITIES

PREOCUPAÇÕES FUNDAMENTAIS: Constatar a funcionalidade e adequação das instalações pedagógicas e de apoio aos alunos
AÇÕES DA COMISSÃO: Visitar as instalações e concluir sobre a sua funcionalidade.

Q12.1 – Premises size and comfort degree:

The premises are well sized as they have grown to accomodate the growing number of students and they are comfortable and well equipped with projection and network infrastructures. There is air conditioning in the lecture rooms. Lectures are organised in four shifts and occupy 66 places amphitheatres.
There is a noticeable over-occupancy of the teacher's offices which are, in general, not individual.

Q12.2 – Acoustic and visual conditions:

In general, the acoustic and visual conditions are good, except for a few large rooms. There are projectors in every room, except for some laboratories.

Q12.3 – Cleanness and condition:

There is a clear concern with keeping the premises quality and cleanness so they constitute a pleasant space for study and research.

Q12.4 – Routines to recover the condition after each use:

The routines are established by contract with cleanning companies, operating in the morning before the classes.

Review Team statement on REQUISITE 12:

The facilities satisfy the Programme needs.

REQUISITE 13 – PEDAGOGIC FACILITIES AND RESOURCES

PREOCUPAÇÕES FUNDAMENTAIS: Constatar a adequação das instalações pedagógicas e de apoio aos alunos
AÇÕES DA COMISSÃO: Visitar as instalações e avaliar a adequação dos recursos pedagógicos de apoio aos alunos.

Q13.1 – Comments on the laboratories facilities and use

Q13.1.1 - Quantity and quality of the lab equipment:

There is equipment in enough quantity and quality for the Programme needs, in particular through the use of virtualization techniques able to efficiently offer computational environments adapted to each one's needs. There has been a significant increase in the number of network equipments and pedagogical software through the establishment of partnerships with CISCO, Microsoft, and Linux Professional Institute.

The Networks Lab has equipment for 20 students and runs courses preparing for CISCO certification, besides supporting regular courses. Certifications obtained by students, at a reduced price, may be credited in network courses.

The Knowledge and Decision Support Lab is equipped with Clementine and EKA, among other software.

The Multimedia Lab has a TV studio able to broadcast on the Internet, three HD cameras, a 3D virtual studio and large screen Macintosh computers with graphics board adequate to multimedia processing.

Q13.1.2 – Equipment stowage:

There are enough laboratories and racks to package the equipment, some of which are mobile to improve the flexibility of the space organization.

Q13.1.3 – Rules for the maintenance and test of equipments

N/A.

Q13.1.4 – Safety system, emergency procedures and plans:

N/A.

Q13.1.5 – Visibility and accessibility of the use and safety instructions:

N/A.

Q13.1.6 – Storage conditions of the dangerous, explosif or flammable materials and products

N/A.

Q13.1.7 – Student access to labs during and outside class schedules:

The buildings and the labs have card access enabling policies of extended access to the workplaces.

Q13.1.8 – Lab assignments list and goals:

There are scripts for the assignments of several courses, especially the integrated lab courses.

Q13.1.9 – Quantity and quality of the practical lab assignments:
It has been analysed in the context of the courses.

Q13.1.10 – Quality of the lab assignments scripts and reports:
N/A.

Q13.2 – Comments on the Library facilities and use

Q13.2.1 – Quality of the journals, publications and e-publications:
The Library has access to the b-On, the Online Knowledge Library from FCCN. It follows a policy of acquiring at least one issue per reference book of every course. There are budget constraints on the acquisition of scientific bibliography.

Q13.2.2 – Use conditions:
Information access is done through a "mylibrary" portal. There is no reference service supporting the research.

Q13.2.3 – Reading, information research, and reproduction equipment:
There are computers available for information search and wi-fi network for mobile devices.

Q13.2.4 – Reading room for students:
The available space, though not very large, has been recently increased and the access to older documents facilitated. There are spaces for individual reading and for group work. The existing spaces have an occupation ratio about 50% and there are about 1000 lendings per month.

Q13.2.5 – Shelves size:
The publications are on free access and well packaged.

Q13.2.6 – Opening hours:
The reading rooms and service desk are open from 9 a.m. to 10 p.m.

Q13.3 – Comments on IT support

Q13.3.1 – Student access to IT means relevant for the Programme:
ISEP has made a significant effort towards a paperless administration, simultaneous with a policy of administrative reorganization. For that, it launched the project "SIMPLEXmente Académico" to internally develop a portal with multiple services to students, teachers and technical staff like registration, attendance control, grades recording, requirements, or service trips, on top of a workflow engine and a document management system in charge of the systematic digitization of the documents arriving at the institution.
There is also an e-learning management system (Moodle) with integrated authentication, being used by a growing number of courses, in special the lab courses.
The academic community has remote VPN access to the ISEP environment. The virtualization policy has facilitated the systems management and improved the flexibility on the creation of computational environments adequate to each situation. The data centre is modern and well equipped.

Q13.3.2 – Wireless network:
There is a wireless network with eduroam authentication.

Q13.3.3 – Available software:
The software required for each course is available.

Q13.3.4 – Manuals:
The relevant manuals are on-line.

Q13.4 – Support facilities

Q13.4.1 – Student access and stay in the facilities:
Access to the buildings is controlled by card, enabling extended access to the study rooms and labs.

Q13.4.2 – Eating places, stationer's, study rooms, meeting rooms:
There are working spaces available to the students in rooms near the teachers' offices, and high quality green areas around the buildings. There is a refectory and a restaurant.

Q13.4.3 – Teachers' and technical staff's offices:
The offices are not individual but every teacher has an office assigned. The technical staff is distributed by the labs and the central services.

Q13.4.4 – Volunteer engineering work:
The students are stimulated to participate in volunteer activities. The site of the initiative "Millenium Goals" has been created by ISEP students. The IEEE promotes an world contest for engineering initiation activities and ISEP got the first project outside the USA.

Q13.4.5 – Sports facilities:
There is an health club.

Q13.5 – Subcontracting

Q13.5.1 – Agreements/protocols complementing the Programme:
There are agreements with the CISCO Academy, Microsoft, and Linux Professional Institute to promote the professional certification in complement to the academic education.

Review Team statement on REQUISITE 13:

The pedagogic facilities and resources are adequate to the Programme needs.

3.6 ENSURING QUALITY

REQUISITE 14 – PROGRAMME MONITORING

PREOCUPAÇÕES FUNDAMENTAIS: Apreciar os parâmetros (significativos, mensuráveis e controláveis) utilizados pela Escola para apreciar a evolução da qualidade do seu desempenho.
AÇÕES DA COMISSÃO: Solicitar a explicitação dos parâmetros e acompanhar a forma como são utilizados pela Escola. Ponderar quais dos indicadores interessantes que permitem tirar conclusões consistentes.

There are internal assessments every semester, both from the students through the pedagogical questionnaire and from the teachers through the coordination meetings. There is little information on carreer following.
There is an on-going project called Personas trying to identify the Informatics profiles in the job market in order to assign them competences and to revise the syllabi accordingly.

Q14.1 – Performance indicators used by the School:

One of the indicators is approval rate for LAPR courses. Another is the number of courses per student per year. The implementation of a system of prerequisites has had a positive impact on this indicator. There is a set of indicators for the student efficiency.

At the course level the following indicators are used: assessed/enrolled, approved/enrolled, approved/assessed, total enrolled, total first enrolment.
At the programme level the following indicators are used: number of candidates per vacancy, number of candidates in first option, distribution of the approval rates per curricular year, number of dropouts, number of conclusions after n, n+1, and >n+1 years, average years to conclusion, internship proposals per student enrolled at the capstone project, number of graduates hired by the end of the programme and after six months.

Q14.2 – Characteristics of school failure:

Q14.2.1 – Programme adequation to its actual population:
The main reason for school failure is the misadaptation to the Programme or even to Higher Education of many students who do not conclude any course in the first year or eventually quit. Part of this may come from bad studying habits from high school. Another reason is the fact that many students come from low income families.

Q14.2.2 – Effect of the acess conditions, pedagogical methods, and teachers performance:
Students who do submit themselves to assessment get relatively high results so the main identified difficulty is the abandon of the frequency, especially on the first year. The admission of candidates with the qualifying Mathematics B exam is also seen as a cause of failure in the basic sciences courses and elsewhere, so it has already been decided to require the Mathematics A exam for future candidates.
A large number of recurrent enrollment students are actually ghosts who keep registering and do not show up in classes. They are put in specific classes so they do not contaminate the freshman.

Q14.2.3 – Effects of the yearly variation of the population:
Due to the large numbers of new students each year the variation is not significant. The last student in 2011/2012 had a candidate grade of 13.15.

Q14.2.4 – Number of registrations legally blocked due to poor performance:
N/A.

Q14.2.5 – Connections to the academic, business, and research worlds, publications in pure and applied sciences, pedagogical experiences, prizes and awards to students and teachers:
ISEP and DEI have made a big effort to connect to other institutions. I the case of the academic world, there are partnerships with several universities (UTAD, FEUP, UNL, …) as a way to participate in joint projects but also to overcome some statutary limitations, namely at the third cycle level. There are also several partnerships at the research level, with ISEP units leading national and European projects and also through the integration of ISEP units in Associate Laboratories like INESC TEC.
The cooperation with companies is strong both through agreements for professional certification in specific technologies and for service contracts and through internships (80% of the students).

Q14.3 – Conclusion of other assessments

Q14.3 1 – Conclusions from the assessment by FUP/CCISP/APESP:
N/A.

Q14.3.2 – Conclusions from the R&D units assessment (FCT):

CISTER - Research Centre in Real-Time Computing Systems has been assessed Excellent and GECAD – Research Group on Knowledge Engineering and Decision Support has been assessed Good. The units GILT - Graphics, Interaction and Learning Technologies and LSA – Autonomous Systems Laboratory have not yet been assessed.

Review Team statement on REQUISITE 14:

The adoption and use by the School of the programme monitoring parameters are adequate, except for the graduate follow-up.

REQUISITE 15 – CORRECTIVE ACTIONS AND THE QUALITY PLAN

PREOCUPAÇÕES FUNDAMENTAIS: Verificar se as contribuições para a melhoria da Qualidade são devidamente tidas em conta e se as ações corretivas e preventivas são eficazes.
AÇÕES DA COMISSÃO: Apreciar os efeitos das recomendações das avaliações da OE e a sua inclusão no Plano de Melhoria da Qualidade da Escola. Verificar se o Plano de Qualidade é anualmente revisto.

Q15.1 – Comments on the quality improvement plan:

There was no formal quality system for the pedagogical activity at the School level, there is one being implemented. There is a quality system for the central services, already audited.

Q15.2 – Preparation and discussion of the quality plan:

N/A.

Q15.3 – Inclusion in the quality plan of the results of questionnaires and opinions of students, graduates, teachers and employers:

There are pedagogical questionnaires applied to the students every semester. There are questionnaires applied to the employers, especially to the internship supervisors. The corresponding answers are analysed by the Quality Office and by the relevant boards, in particular the Pedagogic Council, that determine the actions to be executed after that analysis.

Q15.4 – Follow-up of the quality plan by the academic authorities:

N/A.

Q15.5 – Effects of the recommendations by the previous assessment:

The recommendations contained in the OE 2006 assessment have been taken in consideration and the following measures have been implemented in subsequente years:
Recommendation 1 – To improve in number and in quality the human and materials resources used in the programme:

- the technical and administrative staff have been enlarged, for instance, to support the professional academies;
- DEI is going through an effort of organization of the scientific areas;
- the number and equipment of the laboratories have been reinforced;
- the classrooms have been modernized and equipped with air conditioning and projectors.

Recommendation 2 – To reduce contact class hours and excess workload associated with courses' projects and home work, proposing the creation of interdisciplinary project courses;

- the integrated laboratories have been created;
- the excess of course assignments have been reduced by their concentration on a single integrated laboratory course;
- the total contact hours have beem reduced from 2227 to 2160 for the whole programme, that now has 24h per week.

Recommendation 3 – Reduction of the excessive number of years to graduate:

- a system of precedence has been created based on requiring the student to be approved in the practical component of the course, instead of requiring approval on the full course; this does filter students not able to succeed in subsequent courses without artificially increasing the time to graduation.

Not much progress has been noticed on the time to completion and in the ratio of dropouts problems although some good signs are on the way, namely, the number of students enrolled in the first year has been reduced from 603 to 371 in five years and the number of graduates in 2012 has been 217, significantly higher than the 125 (average) of preceding years.

Review Team statement on REQUISITE 15:

The way the Programme management uses the indicators reveals a systematic analysis effort and the measures implemented prove the determination to correct the issues identified.

PART II - SUMMARY OF EVALUATION AND DECISION PROPOSAL

(BY THE ASSESSMENT COMMISSION)

1 SUMMARY TABLE I

PREREQUISITE	ACCEPTABLE	ACCEPTABLE WITH PRESCRIPTIONS	UNACCEPTABLE
PR1 – Legitimacy of programme operation	X		
PR2 – Process organization	X		
PR3 – Qualification awarded	X		

REQUISITE		ACCEPTABLE	ACCEPTABLE WITH PRESCRIPTIONS	UNACCEPTABLE
1- Programme framework	Q1 – School strategy concerning the programme	X		
	Q2 – Programme evolution	X		
	Q3 – Cooperation with other institutions	X		
2- Programme operation	Q4 – Specific competences and minimum requirements	X		
	Q5 – Curricular structure and pedagogical plan		X	
	Q6 – Characterization of the contents of academic activity	X		
	Q7 – Outcomes		X	
3- Teaching staff	Q8 – Teaching adequacy		X	
	Q9 – Teachers implication in programme direction	X		
4- Students	Q10 – Admission, monitoring and evaluation of the students		X	
	Q11 – Programme evaluation by students, recent graduates and employers	X		
5- Facilities and resources	Q12 – Suitability of facilities	X		
	Q13 – Pedagogic facilities and resources	X		
6- Ensuring quality	Q14 – Programme monitoring		X	
	Q15 – Corrective actions and the quality plan	X		

2 SUMMARY TABLE II

PREREQUISITE	ANALYSIS	RECOMMENDATION
PR1 – Legitimacy of programme operation	The School demonstrated the satisfaction of all the legal and regulatory requirements for the Programme operation. The responsibilities of the institutions supplying complementary educational services to the School are clearly defined.	
PR2 – Process organization	The submitted documentation allows for an easy reading; all the volumes possess a table of contents and the cover letter clearly states all the enclosed elements.	
PR3 – Qualification awarded	After successfully following the Programme the education acquired by the graduate complies with the qualification recognised by OE.	

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
1- Programme framework	Q1 – School strategy concerning the programme	Offering the Programme is in line with the School's strategy and mission. The School's offer is made credible by its market view and the threats it faces. The Programme sustainability has been demonstrated.	
	Q2 – Programme evolution	The changes introduced in the Programme were in the direction of a more clear and up-to-date Programme contents, and of an improved pedagogic effectiveness. The Programme got adapted to the current post-Bologna legal framework.	
	Q3 – Cooperation with other institutions	The cooperation with national and foreign institutions shows a moderate projection of the institution in the country and abroad. The level of the partners is considered medium.	
2- Programme operation	Q4 – Specific competences and minimum requirements	The minimum requirements are in general guaranteed. The acquired competences are in the scope of the Informatics Engineering College and concentrate on the following areas (according to the ACM/IEEE curricula):	

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
		Computer Science, Information Technology, and Software Engineering. Some aspects of Information Systems and Computer Engineering are also touched but to a lesser extent.	
	Q5 – Curricular structure and pedagogical plan	The curricular structure displays an adequate articulation and corresponds to the competences that the School presents as the programme objectives.	The curriculum could be improved by a better coverage of some topics like numerical analysis, statistics, distributed systems, standard algorithms, file systems and I/O components in operating systems, and information systems.
	Q6 – Characterization of the contents of academic activity	The academic activities meant to knowledge acquisition and to capability training are enough for the intended Engineering education and match the Programme proposed goals.	
	Q7 – Outcomes	The Programme outcomes have been produced. The main weakness lies in the analysis skills which have space for improvement under the general framework of the Programme objectives.	Improve the oucomes in engineering analysis, mainly in more sophisticated algorithms, in statistical analysis and in software engineering conceptual tools.
3- Teaching staff	Q8 – Teaching adequacy	The coordinations of each course staff are considered globally adequate. The teaching staff is progressing towards a highly qualified team.	The main problems (naturally conditioned by the Ministry of Education's policy) with the teaching staff are the uneven age distribution, a very low staff renovation rate, and a strong bottleneck on the carrer.
	Q9 – Teachers implication in programme direction	The teachers' involvement and participation in the School causes are adequate.	
4- Students	Q10 – Admission, monitoring and evaluation of the students	The criteria for student admission and the follow-up and assessment systems are adequate.	Continuing effort in the reduction of school failure is needed.
	Q11 – Programme evaluation by students, recent graduates and employers	The assessment of the Programme by students, graduates and employers is credible and enables objective conclusions on the profile of the graduates and on suggestions for improvement.	
5- Facilities and resources	Q12 – Suitability of facilities	The facilities satisfy the Programme needs.	
	Q13 – Pedagogic facilities and resources	The pedagogic facilities and resources are adequate to the Programme needs.	
6- Ensuring quality	Q14 – Programme monitoring	The adoption and use by the School of the programme monitoring parameters are adequate, except for the graduate follow-up.	A more systematic follow-up of the graduates should be implemented.

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
	Q15 – Corrective actions and the quality plan	The way the Programme management uses the indicators reveals a systematic analysis effort and the measures implemented prove the determination to correct the issues identified.	

3 DECISION PROPOSAL

QUALITY ASSESSMENT TO GRANT THE EUR-ACE LABEL

(First Cycle of Bologna Framework)

Licenciatura em Engenharia Informática

from

Instituto Superior de Engenharia do Porto

of

Instituto Politécnico do Porto

Decision Proposal

In regard of the submitted dossier, having verified the prerequisites of the programme legitimacy, the adequacy of the qualification awarded, the appropriateness of the dossier organization and after the visit to the School, the Assessment Commission has the understanding that:

A1) With regard to education in the area of the Programme, the School has a satisfactory strategy.

A2) The Programme evolution has been satisfactory.

A3) Cooperation with other institutions is significant.

A4) The scope of the Programme and the competences to be obtained by the students are acceptable.

A5) The curriculum structure is acceptable with prescriptions.

A6) The academic contents are acceptable.

A7) The learning outcomes are acceptable with prescriptions.

A8) The teaching staff quality is acceptable with prescriptions.

A9) The involvement of teachers in the running of the course is satisfactory.

A10) The admissions system, the course monitoring and the students evaluation are acceptable with prescriptions.

A11) The evaluation of the course by students, recent graduates and employers is significant.

A12) Facilitites are acceptable.

A13) Pedagogic resources available are acceptable.

A14) The system for programme monitoring is acceptable.

A15) The School has a system for self-evaluation and corrective action under implementation. Such system is acceptable.

On the basis of such understanding, the Assessment Commission proposes the granting of the EUR-ACE label to the Licenciatura em Engenharia Informática of the Instituto Superior de Engenharia do Porto of Instituto Politécnico do Porto, for a period of six years from 2013-09-01 to 2019-08-31 within the framework of the Informatics Engineering specialty, with the following recommendations:

- The curriculum could be improved by a better coverage of some topics like numerical analysis, statistics, distributed systems, standard algorithms, file systems and I/O components in operating systems, and information systems.
- Improve the oucomes in engineering analysis, mainly in more sophisticated algorithms, in statistical analysis and in software engineering conceptual tools.
- The main problems with the teaching staff are the uneven age distribution, a very low staff renovation rate, and a strong bottleneck on the carrer.
- Continuing effort in the reduction of school failure is needed.
- A more systematic follow-up of the graduates should be implemented.

The Assessment Commission

Eng. Gabriel David

Eng. Ricardo Machado

Eng. Fernanda Pedro

Eng. José Manuel Ribas

November 7th, 2013

A11) The evaluation of the course by students, recent graduates and employers is significant.

A12) Facilitites are acceptable.

A13) Pedagogic resources available are acceptable.

A14) The system for programme monitoring is acceptable.

A15) The School has a system for self-evaluation and corrective action under implementation. Such system is acceptable.

On the basis of such understanding, the Assessment Commission proposes the granting of the EUR-ACE label to the Licenciatura em Engenharia Informática of the Instituto Superior de Engenharia do Porto of Instituto Politécnico do Porto, for a period of six years from 2013-09-01 to 2019-08-31 within the framework of the Informatics Engineering specialty, with the following recommendations:

- The curriculum could be improved by a better coverage of some topics like numerical analysis, statistics, distributed systems, standard algorithms, file systems and I/O components in operating systems, and information systems.
- Improve the oucomes in engineering analysis, mainly in more sophisticated algorithms, in statistical analysis and in software engineering conceptual tools.
- The main problems with the teaching staff are the uneven age distribution, a very low staff renovation rate, and a strong bottleneck on the carrer.
- Continuing effort in the reduction of school failure is needed.
- A more systematic follow-up of the graduates should be implemented.

The Assessment Commission

Eng. Gabriel David

Eng. Ricardo Machado

Eng. Fernanda Pedro

Eng. José Manuel Ribas

November 7th, 2013