ORDEM DOS ENGENHEIROS

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ENGINEERS PORTUGAL

QUALITY ASSESSMENT TO AWARD

THE EUR-ACE LABEL

(SECOND CYCLE - BOLOGNA PROCESS)

to

Mestrado em Engenharia Química
Integrated Master in Chemical Engineering
from

Instituto Superior Técnico

February 2015

SUMMARY

PART I - CONFORMITY ANALYSIS REPORT

1 PRELIMINARY DATA

1.1 Process identification

The Assessment Process for the Integrated Master in Chemical Engineering of Instituto Superior Técnico has been submitted to OE- Engineers Portugal on 27thJune 2014 in the framework of the Chemical 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 on 23thOctober 2003.

1.2 Procedure

The Review Team is constituted by:

Eng.º (president) Carlos Albino Veiga da Costa;
Eng.ª Cristina Maria dos Santos Gaudêncio Baptista;
EngºLuis Alberto Pereira de Araújo;
Eng.º António Salvador Pinheiro.

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

The visit took place on 28 and 29 January, 2015.

This process is a first submission of the Integrated Master programme to the EUR-ACE Assessment.

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:

- Prof. Arlindo Oliveira, IST President;
- Prof. Jorge Morgado, IST Academic Affairs Vice-President;
- Prof. Luis Oliveira e Silva, IST ScientificCouncilPresident;
- Profª. Raquel Aires de Barros, IST PedagogicalCouncil;
- Prof. Francisco Lemos, Head of Chem. Eng. Dept.;
- Prof. Sebastião Alves, Chem. Eng. Integrated Master Coordinator;
- Profª. Matilde Marques, Chem. Eng. Dept Academic Coordinator;
- Prof. João Bordado, Process Design Scientific Area Coordinator;
- Profª. NorbertaPinho, Engineering Sciences Scientific Area coordinator.

1.3 Recommendations made by the OE in previous assessments

On the 2003 process the final recommendations were:

1. Effort on the programme structure evolution. More active participation of the student in learning; strengthening of computer assisted teaching media and extensive use of the internet. To reduce contact class hours and reduce the number of subjects simultaneously
2. Reform the programme contents reinforcing the complementary components of the specialty;
3. Strengthening the Director / Coordinator figure on the management and coordination of matters and their teaching;
4. Reinforcement, by contracting or make an internal redistribution, technical staff.
5. Increase the number of opcional course units, including themes of environment, management and materials;
6. Improve the information in English on the internet;
7. Reduction of the permanent teaching staff and possible increase of the invited teaching staff;
8. Extension of the biennial operating system of couse units;
9. Increase the level of coordination among related disciplines of common programmes.

2 PREREQUISITES (PR)

PR 1 – LEGITIMACY OF PROGRAMME OPERATION

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

The Integrated Master Degree in Chemical Engineering, which resulted from the conversion according the Bologna Declaration of the Licenciatura in Engenharia Química do IST, was recognized by the Portuguese Government in February 2007. The curricular structure and the plan of studies were published in Diário da República, 2ª série – Nº 32 – 14 de Fevereiro de 2007 (despacho nº 2360/2007). In 2008, 2009, 2010, 2012 and 2013 there were slight changes in the curriculum following dispatches published in Diário da República: Despacho nº 22399/2008,Diário da República, 2ª série – Nº 167 – 29 de Agosto de 2008;Despacho nº 18555/2009, Diário da República, 2ª série – Nº 154 – 11 de Agosto de 2009; Despacho nº 19292/2010, Diário da República, 2ª série – Nº 251 – 29 de Dezembro de 2010; Despacho nº 7970/2012, Diário da República, 2ª série – Nº 112 – 11 de Junho de 2012; Despacho nº 10346/2013, Diário da República, 2ª série – Nº 151 – 7 de Agosto de 2013.

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

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:

Not applicable

Review Team statement on PREREQUISITE 1:

All legal and regulatory aspects related with programme operation are accomplished

PR 2 –PROCESS ORGANIZATION

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

The process was well organized and there is a table of contents in the report.

PR2.2 – On its sufficiency for the analysis:

The information in the report was sufficient to support a thorough analysis of the degree programme, enablers and results to be complemented and verified during the visit.

PR2.3 – On the identification of its origin:

The origin is well identified.

PR2.4 – On being supported by evidences:

All the critical issues could be analysed using reported evidence.

Review Team statement on PREREQUISITE 2:

The process was well organized and all the important elements were reported.

PR 3 – QUALIFICATION AWARDED

PR3.1 –Qualification awarded:

The Programme awards the qualification of Master in Chemical Engineering.

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

The Integrated Master in Chemical Engineering is a two-cycle integrated five-years programme. The 1st cycle is 6 semesters long and provides a 1st cycle degree in Chemical Engineering Sciences, which allows the student to either proceed to the 2nd cycle (which leeds to a Master Degree in Chemical Engineering) or to any other compatible 2nd cycle programme in a country that joined the Bologna Process.

PR3.3 –The admission criteria:

The admission exams are Matemathics A + Physics and Chemistry. The minimum classification is 10.0 (10 points in a 20 points scale) in each admission exam with a minimum global classification of 12.0 (12 points in a 20 points scale). This one is calculated with 50% weight, for both the final secondary school classification and for the admission exams classifications (25% Mathematics A + 25% Physics and Chemistry).

Review Team statement on PREREQUISITE 3:

The programe awards the qualification of Master in Chemical Engineering in an integrated 3+2 years arrangement. The minimum global classification for admission (12/20) is higher than the minimum (10/10) necessary to comply with Portuguese regulations.

3 REQUISITES

3.1 PROGRAMME FRAMEWORK

REQUISITE 1 – SCHOOL STRATEGY CONCERNING THE PROGRAMME

Q1.1 – Programme statute and starting date:

This programme started in September 2007 being slightly modified several times along time. Its present structure is in operation since September 2013. Within the Chemical Engineering Department it can be said that this is the anchor degree programme, with the larger number of students and involving most of the teaching staff and academic facilities.

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:

The differenciating characteristics offered by this programme are:

- strong education in basic and engineering sciences;
- comprehensive learning of the technologies associated with chemical engineering;
- quite complete process systems engineering education including mass and energy conservation networks, multiproduct and multiprocess systems, safety and utilities, integrated via an important preliminary design exercise that gives the opportunity to feel chemical engineering in practice and of training in dealing with ill-defined complex systems;

- to keep market recognition of the brand by its capability to produce graduates able to operate not only in companies posicioned in the tradicional chemical industry supply chain but also in related areas.

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:

The school identified in the report several competitive advantages that should be able to keep the atual attractiveness of the degree programme and to cope with the demographic threat that will be more visible after 2020. The other important recognised threat is the economic environment in Portugal and Europe which, if not overcome in the next coming years, will certainly deserve a special attention as it can negatively impact this degree programme. IST is dealing with those issues in its strategic thinking.

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

The institutional, pedagogic and finantial support of this degree programme, as far as they can be foreseen, will not affect its operation at least in the next six years, despite the identified main problems: renewal of the teaching staff and laboratories and research support.

Review Team statement on REQUISITE 1

This degree programme is certainly an anchor for the Chemical Engineering Department and for the School that is already very well positioned in the Portuguese education market and becoming more internationalised. For the next six years its sustainability will not be in danger.

REQUISITE 2 – PROGRAMME EVOLUTION

Q2.1 –Current designation:

Master in Chemical Engineering, since 2007.

Q2.2 – Previous designation:

Before the Bologna process Licenciate in Chemical Engineering assessed in 2003 (5 years) + Master in Chemical Engineering (2 years).

Q2.3 –Foreseen modifications:

The original structure published in 2007 with a 1st cycle in Engineering Sciences – Chemical Engineering (180 ECTS) and of the integrated Master (180ECTS+102CTS common for all students + 18 ECTS minors: 6 branches) was kept along the reported adjustements, as well as all the scientific areas and the credits allocated to each one.

So, only very small adjustements were made driven by the operation with the original plan.

Q2.4 – Future designation:

Master in Chemical Engineering

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

No other changes occurred.

Review Team statement on REQUISITE 2:

Degree programme evolution was driven firstly by the need to adapt to the Bolonha Process and to the Portuguese legislation (2007) and then by the feedback from the operation with the planned structure and contents (2008, 2009, 2010, 2012 and 2013)

REQUISITE 3 – COOPERATION WITH OTHER INSTITUTIONS

Q3.1 - Total number of relevant projects:

The number of projects related with this degree programme and running in 2013 is:
- 7 international;
- 102 national.

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

The number of projects related with this degree programme led by the school and running in 2013 were:
- 1 international;
- 30 national.

Q3.3 – Total number of relevant partnerships:

- Erasmus students exchange: 24 european higher education institutions;
- Double degree: university of Camerino (Italy) and university of S. Paulo (Brazil);
- Member of CUSTER;
- Industry: Compañia Española de Petroleos SAU (CEPSA); Fujifilm; GOVI Engineered Chemicals; Institut Français du Pétrole, EnergiesNouvelles; Petrobras; ProcessSystemsEnterpriseLimited; Raffinerie TOTAL Grandpuits; Panrico -

Produtos Alimentares SA; Solvay; Sisav; Biosog SA; Caima - Indústria de Celulose SA; CAPEC / TechnicalUniversityDenmark; Galp Energia SA; Iberol; ExideTecnologies Lda; EnkrottQuimica SA; Empresa Brasileira de Pesquisa Agropecuária – Embrapa; GlaxoSmithKline; Hempel; Fisipe; Resiquímica; CUF; REPSOL; CIPAN; Robcork; AtlanticCompounds; Complage; Adosrfoam; Vetroplas; Cecil; Companhia das Lezirias; Joiex; Portucel; Eurogalva; Hovione; Greanseal; Altachem; Fabrires.

Review Team statement on REQUISITE 3:

There is a large number of international and national cooperation both with higher education institutions and companies where students can spend a semester or find employement and where staff can find partnerships for research or knowledge transfer projects.

3.2 PROGRAMME OPERATION

REQUISITE 4 – SPECIFIC COMPETENCES AND MINIMUM REQUIREMENTS

Q4.1 – SCIENTIFIC AREA: Mathematical principles: Área Científica de Lógica e Computação + Área Científica de Matemáticas Gerais + Área Científica de Análise Numérica e Análise Aplicada + Área Científica de Probabilidades e Estatística - 6 + 27 + 4,5 + 6ECTS

The minimum requirements on mathematical principles for a Chemical Engineer are fulfilled and these courses are part of first cycle programme.

Q4.2 – SCIENTIFIC AREA: Physics and Biology principles: Área Científica de Físicas e Tecnologias Básicas + Área Científica de Ciências Biológicas -12 + 6 ECTS

The basic Chemical Engineering requirements on physics and biology are included in three different semester courses during the first and second year.

Q4.3 – SCIENTIFIC AREA: Chemistry principles: Área Científica de Síntese, Estrutura Molecular e Análise Química - 33 ECTS

The key scientific principles of chemistry are part of the syllabus of the five courses in this field (Chemistry I + II; Organic Chemistry I + II and Analytical Chemistry). The laboratory courses (Chemistry Laboratory I, II and III) allow illustrating these principles, including organic chemistry reactions. Skills and learning outcomes for the students should be better described.

Q4.4 – SCIENTIFIC AREA: ChemicalEngineeringsciences: Área Científica de Ciências de Engenharia Química – 67,5 ECTS

The minimum requirements in basic and engineering sciences are fulfilled in the courses included in this scientific area: thermodynamics, transport phenomena, chemical

reaction and separation processes. This will allow a systematic understanding of many of the key chemical engineering aspects by the end of the first cycle, and is complemented by experimental work in three laboratory courses. It is not very clear if it is required that students make an effort to integrate concepts. There is a need to better clarify learning outcomes.

Q4.5 – SCIENTIFIC AREA: Chemical Engineering Processes and Design: Área Científica de Engenharia de Processos e Projeto + Dissertação – 66 + 30 ECTS

The curriculum structure enables students hearing and learning about chemical processes from the very beginning of their studies (first year) and several courses in the second cycle consolidate this knowledge. In Dissertation, last semester, students carry out their project outside IST, in the industry or in a foreign research institute. There is a need to better clarify expected learning outcomes of each course. The minimum requirements in this scientific area are met in the 3rd year when students are introduced to process design, but it is mainly in the second cycle that a better knowledge of chemical processes is achieved. Working in teams, in Process Design courses, students have an opportunity to integrate knowledge and concepts during the design of an industrial process.

Q4.6 – SCIENTIFIC AREA: Multidisciplinary areas: Áreas Científicas de: Química Física, Materiais e Nano Ciências + Engenharia Biomolecular e de Bioprocessos + Engenharia e Gestão das Organizações + Opções – 12 + 7,5 + 4,5 + 18 ECTS

In the courses included in these scientic areas the minimum requirements on complementary and multidisciplinary Chemical Engineering areas are met.

Review Team statement on REQUISITE 4:

Curriculum structure is well organized and second cycle graduates should have the ability to analyse and understand chemical engineering problems, the ability to look for incomplete information for solving problems and use in daily work.

There is a need to better clarify learning outcomes in each course and cycle. An improvement in creativity skills may be achieved by including more open problems to be solved. This is expected to enable graduates to better understand and solve new problems.

REQUISITE 5 – CURRICULAR STRUCTURE AND PEDAGOGICAL PLAN

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

Discontinuities were not detected.

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

The curriculum structure is very broad fulfilling the principles of Chemical Engineering. To succeed in five years, in depth study of every subject is difficult to achieve. The main scientific areas are considered and insufficiencies were not detected.

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

The experimental work is carried out in teams. The number of students in each team ranges from 2-4. Although some experiments may require a 3 students' team, teams of 4 students in "Análise Química" will hardly enable students becoming acquainted with the apparatus and techniques.

In the experiments students follow detailed instructions leaving little opportunities for developing their creativity

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

Isolated topics with no continuity were not detected.

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

The number of seminars with guest speakers and field visits could be increased.
Among the optional courses, the students may choose the course "Seminários sobreinovação e desenvolvimento sustentável" which includes seminars by invited speakers.
Chemical Engineering students organize conference/meeting at IST on an annual basis.

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

There is a need to analyze the causes for the high failure rate recorded and the reasons for, on average, students spending more than 6 years to get the 2nd cycle diploma.

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

Many course syllabuses include information on previous knowledge required for attending, by listing previous courses in the curricular structure. Nevertheless, a formal precedence system is not implemented.
Limitations on registration are set in terms of a maximum number of ECTS per semester.
According to national criteria for Higher Education the "prescrição" system is enforced.

Review Team statement on REQUISITE 5:

Curriculum structure is well organized and second cycle graduates should have the ability to analyse and understand chemical engineering problems, the ability to look for incomplete information for solving problems and use it in daily work.
There is a need to better clarify learning outcomes and improve creativity enabling graduates to understand and solve new problems.

REQUISITE 6 – CHARACTERIZATION OF THE CONTENTS OF ACADEMIC ACTIVITY

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

The programme includes a first design course in the 3rd year (Dimensionamento de Equipamento) and later two design courses (Projecto de Engenharia Química I and II) where students work in teams to design a process under supervision. In the 4th year the curricular structure includes two other courses (Engenharia Química Integrada and Síntese e Integração de Processos) where, although not refered in the expected outcomes, design and an integrating perspective are included.

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

Communication competences, as well as team work, are developed by working in teams in every laboratory course as well as in design courses. Students/teams have to deliver reports and/or make oral presentations.

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

The lists of references in the syllabus include several books and encyclopedias in English. Journals in the library, as well as those available with b-on, are in English.
Courses in the 4th and 5th year are taught in English when Erasmus students are enrolled.

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

Fourth year students organize an annual three-day meeting, JEQ- Jornadas de Engenharia Química, with talks, workshops and field visits to chemical plants.
Students also take part in the activities the Chemical Engineering Department organizes to welcome high school students (Open Labs) and introduce them to Chemical Engineering.

Although these activities may not be ranked as “engineering activities” it is relevant to mention them.

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

In the report, and during the visit, it was not clear students are encouraged to be creative. The experimental work carried out in laboratory courses, following the protocols for each experiment, it is not expected to develop their critical skills and to manage difficult situations.

Review Team statement on REQUISITE 6:

The knowledge transfer activities and skills development meet the minimum requirements for a Chemical Engineer and comply with the objectives set for the programme.

REQUISITE 7 – OUTCOMES

Comments on the following Learning Outcomes:

Q7.1 – KNOWLEDGE AND UNDERSTANDING

Evidences	**Documental analysis:** Course content; exercises in fundamentaltopics; exams ; tools for surveys	**Personal Interviews:** Motivation for learning; fundamental knowledge; attitude; critical perception; capacity of decision making
Comments	Courses’ contents are described but information on outcomes not evidenced. Exams were provided. Reports from Projecto de Engenharia Química II enabled understanding the difficulty involved in the process design case study.	According to the teachers the students leave or accumulate on the 1st and 2nd year due to the large difference between the learning processes and compliance with proficiency levels at high-school and college. Students recognize that they grow while studying Chemical Engineering. Teachers reported that the autonomy and student motivation improves in the 4th and 5th year.

Q7.2 – ENGINEERING ANALYSIS

Evidences	**Documental analysis:** Course content; technical exercises; case studies; tools for surveys ; work plans ; exams	**Personal Interviews:** Motivation for technical issues; structured mind; ability to speculate; critical perception, prediction skills; experience in diversity; attraction for innovation;
Comments	The curriculum and course content include scientific principles of engineering conferring ability to solve engineering problems, understand and	Students acknowledged they would like to have more hands-on classes and more field visits to get to know the industry better.

	analyse engineering processes in traditional and emerging fields. Work plans and exams are adequate.	

Q7.3 – ENGINEERING DESIGN

Evidences	**Documental analysis:** Course content; case studies; R&I&D research projects; extra-curricular projects. group discussions; work reports;	**Personal Interviews:** Holistic perception and knowledge; creativity; objectiveness; data processing ability; persistency; capacity of doing
Comments	In several courses, students work in teams to design equipment or a process. In the final year design project students have to search for data and information on the process. The reports are assessed by a jury.	The interviews with students and teachers were not enlightening about how critical thinking was developed and creativity exercised. Students referred they are well prepared in terms of working capacity.

Q7.4 – INVESTIGATIONS

Evidences	**Documental analysis:** R&D project track record; fundamental knowledge; capacity to search and process information; problem group discussion; structured mind; modeling; laboratory work;	**Personal Interviews:** Learning attraction; objectiveness; strong basic knowledge; strong reasoning ability attraction for innovation and discovery; persistency; hands-on personality
Comments	The curricular structure provides students with enough information and knowledge on how to pursue research and search for data and information. Mathematical modelling skills are developed during the master programme.	The students interviewed showed a good engineering background, to be persistent and with hands-on profile.

Q7.5 – ENGINEERING PRACTICE

Evidences	**Documental analysis:** Course content; case studies; stimulated discussions; survey tools; practical presentations; field trips; laboratory work. problem solving	**Personal Interviews:** Applications experience; a broad knowledge of Engineering; ability to synthesize; objectiveness; persistency.
Comments	Course content includes information on the use of materials, computer modelling, equipment and laboratory experiments. Limited number of field trips.	Both academic staff and students mentioned the limited number of field trips. Students who carry out "Dissertação" in the industry improve engineering skills. Several students said the number of

		optional courses should be higher.

Q7.6 – TRANSFERABLE SKILLS

Evidences	**Documental analysis:** Management courses; group work reporting; individual work reporting; work presentations; leadership techniques disciplines; communication techniques disciplines; organization of seminars; reporting in foreign languages	**Personal Interviews:** Management driven; self-confidence; leadership competences; communication competences; foreign language skills;
Comments	Individual work is carried out in "Dissertação". In other courses students work in group. Students develop communication skills, but it is not clear human resources skills and leadership are practiced.	Students were fluent in English. One student acknowledged that he developed a team attitude by practicing rugby rather than as a student.

Q7.7 – INDIVIDUAL ATTITUDE

Evidences	**Documental analysis:** Group work reports; Discussion group reporting; oral presentation of activity; seminar organization	**Personal Interviews:** open mindedness; capacity to adapt to new environments and problems; cultural knowledge; understanding of other cultures
Comments	Along their studies students carry out work in groups and write down reports and give oral presentations. Some students take part in seminars organization and "Open Labs".	Some students go abroad for their "Dissertação". The Chemical Engineering Department welcomes foreign students and Portuguese students also make use of students' exchange programmes.

Review Team statement on REQUISITE 7:

Although the outcomes to be achieved are not mentioned, and knowledge and skills attained by students in engineering analysis, engineering design, engineering practice, research and transferable skills are not referred, a solid knowledge and background in Chemical Engineering is, in general, achieved.

3.3 TEACHING STAFF

REQUISITE8 – TEACHING ADEQUACY

The survey on the Teaching Staff suggests the following comments:

Q8.1 – On the Teaching Staff qualification:

The qualification of the teaching staff is high, at the least they are assistant professors

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

The teaching staff is very mature and there is none in the qualification phase

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

The advanced age of most of the teaching staff appears as a weakness, since the replacement due to jubilation of each member, may have to occur in a short years span.

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

Although the formal mentoring and tutoring systems that are in place are not functioning very well, the students report to have easy access to teachers, for clarifications, doubts and counselling for most of the curricular units.

Review Team statement on REQUISITE 8:

The teaching staff seems to form a good and qualified team, although their advanced average age could be a threat if corrective measures are not taken in time.

REQUISITE 9 – TEACHERS IMPLICATION IN PROGRAMME DIRECTION

The teachers panel was composed by

Name	Degree	Category	Position	Courses	Dedication
Pedro Santos	PhD	Assistant Prof		Organic Chemistry I	100%
Vitor Geraldes	PhD	Assistant Prof			100%
Cristina Fernandes	PhD	Assistant Prof		Process Synthesis and Integration	100%
Carla Pinheiro	PhD	Assistant Prof		Advanced Process Control System Dynamics and Process Control	100%
Joana Correia	PhD	Assistant Prof		Biofuels Athmosferic Pollution and Gaseous Effluent Treatment	100%
Eduardo Filipe	PhD	Assistant Prof			100%
Carlos Henriques	PhD	Associate Prof		Catalysis and Catalytic Processes Integrated Chemical Engineering Chemical Engineering Project I and II	100%

Q9.1 –Teachers testimony highlight the following aspects:

Q9.1.1–Quality of the admitted students:,

Quality is high, one of the best in Portugal.

Q9.1.2 –Student learning:

Despite their quality, some of them have difficulties in some of the first three years curricular units.

Q9.1.3 – Funcionality and quality of the facilities and pedagogical means

Considered good.

Q9.1.4 –Programme coordination:

Works well.

Q9.1.5 –Implemented actions by suggestion of teachers or students:

Besides the councils where according to the Portuguese law and IST by laws the teaching staff occupies places: representants, scientific and pedagogic councils, there are other structures at the department level where that participation also occurs.

The quality assurance system also contributes to detect opportunities of improvement.

The self evaluation report shows various examples of actions that were confirmed during interviews.

Q9.1.6 –Use by the students of the tutorial periods:

Only a small part of the students use these periods.

Q9.1.7 –Pedagogical assessment by the students:

Considered important and fair.

Q9.1.8 –Support for scientific and pedagogical updating:

There is support for scientific updating through research but there is no formal pedagogic support for teaching staff.

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

Q9.2.1 –The existing kind of cooperation.

The environment among teachers is good and cooperative.

Q9.2.2 – The working conditions.

Working conditions are good except in which concerns the difficulties in opening places for associate and full professor.

Q9.2.3– The financing and teachers availability for research and publication.

Due to the crisis financing was reduced although most teachers continue available to do research and to publish their results.

Review Team statement on REQUISITE 9:

Teaching staff have opportunities to suggest improvements and there are evidences of actions that took place with that origin.

There are difficulties to find higher career positions and there is at least no formal support for pedagogics.

3.4 STUDENTS

REQUISITE 10 – ADMISSION, MONITORING AND EVALUATION OF THE STUDENTS

Q10.1 –Admission of candidates to Engineering Higher Education

Q10.1.1 – Admission conditions on the last 5 years:

The minimum classifications have been referred at PR3.3 (see above).
Actual classifications during the last years have been stable, being the average about 16 and minimum about 15 both in a scale of 0 to 20. These are high classifications if compared with other similar schools in Portugal.

Q10.1.2 – Weaknesses in the students' previous knowledge:

According with the opinion expressed by the professors teaching the first years of the programme, students coming from the secondary school show an acceptable level of knowledge, although they have not yet developed the working methods required by an university programme.

Q10.1.3 – Transfer conditions of students from other schools:

The admission of a candidate to the last 2 years of the programme is done taking into consideration the classifications of the candidate and the similarity between its 1st cycle completed and the 1st. cycle of this programme.
There is a table, fixing the requirements for propaedeutic curricular units, according to the school where the students have done the 1st. cycle

Q10.1.4 – Criteria to fill the available places:

The available places are filled according to students marks.

Q10.2 – Student follow-up and support

A tutorial system is implemented but, according to the interviews, this system is not followed by a significant number of students, due to their lack of will.
According to the interviews, the relationships between teachers and students are normally close and good, allowing the follow-up of the students.

Q10.2.2 – Optional foreign language courses and artistic and leisure activities:

Some lectures are in English.
Artistic and leisure activities are available, although interviews revealed that the intensity of the curricular works does not leave enough time to profit from these offers.

Q10.2.3 – Internal dissemination of information on academic and cultural activities:

Evidences of sufficient information were found

Q10.2.4 – Activities stimulating the professional exercise:

There are lectures given by professionals coming from the outside and visits to industries, although from the interviews came the perception that this kind of activities should be increased.

Q10.2.5 – Assessment of student expectation satisfaction:

A system of assessment based in questionnaires is implemented and it seems satisfactory

Q10.2.6 – School answer to student expectations:

Generally the students who succeded to complete the programme find it as fulfilling their expectations

Q10.3 – Student assessment

Q10.3.1 – Student assessment system.

Student assessment is based on tests and projects and it seems adequate.

Q10.3.2 – Assessment of design or integration assignments:

Classification is done by a jury taking into account the scientific and technical quality, the quality of the report, the quality of the public presentation and of the public defense of the work.

Q10.3.3 – School failure:

The number of the students who do not finish the course is significant (30-40%)

During the first years there is a significant percentage of students (up to 40 %) who do not attend the tests. The teachers refer that students are normally too ambitious when choosing yearly the number of curricular units and afterwards they fail to keep the required involvement.

According to the interviews, during the early years many students find that they made a wrong choice selecting the programme. The intensity of the work required, especially during the early years, is certainly a factor that accentuates this feeling.

The teachers sustain that these difficulties are required to select the really apt ones.

Q10.3.4 – Student assessment in nontraditional contexts:

It is done according the Quality Assurance System

Review Team statement on REQUISITE 10:

The selection of the students is based in classifications and it is adequate.

Students' assessment during the programme is adequate.

The intensity of the work creates problems to the students, especially during the first years, and a significant percentage leaves the programme during these years, which is considered by the teachers as a normal situation in terms of selection of the apt ones.

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

Q11.1 – Assessment by students

The students present in the panel were:

Year	Average	Name
4	16.33	Ana Teresa Fialho Batista
Grad.	15	Bernardo Horta Barros
4	14	Rita Almeida Lino
Grad.	16	Ana Catarina Braz
5	13	Filipe António Henriques Rego

Q11.1.1 – Consequences of the assessment of teachers by students:

According to the interviews, the existing system of assessment is adequate.
In case of persistence of students' failure, the discipline is assessed by the Pedagogical Council.

Q11.1.2 – Safety measures in the exams:

The measures are adequate

Q11.1.3 – Pedagogical questionnaire results dissemination:

It was found adequate.

Q11.2 – Assessment by former students

The former students panel was:

Name	**Company**	**Position**
Manuela Cipriano Messias	Nutrinveste Sovena	CFO
Marta Silva	Galp Energia	Flow Assurance & Process Engineer
José Relvas	Hovione Farmaceutica	Process Chemist /Engineer
Bernardo Fialho Reis	Philip Morris International	Brand Builder

Q11.2.1 – Graduates influence in the School:

The school tries to keep connections with the graduates. Initiatives as alumni day and employment assessments are examples of initiatives with this purpose. Inquiries to the graduates are done at a regular basis, with a good rate of answers.

Q11.2.2 – Graduates opinion:

During interviews the graduates have expressed quite positive opinions concerning the education acquired in the school, both in the fields of knowledge and methodology to solve problems. They have not stated any problems concerning the adjustement to the professional environment. Some referred that the programme should include more specific curricular units (polymers was an example), but these opinions should be viewed as personal and not considered as a real need.

Q11.3 – Assessment by employers

The employers present were:

Name	Company	Position
Paulo Araújo	CUF QI	Head, Technology, Process Engineering & Develop.
Bernardo Fialho Reis	Philip Morris International	Brand Builder
Susana Mega Madeira	Galp Energia	Research &Technology
Jorge Moniz	Resiquímica	Research & Development
Maria José Silva Neto Sobrinho Dias	Panrico	Quality Manag. and R&D

Q11.3.1 – Participation of employers in their graduate employees' assessment:

Due to their position as supervisors of engineers, all the employers' representatives present at the interviews are in good conditions to evaluate recent graduates. Participation of the employers' representatives in the assessment of the graduates is not fully implemented.

Q11.3.2 – Employers opinion:

During interviews, all the employers stated experiences with recent graduates and expressed quite favorable opinions.

High level of technical qualifications, persistence, capacity to solve problems and easy integration in teams were the most quoted qualities.

Review Team statement on REQUISITE 11:

During interviews graduates and employers have shown a quite favourable opinion about the programme and considered the education acquired by the graduates as quite suitable to the requirements of the professional activity. The school should improve the methods to systematically collect the opinions the employers

3.5 FACILITIES AND RESOURCES

REQUISITE 12 – SUITABILITY OF FACILITIES

Q12.1 –Premises size and comfort degree:

Permises size and confort are quite acceptable.

Q12.2 –Acoustic and visual conditions:

Accoustic and visual conditions are appropriate

Q12.3 –Cleanness and condition:

Cleanness and condition are proper.

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

There is a maintenance programme.

Review Team statement on REQUISITE 12:

Facilities are suitable.

REQUISITE 13 – PEDAGOGIC FACILITIES AND RESOURCES

Q13.1 – Comments on the laboratories facilities and use

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

Quantity of lab equipment is appropriate but some equipment needs replacement

Q13.1.2 –Equipment stowage:

Not applicable

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

There is a maintenance programme

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

At least in the lab there are no visible emergency procedures and safety plans.

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

There is no visibility for the use of the safety system but apparently some instructions do exist.

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

In which concerns gas bottles there were several not attached to a fixed structure in various labs we visited.

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

There are fixed schedules for lab classes always in the presence of a teacher.

Q13.1.8 –Lab assignments list and goals:

Each lab curricular unit has its own assignements and goals.

Q13.1.9 –Quantity and quality of the practical lab assignments:

Quantity and quality of lab assignements is appropriate.

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

Reports that we sampled are of good level.

Q13.2 – Comments on the Library facilities and use

Q13.2.1 –Quality of the journals, publications and e-publications:

Good. There are almost no e-books.

Q13.2.2 –Use conditions:

Good

Q13.2.3 –Reading, information research, and reproduction equipment:

Good

Q13.2.4 –Reading room for students:

Enough space.

Q13.2.5 –Shelves size:
Around 2 meters high

Q13.2.6 –Opening hours:
8:00 to 20:00

Q13.3 – Comments on IT support

Q13.3.1 –Student access to IT means relevant for the Programme:
There are several rooms were students can use computers and licensed applied software

Q13.3.2 –Wireless network:
Good

Q13.3.3 –Available software:
MatLab, Aspen, Fluent, etc.

Q13.3.4 –Manuals:
They are available in the rooms.

Q13.4 – Support facilities

Q13.4.1 –Student access and stay in the facilities:
Have access during classes' hours and can stay in study rooms.

Q13.4.2 –Eating places, stationer's, study rooms, meeting rooms:
Good and enough

Q13.4.3 –Teachers' and technical staff's offices:
Good

Q13.4.4 –Volunteer engineering work:
Studends volunteer to help with demonstrations in the laboratories during "Open Labs" organized by the Department to introduce high-school students to Chemical Engineering and they organize annual conference/workshop (JEQ).

Q13.4.5 –Sports facilities:
Available inside the premises and in other locations.

Q13.5 – Subcontracting

Q13.5.1 –Agreements/protocols complementing the Programme:
NA

Review Team statement on REQUISITE 13:

IT support, libraries and support facilities are good. Lab space is appropriate, some equipment needs renewal and safety needs a complete review.

3.6 ENSURING QUALITY

REQUISITE 14 – PROGRAMME MONITORING

The School has a sound Quality Assurance Management System which includes the MIEQ.
For several years now this quality assurance management system is operational and giving results that after analysis produce feed backs that are followed.

Q14.1 – Performance indicators used by the School:

The main instruments to manage the teaching quality in IST are:
- System QUC- "Qualidade das UnidadesCurriculares" (Quality of the Curricular Units) , which includes procedures to evaluate the performance of the teachers.
- R3A – "RelatóriosAnuais de Autoavaliação" (Yearly Self Evaluation Reports)

Both are part of the quality system of the School (SIQuIST), which was accredited in January 2013 by the A3ES -"Agência de Avaliação e Acreditação do Ensino Superior" (Agency for Evaluation and Acreditation of Higher Education)

Q14.2 – Characteristics of school failure:

The School has been reporting increased level of quality and professional success for students that finish the study cycle, the price to pay for this is the failure in several more difficult curricular units.

Q14.2.1 –Programme adequation to its actual population:

The balance between the difficulty to improve quality and reasonably low difficulty to avoid excessive failure was the aim of the responsibles,

Q14.2.2 –Effect of the acess conditions, pedagogical methods, and teachers performance:

The study cycle enrolls students with high level marks

Q14.2.3 –Effects of the yearly variation of the population:

Nothing is worth to mention

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

Nothing is worth to mention

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:

The School has a broad connection with academic world in Portugal and abroad, also with the industrial world in Portugal and even in some cases abroad.

Q14.3 – Conclusion of other assessments

Q14.3 1 –Conclusions from the assessment by FUP/CCISP/APESP/A3ES:

At paragraph 1.3 of this report are mentioned conclusions of the assessment by Ordem dos Engenheiros (Engineers Association of Portugal) in 2003 and it can

be assumed that the current programme took into consideration the remarks produced in 2003
Assessment by A3ES will take place in 2015.

Q14.3.2 –Conclusions from the R&D units assessment (FCT):
The conclusions of 2014 FCT Assessment are not yet public

Review Team statement on REQUISITE 14:

The School and therefore the MIEQ, which is here under scrutiny, have a sound Quality Assurance Management System in place.

REQUISITE 15 – CORRECTIVE ACTIONS AND THE QUALITY PLAN

Q15.1 –Comments on the quality improvement plan:

Questionaires are filled by the students every semester and also by teachers and coordinators.

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

Throughout the School every concerned people is involved in the cycle of preparation, evaluation and follow up of quality improvement subjects.

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

The results of the questionaires are taken into consideration

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

The Direction of the School follows the results produced by the quality management system.

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

Concerning the assessment of 2003 referred in paragraph 1.3 of this report all recommendations seemed to have been taken into consideration.
Assessments conducted by other entities were not analysed by the present commission

Review Team statement on REQUISITE 15:

The Quality Assurance Management System produces recommendations that are followed

PART II - SUMMARY OF EVALUATION AND DECISION PROPOSAL

(BY THE ASSESSMENT COMMISSION)

1. SUMMARY TABLE 1

PREREQUISITE	ACCEPTABLE	ACCEPTABLE WITH PRESCRIPTIONS	UNACCEPTABLE
Legitimacy of the functioning of the course (PREREQUISITE 1)	Yes		
Organization of the process (PREREQUISITE 2)	Yes		
Qualification awarded (PREREQUISITE 3)	Yes		

REQUISITE		ACCEPTABLE	ACCEPTABLE WITH PRESCRIPTIONS	UNACCEPTABLE
1. Course framework	1.1 - Strategy of the Higher Educational Institution regarding Education in the area of the Course (REQUISITE 1)	Yes		
	1.2 - Course evolution (REQUISITE 2)	Yes		
	1.3 - Cooperation with other institutions (REQUISITE 3)	Yes		
2. Course functioning	2.1- Specific competences and minimum requirements (REQUISITE 4)	Yes		
	2.2 - Curriculum structure and pedagogic programme (REQUISITE 5)	Yes		
	2.3 - Characterization of the content of academic activities (REQUISITE 6)	Yes		
	2.4 – Outcomes (REQUISITE 7)	Yes		
3. Teaching Staff	3.1 - Teaching adequacy (REQUISITE 8)	Yes		
	3.2 - Involvement of the teachers in the running of the Course (REQUISITE 9)	Yes		
4. Students	4.1 - Admission, monitoring and evaluation of the students (REQUISITE 10)	Yes		
	4.2 - Evaluation of the Course by students, recent	Yes		

REQUISITE		ACCEPTABLE	ACCEPTABLE WITH PRESCRIPTIONS	UNACCEPTABLE
	graduates and employers (REQUISITE 11)			
5. Facilities and Resources	5.1 - Suitability of premises (REQUISITE 12)	Yes		
	5.2 - Pedagogic resources (REQUISITE 13)		X	
6. Ensuring Quality	6.1 - Course monitoring (REQUISITE 14)	Yes		
	6.2 - Corrective actions and quality plan (REQUISITE 15)	Yes		

2. SUMMARY TABLE 2

PREREQUISITE	ANALYSIS	RECOMMENDATION
Legitimacy of the functioning of the course (PREREQUISITE 1)	All legal and regulatory aspects related with programme operation are acomplished	
Organization of the process (PREREQUISITE 2)	The process was well organized and all the important elements were reported	
Qualification awarded (PREREQUISITE 3)	The programe awards the qualification of Master in Chemical Engineering in an integrated 3+2 years arrangement. The minimum global classification for admission (12/20) is higher than the minimum (10/10) necessary to comply with Portuguese regulations.	

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
1. Course framework	1.1 - Strategy of the Higher Educational Institution regarding Education in the area of the Course (REQUISITE 1)	This degree programme is certainly an anchor for the Chemical Engineering Department and for the School that is already very well positioned in the Portuguese education market and becoming more internationalised. For the next six years its sustainability will not be in danger.	
	1.2 - Course evolution (REQUISITE 2)	Degree programme evolution was driven firstly by the need to adapt to the Bolonha Process and to portuguese legislation (2007) and then by the feedback from the operation with the planned structure and contents (2008, 2009, 2010, 2012 and 2013)	
	1.3 - Cooperation with other institutions (REQUISITE 3)	There is a large number of international and national cooperation both with higher education institutions and companies where students can spend a semester or find employement and where staff can find partnerships for research or knowledge transfer projects.	

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
2. Course functioning	2.1- Specific competences and minimum requirements (REQUISITE 4)	The minimum requirements on specific competences for a Chemical Engineer are fulfilled.	These requisites should be better evidenced by changing the wording used in the syllabuses to comply with that used in the Eurace framework (skills and learning outcomes).
	2.2 - Curriculum structure and pedagogic programme (REQUISITE 5)	Curriculum structure is well organized and second cycle graduates should have the ability to analyse and understand chemical engineering problems, the ability to look for incomplete information when solving problems	There is a need to better clarify the expected learning outcomes in terms of knowledge and skills attained by students in: in engineering analysis, design, engineering practice, research and transferable skills. To include more open problems to to improve creativity skills enabling graduates to understand and solve new problems.
	2.3 - Characterization of the content of academic activities (REQUISITE 6)	The knowledge transfer activities and skills development meet the minimum requirements for a ChemicalEngineer and comply with the objectives set for the programme.	

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
	2.4 – Outcomes (REQUISITE 7)	Although the outcomes are not mentioned in the courses syllabuses a solid knowledge and background in Chemical Engineering is, in general, achieved.	Change the wording used in the syllabuses to comply with that used in the Eur-Ace framework (skills and learning outcomes)
3. Teaching Staff	3.1 - Teaching adequacy (REQUISITE 8)	The teaching staff seems to form a good and qualified team, although their advanced average age could be a threat if corrective measures are not taken in time.	Plan for replacements of retirements in time
	3.2 - Involvement of the teachers in the running of the Course (REQUISITE 9)	Teaching staff have opportunities to suggest improvements and there are evidences of actions that took place with that origin. There are difficulties to find higher career positions and there is no at least no formal support for pedagogics.	To develop policies for opening career positions. To develop formal support for pedagogics.
4. Students	4.1 - Admission, monitoring and evaluation of the students (REQUISITE 10)	The selection of the students is based in classifications and it is adequate. Students' assessment during the course is adequate. Although the admission classifications are high, there is a significant percentage of students leaving the program during the first years, being this situation	The high percentage of students leaving the program during the first years is an issue which should be object of deeper analyses and discussion by coordinators

GROUP	REQUISITE	ANALYSIS	RECOMMENDATION
		considered by the teachers as a normal process of selection	
	4.2 - Evaluation of the Course by students, recent graduates and employers (REQUISITE 11)	During interviews graduates and employers have shown a quite favourable opinion about the programme and consider the education acquired by the graduates as quite suitable to the requirements of the professional activity.	The school should improve the methods to systematically collect the opinions of the employers and to follow the graduates' careers during their first years of professional activity.
5. Facilities a Resources	5.1 - Suitability of premises (REQUISITE 12)	Facilities are suitable	
	5.2 - Pedagogic resources (REQUISITE 13)	IT support, libraries and support facilities are good. Lab space is appropriate, some equipment needs renewal and safety needs a complete review.	Safety needs a complete review
6. Ensuring Quality	6.1 - Course monitoring (REQUISITE 14)	The School and therefore the MIEQ, which is here under scrutiny, have a sound Quality Assurance Managemer System in place.	
	6.2 - Corrective actions and quality plan (REQUISITE 15)	The Quality Assurance Management System produces recommendations that are followed	

3. DECISION PROPOSAL

QUALITY ASSESSMENT TO GRANT THE EUR-ACE LABEL

INSTITUTO SUPERIOR TÉCNICO DA UNIVERSIDADE DE LISBOA

ENGINEERING COURSE *(Master on Chemical Engineering)*

Decision Proposal

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

A1) With regard to Education in the area of the course, the School has a *satisfactory* strategy

A2) The course evolution has been *satisfactory*

A3) Cooperation with other institutions is *significant*

A4) The scope of the course and the competencies to be obtained by the students are *acceptable*

A5) The curriculum structure is *acceptable*

A6) The academic contents are *acceptable*

A7) The Learning Outcomes are *acceptable*

A8) The teaching staff quality is *acceptable*

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*

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

A12) Facilitites are *acceptable*

A13) Pedagogical resources available are *acceptable with prescriptions*

A14) The system for course monitoring is *acceptable*

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

On the basis of such understanding, the Assessment Commission PROPOSES the granting of the EUR-ACE LABEL to the MASTER on Chemical Engineering of the Instituto Superior Técnico

da Universidade de Lisboa, for a period of six years, within the framework of the Chemical and Biological Engineering with the following recommendations:

- change the wording used in the syllabuses to comply with that used in the Eur-Ace framework (skills and learning outcomes);
- there is a need to better clarify the expected learning outcomes in each course, improve creativity ability by including more open problems, enabling graduates to understand and solve new problems.
- develop policies for opening career positions;
- develop formal support for pedagogics;
-analize and internally discuss the issue of the high percentage of students who do no finish the program
-improve the methods to collet the opinions of employers and to follow the young graduates

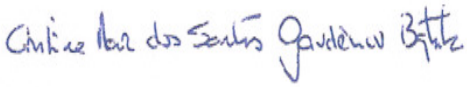
and the following prescription:

- safety in the premises, namely in the laboratories, needs a complete review;

The Assessment Commission

Eng.º Carlos Albino Veiga da Costa

Eng.º António Salvador Pinheiro



Eng.ª Cristina M. S, Gaudêncio Baptista

Eng.º Luís Alberto Pereira de Araújo

25, March, 2015