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15 years of IChemE-accredited degrees at the University of Santiago de Compostela: A description of the motivation, journey, and output

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ABSTRACT

The accrediting scheme by the Institution of Chemical Engineers (IChemE) constitutes an international reference for the specific accreditation of chemical engineering programmes in higher education. The promoters of the initial 5-year chemical engineering programme at the University of Santiago de Compostela (USC) identified such scheme as a very attractive value for the continuous improvement of the programme as well as concomitantly for the skills set and employability of its graduates, getting accredited for the first time in 2010 (and renewed in 2013). In adapting this 5-year programme to a sequence of bachelor + master programmes under the Bologna process in the early 2010s, the design of the new programmes was carefully performed to balance adequately the requirements of a considerably regulated framework for the studies of chemical engineering at the Spanish legislative level and the requirements more connected with the chemical engineer profession emphasised by the IChemE accrediting guidelines. The IChemE accreditation has been successfully achieved (2018) and renewed (2024) by both the Bachelor's Degree in Chemical Engineering and the Master's Degree in Chemical Engineering and Bioprocesses at USC, and it has acted not just as a seal of added value but also as a key driving force in keeping the continuous improvement wheel turning. This has been particularly manifested in aspects such as the introduction in the programmes of new content aligned with the new worldwide trends in the field of chemical engineering, and the growing importance given to embedded cultural learning associated with e.g. ethics, sustainability, health and safety, or diversity.

1. Introduction

Accreditation is a solid pillar of the higher education foundation as it guarantees that institutions meet specific quality standards, ensuring the credibility of the education provided and therefore helping students to make informed decisions about their educational choices. It also improves the intrinsic value of a degree, as employers might value candidates who have graduated from accredited institutions. Besides, accreditation promotes continuous improvement in educational practices as the related auditing procedure encourages the continuous assessment of the programmes, identifies areas for improvement, and implements necessary changes.

Concerning university degrees accreditation, several types of schemes are available and the reasons and motivations to go for one or/and another are different. In Spain, university degrees must undergo periodic institutional re-accreditation by the Council of Universities, via an assessment managed by the Spanish Agency for Quality Assessment and Accreditation (ANECA)[1] or the equivalent regional agencies with delegated functions. Such re-accreditation process ensures that degrees meet the objectives established in their initial design, which granted them official status, and that their outcomes contribute effectively to student development and the achievement of educational goals. This process may be conducted as an individual evaluation of each degree, or collectively for the entire set of degrees belonging to a given school if this school has obtained a so-called "institutional accreditation" (regulated initially by Royal Decree 420/2015[2] and later by Royal Decree

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[1] https://www.aneca.es/en/degrees-evaluation-of-university-education

[2] Royal Decree 420/2015, May 29th, for the creation, recognition, authorisation, and accreditation of universities and university centres [https://www.boe.es/eli/es/rd/2015/05/29/420]

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640/2021[3]). Such "institutional accreditation" must be preceded by the certification of an Internal Quality Assurance System (IQAS) of the school/faculty by a quality agency registered in the European Quality Assurance Register for Higher Education. In the particular case of the USC School of Engineering, which is home to both the bachelor's and master's programmes in Chemical Engineering of the USC, the original award of the "institutional accreditation" was in 2019 (after having certified the implementation of the IQAS in 2016), and its renewal after the 6-year period of validity is expected to occur before the end of 2025 (once the IQAS certification has been already renewed in 2024).

In addition to official accreditation by the corresponding national authority, there are also specialised accreditations that focus on specific programmes or fields of study. In this sense, the Institution of Chemical Engineers (IChemE) is an institution of recognised prestige in the field of chemical engineering at international level that has developed and manages an accreditation system for chemical engineering programmes, both undergraduate and master's degrees.[4] Besides, the European Network for Accreditation of Engineering Education (ENAEE) promotes quality engineering education across Europe and beyond by means of the EUR-ACE® (European Accreditation of Engineering Programmes) label[5], while ABET[6] accredits college and university programmes in the disciplines of applied and natural science, computing, engineering, and engineering technology at the associate, bachelor's, and master's degree levels.[7] These accreditations ensure that the programmes meet industry-specific standards and provide students with the necessary knowledge and skills. In Spain, according to López-Pérez et al. (2023), 24 chemical engineering degrees were accredited by one of these international schemes as of 2023: 21 had obtained the EUR-ACE label, 2 the IChemE accreditation, and 1 the ABET accreditation; which is clear evidence of the increasing value that the Spanish institutions are giving to such accreditation systems, taking into account that just 5 years earlier only 7 out of the 44 chemical engineering degrees taught in Spain were internationally accredited (Feijoo et al., 2018).

Regardless of the accreditation scheme, the accreditation process typically involves a self-assessment conducted by the educational institution, followed by an external evaluation by a team of experts which implies documental revision and on-site visit to the facilities, where the experts thoroughly review and audit the real practices around the curriculum. Afterwards, the experts submit a report with their findings and recommendations to the accrediting body, which finally decides on granting the accreditation to the degree(s). The whole process can only be a success if all the entire university community involved in the degree(s) contributes to it. This article presents the story of how the different chemical engineering degrees of the University of Santiago de Compostela (USC) have experienced the accreditation and subsequent re-accreditation processes under the IChemE scheme in a context of constraints derived from the regulatory framework in Spain for the studies of chemical engineering and professional development of the chemical engineers, where the recognition by international standards is playing an important role.

2. Accreditation schemes in chemical engineering in Spain

2.1. The EUR-ACE® label

EUR-ACE®, the European quality label for engineering degree programmes at bachelor's and master's levels, is widely implemented in Europe, where, according to Haro et al. (2023), more than 550 programmes are accredited in at least 9 different countries. The EUR-ACE® accreditation process is aligned with the European Qualifications Framework, which means that only bachelor's degrees with a duration of 3–4 years and master's degrees with a duration of 1–2 years are eligible. The EUR-ACE® label is valid (and common) for all branches of engineering, so it does not specifically consider chemical or any other engineering discipline when evaluating both the management of the programme (where the following five elements are considered: programme aims; teaching and learning process; resources; student admission, transfer, progression, and graduation; and internal quality assurance) and its learning outcomes (grouped into eight learning areas: knowledge and understanding, engineering analysis, engineering design, investigations, engineering practice, making judgements, communication and team-working, and lifelong learning).

In Spain, the accreditation processes have been managed by ANECA in collaboration with the Spanish Institute of Engineering,[8] that provides the experts for the evaluation panel. This Institute (funded in 1905) covers the most traditional branches of engineering in Spain (i.e., aerospace, agricultural, civil, forestry, mining, naval, plant, and telecommunications engineering), and thus professionals from the chemical industry are not considered in the recruitment of the industrial representative for the evaluation panels (Haro et al., 2023). As a result, the Spanish Institute of Engineering only has a very limited number of experts with specific background on chemical engineering, which will limit the benefit of the contributions that the panel of experts can make in the permanent update of the degrees.

2.2. The ABET accreditation

ABET is a nonprofit certified quality assurance organisation, funded in 1932, that focuses on programmes in the science, technology, engineering, and math (STEM) disciplines. According to its 2023 Annual Report,[9] 4674 programmes are accredited worldwide from 920 institutions in 42 countries. The ABET accreditation process is carried out by four accreditation commissions: Applied and Natural Science Accreditation Commission, Computing Accreditation Commission, Engineering Accreditation Commission, and Engineering Technology Accreditation Commission, with each commission setting accreditation standards for specific programme areas and degree levels. As it can be deduced, engineering and engineering technology programmes are reviewed and accredited by two separate accreditation commissions, using two separate sets of accreditation criteria[10] as engineering programmes often focus on theory and conceptual design, while engineering technology programmes usually focus on application and implementation. In Spain, only the IQS School of Engineering at Universitat Ramon Llull (Barcelona) has followed this accreditation scheme for both bachelor's and master's degrees in Chemical Engineering, and it is the scheme selected by 4 other institutions for their programmes on Industrial Engineering.

2.3. The IChemE accreditation

Founded in 1922, the Institution of Chemical Engineers (IChemE) is a multi-national institution with primary offices in the UK, Australia, New

[3] Royal Decree 640/2021, July 27th, for the creation, recognition, and authorisation of universities and university centres, and institutional accreditation of university centres [https://www.boe.es/eli/es/rd/2021/07/27/640/con]

[4] https://www.icheme.org/employers-educators/services-for-education-providers/accreditation-degree-programmes/

[5] https://www.enaee.eu/eur-ace-system/

[6] ABET originally stood for the Accreditation Board for Engineering and Technology, but since 2005 they operated exclusively under the acronym.

[7] https://www.abet.org/accreditation/

[8] https://www.iies.es/

[9] https://impactreport.abet.org/

[10] https://www.abet.org/accreditation/accreditation-criteria/

Zealand and Malaysia, that exists to advance chemical engineering's contribution for the benefit of society. From the outset, a core mission of the IChemE was to establish appropriate education pathways for each new generation of chemical engineers, and back in 1934 the degree programmes at Imperial College, King's College and University College of London were recognised as the first IChemE-accredited chemical engineering programmes (Bolton et al., 2023). At present, IChemE accredits chemical, biochemical, and process engineering degree programmes at universities worldwide, and it is in fact the unique accreditation system with international recognition fully tailored to chemical engineering programmes. Currently, programmes at over 60 universities worldwide are accredited.[11] IChemE accreditation comprises a high-value, confidential, discipline-specific peer review by a small panel (i.e. three people) of experienced professional chemical engineers drawn from industry and academia. It is then a joint enterprise in which the IChemE panel and the university department seek understanding through mutually respectful discussion of the available evidence. In addition to the direct benefits to the programmes, accreditation also ensures that an individual applying to become either an Incorporated Engineer[12] or Chartered Engineer[13] (both titles awarded under licence from the UK Engineering Council) has the required academic background to do so without performing an individual check on the candidate's academic history. This could be an important benefit for chemical engineering graduates seeking employment outside Spain, particularly in the UK as well as other countries where IChemE operates.

3. The USC Chemical Engineering degrees experience

3.1. Driving forces in the first accreditation

The educational context for initiating the IChemE accreditation of the seminal degree in Chemical Engineering at USC (established as an integrated master's programme (5-year degree) since the academic year 1994/1995) was characterised by the changing period associated to the Bologna Process that was established to bring more coherence to higher education systems across Europe.[14] That model came to transform this integrated master's degree into bachelor's plus master's levels as two distinct degrees. In that moment of transition between the two models, both internal and external driving forces (IDF and EDF, respectively) played a relevant role:

IDF1: To open the perspective of analysis and reflection beyond national borders and to try to address questions about what and how we were developing the competences of the Chemical Engineer. Were we aligned with international guidelines?

IDF2: To get the whole organisation effectively involved in the continuous improvement process inherent to the international accreditation process.

IDF3: To overcome the inherent resistance to change in academia by relying on institutions of recognised prestige in our field of knowledge.

IDF4: To boost our self-confidence.

EDF1: To enable benchmarking with other well-known universities accredited by the same scheme.

EDF2: To favour the international recognition of our graduates.

EDF3: To be active part of the chemical engineering global challenges, by incorporating critical topics such as process safety, sustainability, professional ethics, etc.

IChemE accredits academic programmes to four standards (bachelor's, master's, integrated master's, and diploma) and each standard is defined in terms of a set of learning outcomes and the level at which these learning outcomes are achieved. The 5-year degree in Chemical Engineering at USC was firstly accredited in 2011 by IChemE (Fig. 1) in the integrated master's mode, which corresponds to a combination of first and second cycles under the Bologna Process scheme and meets the academic requirements for Chartered Chemical Engineer. A re-accreditation under the same standard took place in 2013, being valid for the period 2013–2017. The unreserved commitment of the different stakeholders (students, academic staff, supporting staff, authorities), who shared a positive perception of the benefits derived from having the programme accredited, was key in succeeding with both the original and renewal appraising processes.

3.2. Joint accreditation of the bachelor's and master's degrees

The Bologna Process was implemented in Spain as 240 ECTS[15] credits (4 years) for most first cycle (or bachelor's) degrees, and leaving the second cycle (or master's degrees) open to 60, 90, or 120 ECTS (1–2 years). In this new and complex context, two aspects had to be combined: (1) to fulfil the competences required for a professionalising degree in the second cycle; and (2) to achieve a competitive duration of both cycles as the common approach in Europe at that time was a 3+2 years model and the Spanish model was 4+(1−2) years.

The experience gained during the previous accreditation and re-accreditation processes contributed to the certain definition of the contents and competences of the syllabus of the USC bachelor's degree in Chemical Engineering, that met both the requirements of the Spanish legislation and the international requirements defined by IChemE. The fact of having 240 ECTS allowed us a sufficient margin to comply with the core aspects of both accreditation systems. To define the adequate duration of the master's degree, an advisory board was established including both academics and renowned professionals working in leading companies (oil refining, chemical industry, environmental consultancies, process engineering consultancies, professional

Fig. 1. Press conference on the first accreditation by IChemE of the degree in Chemical Engineering of the USC, in January 2011. From left to right: Prof. Juan M. Lema, director of the School of Engineering; Prof. Juan J. Casares, rector of the USC; and Prof. Gumersindo Feijoo, director of the Department of Chemical Engineering.

[11] https://www.icheme.org/education-career/find-a-degree-programme/

[12] Incorporated Engineers maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation. (https://www.icheme.org/membership/professional-registrations/ieng/)

[13] Chartered Engineers develop solutions to engineering problems using new or existing technologies, though innovation, creativity and change and/or they may have technical accountability for complex systems with significant levels of risk. (https://www.icheme.org/membership/professional-registrations/ceng/)

[14] https://ehea.info/

[15] https://education.ec.europa.eu/education-levels/higher-education/inclusive-and-connected-higher-education/european-credit-transfer-and-accumulation-system

associations, etc.) in our region (i.e. Galicia, NW Spain). Taking into account the conditions previously mentioned, the duration of the master's degree was stated as 90 ECTS credits (1.5 years), where the final 30 ECTS (i.e. the third semester, corresponding nominally to the second academic year) would be fully dedicated to the internship in a company and the final master's thesis. By doing so, the USC master's degree in Chemical Engineering and Bioprocesses (named as such due to including a specific module on bioprocesses, providing a certain specificity and differentiation of this master's degree with respect to other master's degrees in chemical engineering in the Spanish system) was able to achieve the requirements of both the IChemE accreditation and the Spanish legislation, as well as to promote mobility and employability. The simultaneous IChemE accreditation at the bachelor's level (referring to a solid academic foundation in chemical engineering of a first cycle degree, i.e. the bachelor's degree) and at the master's level (referring to the advanced chemical engineering knowledge and skills of a second cycle, i.e. the master's degree) was successfully completed in the academic year 2017/2018 (Fig. 2), providing coverage to all graduates from both degrees until, in principle, 2022.

The worldwide irruption of the COVID-19 pandemic motivated the extension of the validity of the IChemE accreditation awarded in 2018, due to the need of postponing the re-accreditation process. This process eventually took place in 2024, under the adapted IChemE standards, with a satisfactory output that extended the accreditation of both USC bachelor's and master's degrees until 2028. A mention can be made to the fact that, in the accreditation status letter, the integration between subjects taught by different departments, in the context of the multidisciplinary training provided by our programmes, was indicated as an example of good practice. Also, the auditing panel highlighted the close relationship with industry, particularly in relation to the schemes of industrial internships and courses linked to industrial practice, offering valuable practical experience to the students.

Once again, the commitment of all the stakeholders during the mentioned accreditation processes deserves to be highlighted and was essential for the systematically favourable outcome.

4. At the intersection of the Spanish legal regulations and the IChemE accreditation requirements

As of 2025, in Spain there are only two bachelor's degrees (programmes at the University of Oviedo and at USC) and one master's degree (programme at USC) with accreditation by IChemE currently effective. This renders the USC as the only institution in Spain having its entire scheme of bachelor's and master's programmes accredited by IChemE. In the road towards this achievement (Fig. 3), the balanced consideration of the Spanish legal regulations for chemical engineering degrees in higher education and the specific requirements of the IChemE accreditation in the design of the programmes has played a critical role.

The "technical industrial engineer" (which can be associated to a professional engineer with a bachelor's degree in an industrial engineering discipline) corresponds to a regulated profession in the Spanish workforce landscape. In this context, in 2009 a series of official requisites were established for the Spanish universities to consider in their configuration of bachelor programmes in engineering disciplines of the industrial family (Order CIN/351/2009)[16]: a minimum of 60 ECTS in basic training (shaded in green in Fig. 4), of 60 ECTS in a module common to all industrial disciplines (shaded in light orange in Fig. 4), and of 48 ECTS in a specific module for each discipline (Table 1, shaded in pink in Fig. 4), together with a Final Project with no less than 12 ECTS (shaded in dark orange in Fig. 4).

The Bachelor's Degree in Chemical Engineering at USC (4 years – 240 ECTS) was started in 2010, and underwent a first modification of its curriculum in 2015 to give response to a requirement of the Agency for Quality Assurance in the Galician University System (ACSUG).[17] Besides, that curriculum has recently been revised to give response to the new Spanish regulation context (Royal Decree 822/2021), to the current and future demands and needs of the regional and national business community (through invaluable feedback provided by an industrial advisory board that provides ongoing stewardship of the suitability of the training supplied by our programmes to the students), and to the new demands of IChemE to comply with Engineering Council requirements in terms of reinforcement of security training and incorporation of basic aspects of artificial intelligence. The gradual implementation of the latest version of the programme has been initiated in the present academic year (2024–2025) and will be the object of IChemE accreditation appraisal in due course. This Bachelor's Degree aims to generate professionals who know the product and process design, including the conception, calculation, construction, commissioning, and operation of equipment and installations where processes are performed and matter undergoes changes in its composition, state or energy content. It provides a solid academic foundation in chemical engineering knowledge and skills, which may be aligned with the bachelor's level IChemE outcomes, thus meeting the academic requirements for the Incorporated Engineer profile. The programme curriculum integrates generic content on fundamental science disciplines (mathematics, physics, chemistry, economics, and materials science) and on technology disciplines (computing, drawing) with specific elements of chemical engineering, covering in detail systems and processes characteristic of this discipline. Out of the 240 ECTS, 222 are mandatory, including 24 ECTS for the *Final Project* and 6 ECTS for the *Professional Classroom*, where students develop transferable skills directly related to the labour market. The remaining 18 ECTS are elective, to be chosen from an offer of 36 ECTS with two intensifications/specialisations: i) Chemical and Biochemical Processes, and ii) Environmental Technologies. Aspen HYSYS, a top process simulation software, is used throughout the entire programme in (at least) one course per semester, starting at Fundamentals of Chemical Processes. Although Spanish and Galician are the official languages of instruction, English has been also promoted throughout the programme, including the mandatory course of Technical English (4.5 ECTS) in the first semester and the possibility of signing up for different courses offered complementary in English along the remaining semesters.

A set of recommendations by the Spanish Council of Universities was also officially published, in 2009, for the configuration of master's programmes in a series of engineering disciplines, including chemical

Fig. 2. Group picture of authorities of the USC, its School of Engineering, and its Department of Chemical Engineering, following the press conference on the first joint accreditation of the bachelor's and master's degrees in Chemical Engineering of the USC, in March 2018.

[16] Order CIN/351/2009, February 9th, establishing the requirements for the verification of official university degrees that enable the exercise of the profession of Technical Industrial Engineer [https://www.boe.es/diario_boe/txt.php?id=BOE-A-2009–2893].

[17] http://www.acsug.es/en

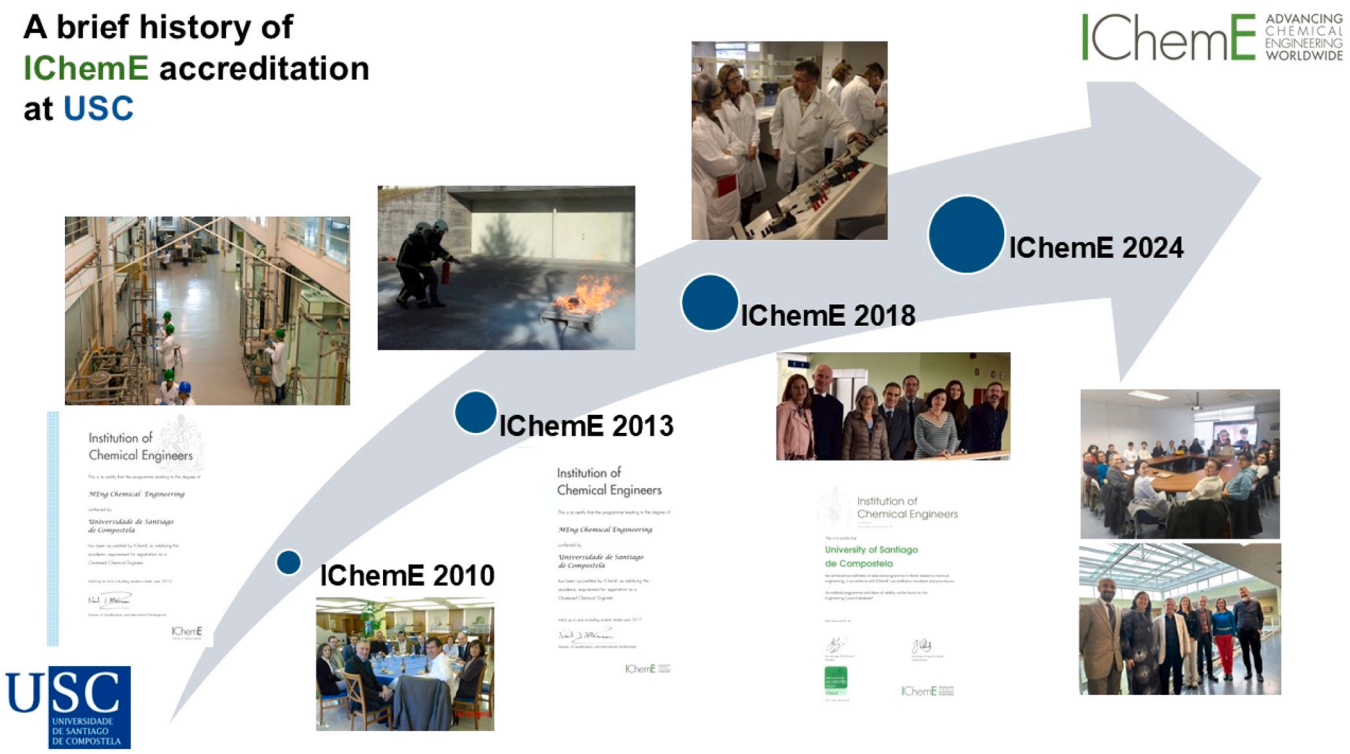

Fig. 3. The brief history of IChemE accreditation at University of Santiago de Compostela.

engineering.[18] These recommendations included a restriction on the previous training of candidates to access the master's programme: these candidates must possess a bachelor's degree in chemical engineering (Spanish/European standard), or equivalent diploma. The USC adhered to this restriction, thus guaranteeing an integrated training in chemical engineering under a bachelor + master scheme for all its master students, in line with the academic formation proposed by IChemE for the figure of Chartered Engineer. This has facilitated the IChemE accreditation at the master's level (focused on advanced chemical engineering outcomes), since the totality of the students have undergone core chemical engineering training before accessing the master's programme. Moreover, the mentioned set of recommendations establishes a minimum of 45 ECTS on process and product engineering and 15 ECTS on management and optimisation of the production and sustainability, apart from an undetermined number of ECTS for a final project. This leads to programmes with more than 60 ECTS, which concomitantly implies programmes longer than just one academic year (the standard workload is 60 ECTS/year, or 30 ECTS/semester). In the USC, the total duration of the master's programme was adjusted to 3 full semesters (90 ECTS), with the last semester corresponding exclusively to a mandatory internship in a company (12 ECTS) plus the final project (18 ECTS). This overall duration was well synchronised with the programme duration and credits suggested by IChemE for accreditation of master's programmes at the master's level: "one extended year" and 90 IChemE credits (1 IChemE credit represents approximately 20 h of student workload, being somewhat lower than that of 1 ECTS). The practical training carried out during the internship by all the students has also helped to boost the content of the programme related to what IChemE refers to "advanced chemical engineering practice", comfortably surpassing the threshold of number of credits set in this category for the master's level accreditation. Since a number of credits on "advanced chemical engineering design" are also specifically required by IChemE for awarding the accreditation, contents and associated outcomes in this vein were guaranteed in the USC master's programme mainly through a course on Conceptual Design of Projects (6 ECTS). It can be considered, nevertheless, that a nice complementary contribution to the latter is done by the course on Engineering Project Management (4.5 ECTS), in which the master students supervise teams of undergraduate students in the preparation of design projects.

5. Beyond direct chemical engineering learning outcomes

IChemE accreditation is much more than chemical engineering learning outcomes and pays a significant attention to the importance of the cultural development of chemical engineering students, extending the auditing process to the behaviours that they will exhibit in their professional work. This cultural learning is seen particularly in the approach of students to issues related to health and safety, ethics, sustainability, diversity, and inclusion; issues that are key to support the fundamental role that chemical engineers are called to play in addressing societal challenges (Byrne, 2023, Motalifu et al., 2023, Ocone, 2013). Many of these aspects do often go beyond the syllabus within the boundaries of the specific programmes and are more directly related to the School of Engineering as an integrating educational centre. In this sense, and due to the commitment of all agents of the School of Engineering to achieve high standards in safety and prevention of occupational hazards, this centre was the first teaching and research centre of the USC to obtain the OHSAS 18001 certification. In an adaption to the new standard of reference, since 2021 the School has a certificate for the Occupational Health and Safety Management System for the rendering of services of university education, teaching and investigation, issued by AENOR,[19] which fulfils the requirements of ISO 45001:2018 ("Occupational health and safety management systems —

[18] Resolution (June 8th, 2009) for public disclosure of the Agreement on the Council of Universities establishing recommendations for [the design of official master's programmes] in the field of […] Chemical Engineering [https://www.boe.es/eli/es/res/2009/06/08/(3)]

[19] https://www.aenor.com/

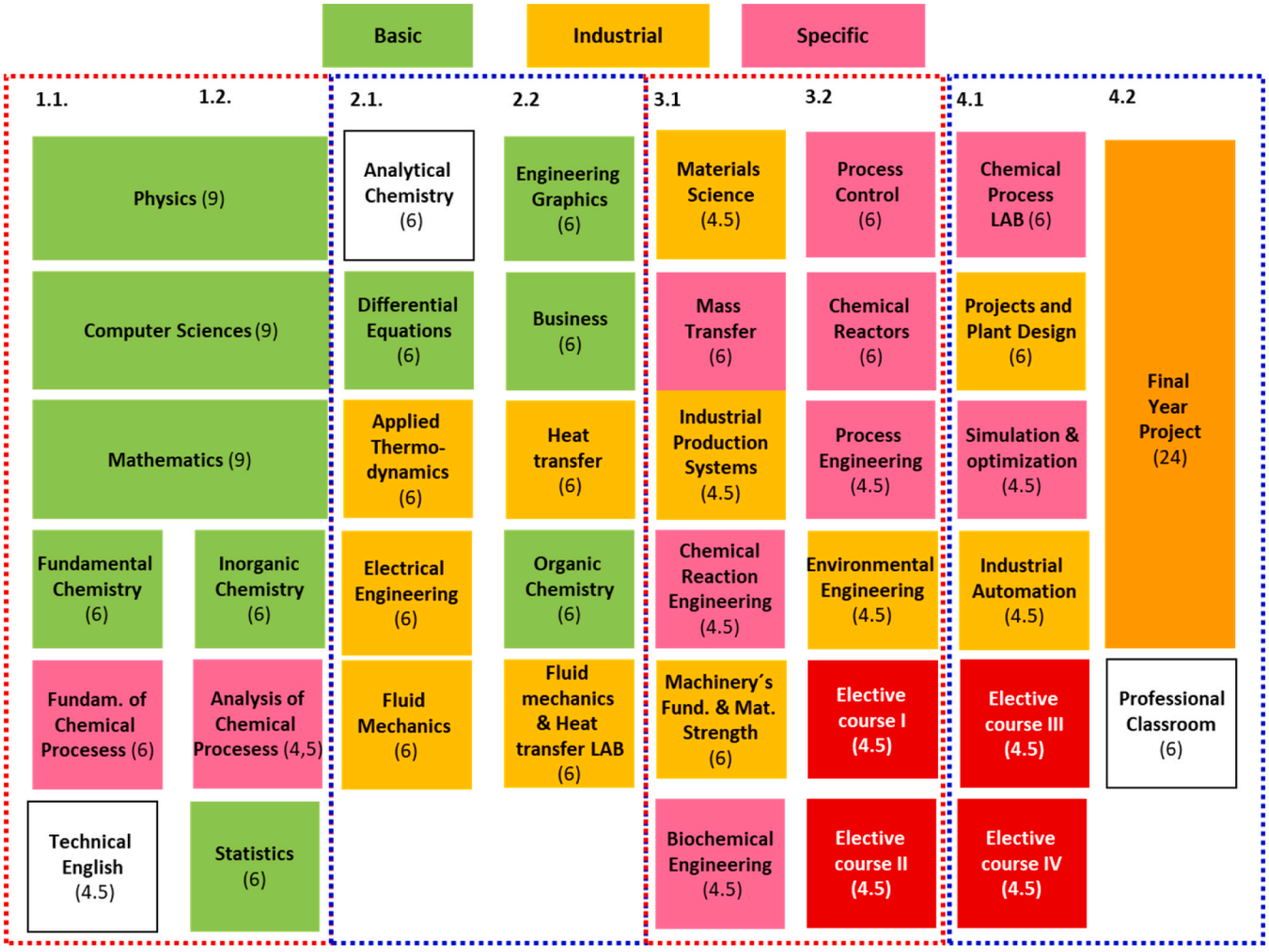

Fig. 4. Programme structure of the Bachelor's Degree in Chemical Engineering at USC (valid up to the academic course 2027–2028).

Table 1
Competences that should be acquired within the specific module for Industrial Chemistry.

Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and valorisation and transformation of raw materials and energy resources.
Ability to analyse, design, simulate and optimise processes and products.
Ability to design and apply experimental procedures, especially for the determination of thermodynamic and transport properties, for the modelling of phenomena and systems in the field of chemical engineering (i.e. fluids flow, heat transfer, mass transfer operations, chemical reactions kinetics and reactors design).
Ability to design, manage and operate strategies for simulation, control and instrumentation of chemical processes.

Requirements with guidance for use"). As consequence of this system, all courses entailing student time in the laboratories require the reading in advance of the risk assessment of the facilities. Besides, during the first session, the instructors provide the students with all the required information to guarantee a safe stay in the laboratories.

Ethics aspects are embedded in the mission and vision of the School, which is not only described in its website but also physically displayed (Fig. 5, left) to be present in the daily life of our community. The same applies to our commitment to sustainability (Feijoo and Moreira, 2020), with the 17 United Nations Sustainability Development Goals (SDGs) physically displayed in most classrooms (Fig. 5, right). Besides, SDGs are particularly present in several courses of the bachelor's programme:

Fig. 5. Mission and vision of the USC School of Engineering (left) and SDGs panel in a classroom (right).

Environmental Engineering, together with the courses included in the environmental intensification (Water Management and Treatment, Solid Waste Management and Treatment, etc.) and also in Fundamentals of Chemical Processes, Projects and Facilities Design, or Industrial Production Systems. At master's level, the presence of SDGs is also transversal to a good number of courses, recently increased thanks to an improved action aimed specifically at increasing the significance and depth of SDGs in the master's programme.

Many members of the academic staff are registered and/or actively involved in different international professional associations, such as EFCE (European Federation of Chemical Engineering), IWA (International Water Association), ISA (International Society of Automation), IFAC (International Federation of Automatic Control), IEEE (Institute of Electrical and Electronics Engineers), ACS (American Chemical Society), and FSLCI (Forum for Sustainability through Life Cycle Innovation). Also, the current heads of the Department of Chemical Engineering and of the School of Engineering are active members of CODDIQ,[20] the national association of chemical engineering schools.

6. Conclusions

It has been a decade and a half since the original accreditation of the 5-year (integrated master) chemical engineering programme at the USC by IChemE, a step forward motivated by the perception of the prestige transferred by this accreditation to the diploma awarded, and inherently to our students when facing the job market, as well as the opportunities for continuous improvement and adaption to new needs and trends in the chemical industry thanks to rigorous accreditation standards. The same motivating elements have remained active during all this period, and in fact the desire of maintaining the IChemE accreditation has played a key role at the time of configuring the transformation of the above mentioned 5-year programme to the present scheme of 4-year bachelor's programme plus 1.5-year master's programme. In a quite regulated context from the legislative point of view, as it is the case in Spain for the professional profile of the chemical engineer (specially at the bachelor's level), we managed to combine the fulfilment of the requirements of this legal framework with the general breath of the IChemE accreditation standards in the design of the new programmes. The resulting programmes, with a proportionally relevant content of practical credits, represent a good balance between academic attractiveness and professional capacity building, while allowing flexibility to adapt to novel trends and circumstances.

CRediT authorship contribution statement

Almudena Hospido: Writing – review & editing, Writing – original draft, Conceptualization. **Héctor Rodríguez:** Writing – review & editing, Writing – original draft, Conceptualization. **Gumersindo Feijoo:** Writing – review & editing, Writing – original draft. **Juan M. Garrido:** Writing – review & editing. **Julia González-Álvarez:** Writing – review & editing, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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