

NICEST - Master study proposal on Next generation Industrial Control Engineering for Sustainable water system Treatment

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Abstract:

In this paper a collaborative experience towards the development of a new joint master degree is presented. The design of the curriculum has as main pillars: a) to provide an interdisciplinary view and approach to advanced water treatment solutions, and b) the development of the curriculum is done according to the new challenges for Higher Education in Europe, therefore providing references of good practices with this respect. The experience is worth to be shared as in an immediate future the expected collaboration among Higher Education Institutions in Europe is to increase if an integrated and high quality Higher Education Area is to be developed. The ongoing reviewing/re-structuring process of higher education programmes provides the opportunity to promote new types and levels of learning new technologies and practices in and through pan-European collaboration. The proposal that is motivated by the need for a green approach to water treatment. Like many other industries, water and wastewater treatment plants also face the problem of a staffing shortage. Efficient and productive workers that are skilled in the business are necessary to properly manage water systems. Automation may be a potential solution to this shortage. Not only will it fill in the gaps of needed employment, but it will also put less stress on existing workers. To this aim the Next generation Industrial Control Engineering for Sustainable water system Treatment (NICEST) project is presented in this paper.

Keywords:

Water Engineering, Control Technology, Higher Education

1. Introduction

There is by now (almost) no doubt that to establish joint collaborative experiences on curriculum design and the establishment of joint degrees in particular is one of the major challenges of the forecasted European Higher Education Area. [6] In particular to work for a joint degree puts on the table existing differences both on academic conception of courses and on established procedures for administrative matters. In fact, Feel Europe!! This could be a possible synthetic way of expressing one of the major characteristics asked for to the newly developed study programmes at European Level. Integration of parts of the curriculum to be offered by leading institutions (therefore taking advantage of acquired expertise) as well as offering the possibility of realising the different cultural experiences both from academic and social points of view.

To overcome these differences is not an easy task. It is the author's opinion that an actual barrier that avoids having a large number of experiences is the lack of knowledge on how to tackle such an interdisciplinary project or, even not knowing what are the problems that the consortium will need to face with.

This communication's aim is to present what the authors experienced as the road taken in order to establish an international joint master degree. It is intended to be a guideline both for the kind of problems that arise on such projects and suggestions for strategies that will help to face them. Different faces of the overall process are presented, highlighting the strategies to follow and the important points to take into account that may be possible source of problems.

Regarding the scope of the study programme, this is motivated by the need for a green approach to water treatment [1]. In fact, the water sector is a key one where digital innovation plays a key role looking forward to the European Green Deal challenge. The Water Sector is at the core of the environmental debate. Water is, quite simply, the most essential natural resource on the planet. Global water challenges affecting water resources, such as climate change, population growth, increasing urbanization and ageing infrastructure, continue to intensify. The European Green Deal is that response. It will drive us forward to climate neutrality by 2050 and at the same time focus on adaptation. The key strategy for the period 2019-2024 is and will be the Twin Transition to a green and digital economy firmly grounded in the objectives of the European Green Deal. No attempt to establish a Green Economy can be successful if it does not involve the water sector in all its facets. Like many other industries, water and wastewater treatment plants also face the problem of a staffing shortage. Efficient and productive workers that are skilled in the business are necessary to properly manage water systems. Automation may be a potential solution to this shortage. Not only will it fill in the gaps of needed employment, but it will also put less stress on existing workers. The ongoing reviewing/re-structuring process of higher education programmes provides the opportunity to promote new types and levels of learning new technologies and practices in and through pan-European collaboration. Currently, there is no programme offered in Europe similar to the one being proposed, nor to modern control systems technology nor with its application to the operation of water systems. The prospective master degree is expected to fulfil the demand for well-qualified personnel required with an enhanced capability for solving many of the water supply problems foreseen in the next 20 years.

On the basis of the two broad issues above, the rest of the paper presents first the rationale; in Section 2.; and innovative and added value of the intended study programme in Section 3.. The rest of the sections are aimed to provide a road-like view to help understand as well as to serve as starting point/reference for those that want to undertake a project like this one. Accordingly, Section 4. will present the three general axes to be considered. Those are developed in the corresponding subsections. Additional considerations regarding economic management, student services and transversal issues are reflected in Sections 6., 7. and 8., respectively. The paper ends with some conclusions.

2. The topic: NICEST rationale

This study programme is motivated by the need for a green approach to water treatment. In fact, the water sector is a key one where digital innovation plays a key role looking forward to the European Green Deal challenge. The European Green Deal was stated as one of the six ambitions/objectives for Europe described by Ursula von der Leyen in 2019 [1]. The increase in global temperature, the depletion of natural resources and continued biodiversity loss, undermine our security and prosperity. The Water Sector is at the core of the environmental debate [2]. Water is, quite simply, the most essential natural resource on the planet. Global water challenges affecting water resources, such as climate change, population growth, increasing urbanization and ageing infrastructure, continue to intensify. The European Green Deal is that response. It will drive us forward to climate neutrality by 2050 and at the same time focus on adaptation. The key strategy for the period 2019-2024 is and will be the Twin Transition to a green and digital economy firmly grounded in the objectives of the European Green Deal. No attempt to establish a Green Economy can be successful if it does not involve the water sector in all its facets. An important advance towards such progress faithfully reflects the second factor of the Twin Transition: Digitalization.

The problem of diminishing clean fresh-water resources facing Southern Europe and most other parts of the world is very serious. Water is essential for life and is central to both industry and agriculture. The demands on water infrastructure are increasing and have to deal with population growth and climate change. Furthermore, in all Mediterranean and Middle Eastern countries, the scarcity of conventional freshwater resources poses a serious threat to their sustainable socio-economic development. In planning for water uses in various human activities, especially in such arid areas, a primary objective should be sustainable development. This target transcends national boundaries, demanding that society should utilize available water resources in a way that will ensure their availability for generations to come. In addition to political vision, water availability problems need technological know-how for their solution. Moreover, specific efforts are focused on water reclamation and reuse while the recovery of added value products and energy represents a challenging option under the water-energy concept. It is not surprising that both the United Nations and the US National Research Council indicated wastewater reuse as a yet untapped available water source. Water reuse is an integral element of sustainable water management, keeping a viable resource in the natural cycle, and allowing its preservation for future uses, at the same time meeting present supply requirements. According to UNESCO, improved wastewater treatment and increase in water reuse, as called for in Sustainable Development Goals Target 6.3 (Clean Water and Sanitation), will support the global transition to a sustainable circular economy. Hence, a selective approach for wastewater recovery to provide water at specific quality standards for different reuse objectives (industrial, agricultural and even potable) is nowadays desirable and technologically feasible. This "fit-for-purpose" approach to water reuse could both save water and would reduce production cost and energy

demand by eliminating unnecessary treatment and long-range conveyance, as it typically aims at local reuses, but it requires appropriate plant and control configurations.

All of these issues, and the global challenges that lie ahead of us in the next few decades, mean that Environmental Engineering will rapidly become one of the most important areas of Engineering. Water resources protection, efficient water uses and recycling, air and soil pollution and materials and energy recovery from effluents and wastes are just a few of the problems that need to be tackled in order to assure sustainable growth of the world economy and ecosystem stability. These problems are relevant in both industrialized countries, where solutions are already being found and implemented, albeit not always at the necessary pace, and in developing countries, where interventions according to the state of the art of technology should be concurrent with ongoing development.

Many environmental problems are related to large scale, geographically distributed control system problems: the regional management of water and wastewater resources at basin scale are conceptually and technologically comparable to the management of a regional or national High Voltage Transmission system. The daily management and operation of a large wastewater treatment facility can be compared to a medium-scale industrial process, where optimization and real-time control can contribute to increased productivity and opportunities for water reuse (better effluent quality) and lower costs (mainly energy and process requirements). A similar situation can be found in waste incinerators with recovery of electrical and thermal energy. Unfortunately, this combination of knowledge has seldom crossed the realm of applied research and has never become part of an academic curriculum, except occasionally at taught postgraduate level.

Digital monitoring solutions can help to optimise the management and control of wastewater treatment plants, which may result in higher degrees of energy efficiency as well reductions in chemicals used and carbon or other gas emissions achieving at the same time an effluent of high quality; such an approach is becoming significant considering the variable composition of the influents and the strong effect of environmental conditions to the operation. Nevertheless, the achievement of an effluent of constant quality will allow for its reuse in various applications requiring safe water. Employing such tools, digital process information can be used to simulate possible configurations of a plant for varying design parameters (e.g. inflow conditions) in order to identify the optimal configuration of wastewater management and reuse systems at different scales and to determine the potential for extraction of valuable materials. With regards to data reporting processes, digital solutions can provide valuable input, with regards, for example, to water quality monitoring designed to support the implementation of the Water Framework Directive (WFD). Green innovative technology has been improving the way we treat water so that the environmental footprint left by wastewater treatment plants is smaller and less impactful. With automation and innovation moving forward, we can continue to expand on these ecofriendly technologies to make wastewater treatment greener.

All the previous issues and scenarios, moved us towards the need for the development of a Joint Degree Master Programme entitled Next generation Industrial Control Engineering for Sustainable water system Treatment (NICEST) according to the European Higher Education principles. The objective of this Master Programme is to fill a rapidly developing gap that is emerging for graduates that are trained in key processes and management associated with water supply and reuse. There is great demand for such graduates at the

3. NICEST added value

Innovations in the water domain are fragmented and often experimented at small scales. Thus, there is a need to strengthen the innovation capacity of the water industry. Even a 1% increase in the growth rate of the water industry could create up to 20,000 new Jobs - from Water Reuse in Europe - Relevant guidelines, needs for and barriers to innovation, Publications Office of the European Union: JRC92582).

There is a wide variety of master's degrees in various aspects of environmental engineering outside Europe coming from the USA and with small but developing groups in Asian countries. From a review carried out by this Consortium, as well as from other sources, we can conclude that conventional water treatments are well covered in EU degrees, either from the technology or the management viewpoint. However, there is a real and urgent need for specialised and regular training in newly developed technologies and areas not covered by the current schemes. There are several MSc programmes covering conventional municipal and industrial water treatment. Some of the programmes are aimed at the science and technology of water provision, while others are more focused on the water management systems.

However, curricula analysis demonstrates a clear skills mismatch related to the employers' expectations. The current master-level curricula in water seldom involve Big Data, IoT or other digitalisation approaches or results, and on some occasions, process simulations. The industry is also occupied with further development of conventional solutions. It is important to bridge the historical gap between control engineers and process specialists in order to overcome the many technological and physical challenges in the sector and support the existing EU research and innovation initiatives.

The NICEST scheme offers a unique programme of education in Desalination and Water Treatment Technologies. It addresses the major developing areas of the subject giving the prospective student state of the art knowledge and opportunities to specialise in the major areas of the subject, Desalination, Water Reuse and Wastewater Control Systems. These are key areas of technology and infrastructure in a developing world that will be required to deal with the threats of climate change and help with conflict resolution based on resources. The Master's degree will fulfil the demand for well-qualified personnel required with an enhanced capability for solving many of the water supply problems foreseen in the next 20 years. It will also support these rapidly developing commercial areas of water technology worldwide. Currently, there is no programme offered in Europe similar to the one being proposed.

Because of the approach and also because the water thematic field is at the forefront of the EU and local governments agenda, the project is aligned with European policies:

- supports strengthening the competitiveness of EU water business through talent and innovation in higher education according to the Strategic framework for European cooperation in education and training [6]. It also addresses revitalisation of educational focus towards the growing mismatch between the digital skills water specialists acquire and the demand on the labour market accounting the water digitalisation trend and supporting development towards Digital Single Market.
- focuses on digital technology for teaching and learning, developing digital competences and skills and improving education through better data analysis and foresight meeting the goals of the EU Digital Education Action plan. [8]
- is designed to support the implementation of the European policy agenda for growth, jobs, equity and social inclusion referring to the importance of education and employment. This will transform the teaching and learning of digital skills in a lifelong learning perspective. This will further develop digital skills for the digital economy, e.g. upskilling and reskilling workers and jobseekers, career advice and guidance.

4. Joint Study Programme elements

The road presented arises from an international experience in new Curriculum Development from the perspective of the new challenges for Higher Education in Europe, and with an interdisciplinary approach to content design [3], [7]. One of the factors stressed in the communication is the need for collaborative work among academic and administrative staff. To run an international joint degree implies different procedures than the ones actually running on standard national degrees.

Different faces of the overall process are presented, highlighting the strategies to follow and the important points to take into account that may be possible source of problems:

- Curriculum Structure: topics like the following ones, among others, should be taken into consideration: ECTS adopted as the central concept on the curriculum structure; Mobility designed as an integral part of the curriculum; Integration Actions to let the students know the corresponding local cultures; Teaching and Learning methods are programmed as a mixture of classical (frontal teaching) and modern (read e-learning and web based) methods.
- Curriculum definition management: Adopted roles and procedures: (i) the use of tools for collaborative work is showed to play a central role in the sharing of information and in the development of coordination and communication aspects among partners, (ii) creation of Committees (steering, admission, quality) to tackle the different management aspects and assuring all partners are involved in the different tasks, etc
- Academic, Administrative Procedures and legal aspects: with no doubt different legislations will go into conflict. People coming from academia are not generally aware of all the pinpoints concerning these issues. In addition to put together administrative staff from the different partner members, joint and collaborative work with administrative staff is a must in order to guarantee the success of the experience. The authors are a representative of this collaborative work.

On a broad sense, the idea is to expose on a clear way the implications of this kind of ventures trying to identify the cornerstones of the process in order to assure as much as possible the success of the experience. The sections that follow are organised in such a way that constitute a first step towards a practical guide of the different aspects to be considered. It is a fact that the actual lack of homogeneity among different national legislations and national degrees structure across Europe constitute a continuous source for difficulties and barriers that are to be solved. This situation constitutes an extra reason for a clear as possible guided road to the establishment of an international joint degree.

4.1. Curriculum Structure

The definition of the curriculum should be done from a holistic point of view. It is a usual practice just to put together modules offered at the partner universities in order to generate the global master offer. This usually provides a curriculum with no added value. One of the important points the consortium has to be able to highlight is the added value of the joint degree with respect to the individual courses offered at the partner universities: something that cannot be done by the partners on their own way.

The design of the curriculum is intended to be done on a top-down basis. Starting from the general goals that the consortium is committed to meet and melting down to details of each one of the integrating modules.

There are some basic questions the consortium has to fix. Even sometimes they seem too basic and obvious it is important to agree on every point from the very beginning. They can be classified on the basis of the aforementioned top-down manner. General Questions at degree level:

- Degree offered (Joint degree, double degree): It should become clear from the very beginning if all partner institutions can award a joint degree (it may depend on local regulations and on each country legal framework) or if double degree awarding is needed. All EHEA countries are supposed to adapt their legal frameworks according to the Bologna process standards prior 2010. To obtain a Joint Degree, a minimum of one semester mobility has to be done to another partner institution (host university/ies).
- Diploma Supplement: Will the Diploma supplement be used? If so the form and content should be agreed.
- What will be the Language of instruction? Use of local languages will introduce the need for deep knowledge of different languages on the students. It is therefore natural to ask for a common language for instruction even local languages are to be introduced in order to help the introduction of local culture settings and to help students
- What will be the mode of study? (full time basis, distance learning based, ...)
- What will be the duration of study? 12 months, 24 months.

These questions can be identified as operational aspects. However, the consortium has also to be able to answer content related questions like: What is the added value of the programme with respect to existing studies? What are the learning outcomes/competences/skills? Professional Qualifications?

With respect to the course structure it is important to think on mobility aspects. What kind of curriculum is desired?

- Will the student be allowed to choose a path from the very beginning? This means the initial hosting institution may not be the same for all the students.
- Will there be the possibility of taking the same modules in more than one institution? This situation will introduce elements of choice based on geographical location more than on educational content. Therefore an unbalanced flow of students may be generated.

Advantage of the local expertise of the partners should be taken and the corresponding specialisations or elective options offered.

At module level, the description suggested from the ECTS User's guide [3] is to be employed. A common module description has to be adopted by all partners in order to facilitate both, coherent information to students as well as transfer of grading and student records information.

4.1.1. Local Constraints

When defining the global structure of the study programme it should be heard in mind that local approvals will be needed from each partner institution (and, in some cases from the local governments). This raises the point that the final structure of the programme should accomplish with local constraints:

- Do all the partners understand and apply the ECTS under the same terms?
- What is the number of elective credits to be offered?
- Is it mandatory to assign a minimum number of credits to the Master Thesis?
- Should the programme assure methodological and/or local culture credits?

The existing local regulations at national level will establish if the awarded degree can be a joint degree or a double degree. For a joint degree it will be needed that all partners be in disposition to award a joint degree.

4.2. Curriculum definition management

4.3. Academic, Administrative Procedures and legal aspects

Admission to the programme is one of the important points the consortium has to agree on. Possibly, each partner institution will have its own procedures and selection criteria. The possible conflicts have to be detected as early as possible. Therefore, each partner has to provide a detailed description of the procedures, required information and documentation the student has to provide as well as the minimum requirements; according to the corresponding national legislation; for a student to access to the degree. Therefore:

- Common standards for admission should be established: mandatory admission requirements. These standards have to accomplish with all institutions requirements. Required documents have to be legalised by at least one of the participating institutions embassies, and the rest should recognise them. It is also advisable that all institutions accept documents officially translated in English or any other agreed language. All these recognitions will make easier the legal procedures that non-EU students will have to follow.
- Common application procedure should be agreed and put in place by the coordinating institution as the consortium secretariat has to be the contact and entering point to the study programme. Note this means that just one application form will be available and that this application form may not be that of any partner
- Joint student selection procedure should be organised by the coordinating institution. The criteria on the basis the applicants will be ranked should be clear and agreed. This will allow to create an applicant scale on the basis of; for example; Accepted / Waiting List / Accept to Waiting List / Cannot Accept

During the entire admission process, staff from the consortium secretariat should be in touch with the candidate and inform him/her on actions to be taken, missing / incomplete documents etc. In addition, dates and timing for application have to be announced. Once the Admission Committee has reached its decision, it is recommended that successful candidates are put in touch with local accommodation offices so that suitable accommodation can be arranged in a timely manner.

Special attention should be put into the troubles some third country students may have in getting the corresponding visas in order to enter to the partner institutions countries. For example, the visa may only be for 6 months. In addition the student may be required to be in their home country to get the visa. This is not a problem for the first country he/she is to visit. However if the mobility requires the visit to another country this may imply an extra travel. Therefore to be taken in to account in order to minimize foreign student travel.

In case the master is going to deliver a double/multiple degree, every institution will need a certified copy of all admission and registration documents, having to update the academic transcript of all those students that are going to receive the degree issued by their institution (those spending at least one semester).

5. Academic Management

Academic management will be one of the major tasks coordinated by the consortium secretariat and will encompass a sequence of tasks that will follow the life of the student within the programme from its very beginning.

The Consortium's Secretariat will keep the full student record in order to monitor progress, to help the preparation of the Diploma Supplement and other actions requiring the full students' record. On the other hand, host institutions will provide the Secretariat with the corresponding semester qualifications, so that it can update students' academic files. This way the consortium secretariat will be in charge of providing the agreed degree and Diploma Supplement.

As the Consortium's Secretariat is to centralise the student's records, at the end of each semester the marks of each student should be communicated to the Secretariat. For this matter, the definition of the Examination Boards facilitates a communication framework among local institutions and Secretariat. The local Examination Boards will be the local committee that gives validity to the marks obtained by the students during the semester and officially communicates (by using a common agreed form) the results to the Secretariat.

6. Economic Management

As the access point to the programme, the consortium secretariat is the appropriate body to be in charge of the economic management of the consortium. This way the consortium secretariat will receive the agreed fees from the students and distribute them to the partner institutions according to the local costs per enrolled student.

When calculating the registration and administration fees, the consortium has to be sure that the amount will cover official fees at each institution. It is a must that all European students pay the same fee. Third country students' fees may differ.

Different national/local rules concerning fees should be solved at consortium level. This way it is preferable that the student.

In order to avoid problems, it is advisory to establish, on a yearly basis:

- What are the fees to be transferred from the secretariat to the partner universities (by student per semester) depending on the amount of ECTS credits.
- Is there any fixed amount devoted to cover administration costs?
- Regular meetings of the different meetings are also to be covered. They need to be included into the cost provision.
- Publicity and web hosting
- Language courses

An interesting option that has also to be considered is the provision of study grants directly from the consortium. If there is the possibility of having sponsors from industry the consortium may consider the possibility of granting some students per year.

7. Student Services

It is important to provide the students with a minimum level of services that guarantee a smooth integration into the local social life as well as facilitate enrolment and development of the lecturing and study activities while the stay in one of the institutions.

The members of the consortium should engage themselves in helping students with incoming procedures such as finding housing and ensure that students will have access to language courses, libraries and canteens as well as to the services of the respective International Offices.

Before any mobility, consortium institutions have to provide legal advice to students, regarding visa requirements to destiny country: how long in advance they have to ask for the visa, required documents, etc. Every European country has its own legislation and requirements, and students need at least a 6 months stay permit.

In addition it is encouraged to provide a personal faculty advisor, chosen from the teaching staff, which will be assigned to each student. The advisor will help the student for particular needs in the curriculum and in the everyday life. In addition, non academic counselling will be provided by trained counsellors from the student support services

8. Transversal and Good Practice Considerations

The elaboration of joint ventures provides a framework for the application of intercultural integration. Therefore, it is desired for the partners to promote the creation of integrated language programmes and cultural integration. This way the students will undertake other activities for improving their language skills and their knowledge of culture of the host country. Typically these classes will include the written and spoken language and/or the culture and civilization of the host country.

A practical way of helping foreign students integration is to provide them with a manual with information on each university / surrounding, structures, procedures, assistance, language tuition, etc

It is also advisable to have a Master website where all this information can be facilitated.

The implemented procedures should guarantee equal opportunities and rights between male and female. Likewise, it is important to assure easy accessibility to any disabled scholars and students.

9. NICEST Curriculum Structure

The NICEST degree programme aims to provide the student with a thorough knowledge in the field of advanced water treatment and particularly in technologies such as saline water desalination and wastewater treatment and reuse. The programme will comprise different teaching approaches, expertise and research competencies of the participating institutions. It reflects the specific experiences of the involved departments, realises important synergies, and gives preference to the best available and most-up-to-date modules in each field.

The determination of the final academic programme with the detail of the modules to be offered and specific syllabus is one of the purposes of this EMDM project. However, because of the expertise contributed by each partner member, an initial structure of the curriculum has been outlined. It exploits the expertise and international reputation of each one of the consortium partner members, so each partner will contribute to the design of the NICEST curriculum by bringing specific competences and skills corresponding to their area of expertise. In some specific cases, for the benefit of accounting for the best specialists and in favour of a rich consortium, academic collaboration between two institutions is expected during the common first semesters.

The structure of the academic programme is reflected in Figure (1). The overall view shows the two years structure, with the academic semesters and interlaced events such as the integration week, summer school and graduation event.

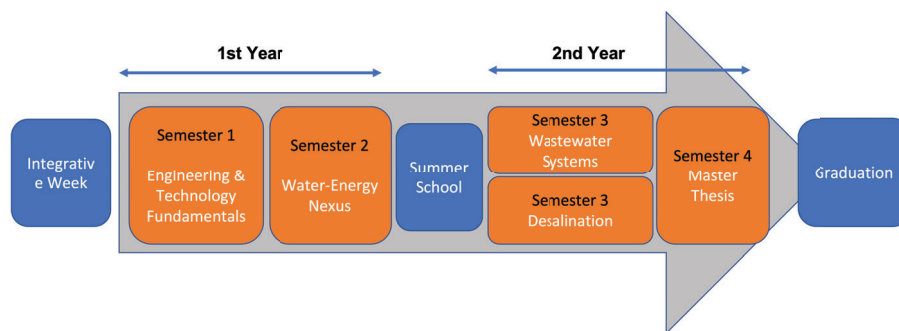


Figure 1: Curriculum degree overview

- **Wellcome Integration days:** This will provide the first contact of the students with the NICEST Consortium. It is proposed to take place in one place that is not mandatory on the curricular itinerary. This way students will have the possibility can get in touch with the partner and get knowledge about the local facts. The new students will get the opportunity to meet the alumni from the previous cohort who are graduating at the same time.
- **Summer School:** This will be intended to provide a transition between the fundamental, more generic courses, of the first year to the second year specialisations. It will be organised on a partner institution different from the welcome, integration week. The Summer School will allow for presenting specific topics related to water treatment, also some topics not covered within the study programme (legal issues for example) with the participation of invited guest speakers.
- **Graduation event:** The graduation ceremony will be organised after the Master's Thesis defence. As previously commented, the idea is to make it coincident, or at least to overlap somehow, with the integration week in order to favour the interaction of recently graduating and newcomers.

Intended structure is:

- Common first year where the basics of Industrial Control, process engineering, sustainability and environmental management, biological processes and aspects related to industrial communication systems and cybersecurity are covered. This first year will be delivered at UAB (Barcelona, Spain) and ULE (Leon, Spain). The second semester will concentrate on what we called the water-energy nexus. This is intended to cover aspects related to energy usage and renewable energies for water treatment. This is a transversal issue that becomes more and more important whatever the water sector we can refer. This second semester will be delivered in Greece with UTH & IHU (Greece) with the research centre CERTH as an associate partner.
- The second year is characterised, at each institution, by the focus on project/specialist work, with courses that reflect the different areas of special expertise of each of the partner institutions. The following specialisation courses are identified at this stage: wastewater treatment UGA & CRA (Romania) and Desalination Engineering ULPGC (Las Palmas, Spain)
- Master project according to the expertise but including co-supervision with an external advisor that complements with needed engineering and technological aspects.

Figure (2) summarises the degree structure and prospective list of modules.

10. Conclusions

In this communication a rough description of the aspects concerned when addressing the conception and design of an international joint degree has been presented. The sections have been structures in order to classify the main points to be addressed and questions to be tackled. The description is by no means far from complete but can be taken as a global picture, therefore a starting point.

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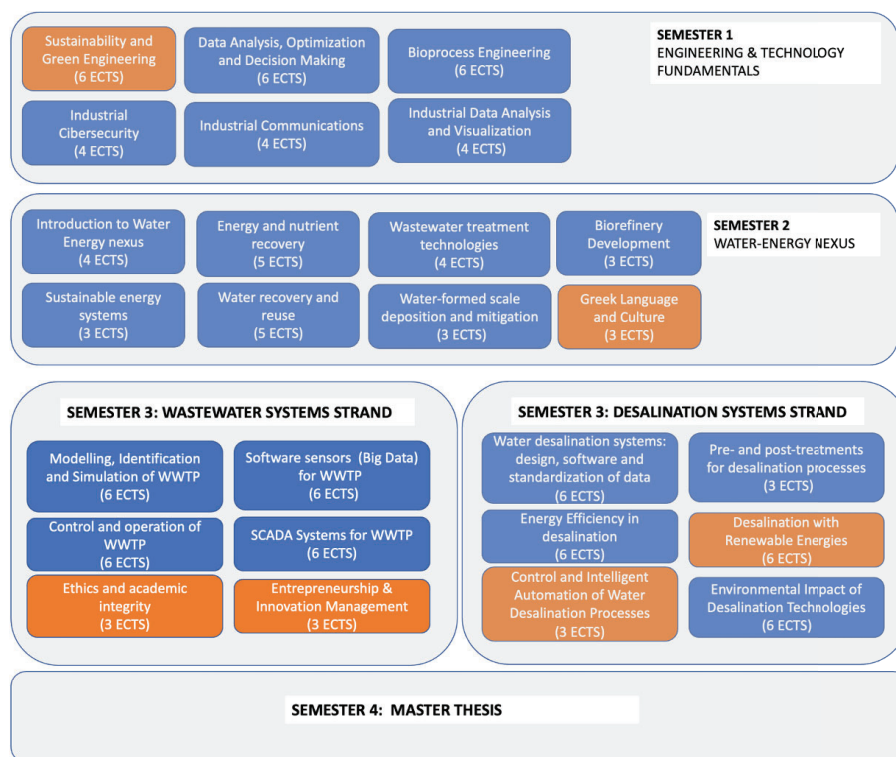


Figure 2: Curriculum detail. Modules and semester content

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