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|  | Doctoral Program in Electrical EngineeringDepartment of Electrical EngineeringUniversitat Politècnica de Catalunya. BarcelonaTech |

# ACREDITATION REPORT OF THE DOCTORAL PROGRAM (IAPD)

# *DOCTORAL PROGRAM IN ELECTRICAL ENGINEERING*

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**Escola de Doctorat**

**Universitat Politècnica de Catalunya**

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# Context

# Identifying data

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| **University** | Universitat Politècnica de Catalunya |
| **Name of the doctoral program** | Doctoral Program in Electrical Engineering by the Universitat Politècnica de Catalunya |
| **Code RUCT** | 5600071 |
| **Link web** | https://ee.postgrau.upc.edu |
| **Coordination of the program** | Joan Montañá Puig  Academic Coordinator of the Doctoral Program |
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| **Responsible of the elaboration of the IAPD** | Balduí Blanqué Molina (faculty)  Ferran Fabró Tàpia (postdoc)  Samuel Galceran Arellano (Head of Department and member of the Academic Commission)  Oriol Gomis Bellmunt (Academic Commission)  Núria Góngora Mora (Management support unit)  Joan Montañá Puig (Academic Coordinator of the Doctoral Program)  Daniel Montesinos Miracle (Academic Commission)  Jordi-Roger Riba Ruiz (faculty)  Luis Sainz Sapera (Academic Commission)  Joan Sau Bassols (student) |
| **Authority responsible of approving** | Junta del Departament d’Enginyeria Elèctrica  Board of the Department of Electrical Engineering |
| **Date of approval** |  |

**Acronyms**

AGAUR: Agency for Management of University and Research Grants

AQU: Catalan University Quality Assurance Agency

CEU: Associated professor (Catedrático de Escuela Universitaria).

CITCEA: From the Catalan: Centre d’Innovació Tecnològica en Convertidors Estàtics i Accionaments. Research group.

CTT: From the Spanish Centro de Transferencia de Tecnología (Contracts office of the UPC).

CU: Full professor (Catedrático de Universidad).

DAD: Document of Activities of the PhD student.

DEE: Department of Electrical Engineering of the UPC.

ED: Doctoral School of the UPC.

EEBE: Barcelona East School of Engineering of the UPC.

EPSEM: Technical College of Manresa of the UPC.

EPSEVG: Technical School of Engineering of Vilanova i la Geltrú of the UPC.

ESEIAAT: The School of Industrial, Aerospace and Audiovisual Engineering of Terrassa of the UPC.

ETSEIB: Barcelona School of Industrial Engineering

GAECE: From the Catalan: Grup d'Accionaments Elèctrics amb Commutació Electrònica. Research group.

GPAQ: From the Catalan: Gabinet de Planificació, Avaluació i Qualitat.

GRC: Consolidated research group.

GRE: Emergent research group.

H2020: Horizon 2020 the EU Framework Programme for Research and Innovation.

JCR: Journal citation reports.

LRG: Lightning Research Group.

MCIA: Centro Innovation Electronics. Motion Control and Industrial Applications. Research group.

MINECO: Ministry of Economy, Industry and Competitiveness.

PAS: Administration and services personnel

PDI: Academic and research personnel.

Q1: First quartile (rank of journals).

QSE: From the Catalan: Qualitat del Subministrament Elèctric. Research group.

R&D: Research and Development.

RD: From the Spanish Real Decreto (Royal Decree-Law).

SEER: Renewable Electrical Energy System. Research group.

SGIQ: From the Spanish Sistema de Gestión Interno de la Calidad (Internal Quality Assurance System)

SGR: Competitive projects of the AGAUR to support Catalan research groups.

TU: Associated professor (Titular de Universidad).

UPC: Universitat Politècnica de Catalunya.

UTG: Technical Management Support Units of the UPC.

VSMA: From the Spanish Verificación-Seguimiento-Modificación-Acreditación (Verification- Following up – Modification and Accreditation)

# Presentation of the Doctoral Program

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| The Doctoral Program in Electrical Engineering dates back to 1987, the year in which the doctoral programs in accordance with the then recently promulgated LRU began, coinciding also with the creation of the Electrical Engineering Department of the UPC. Subsequently, in 2003, this program became the Doctoral Program in Electrical Engineering in accordance with RD 56/2005, which was then in force. The Doctoral Program in Electrical Engineering obtained the Excellence Mention in 2011 (MEE2011-0303). The Doctoral Program in Electrical Engineering was verified in 2012, according to RD 99/2011. It is currently in the process of Monitoring within the VSMA1 framework.  The Doctoral Program is aimed at the electrical engineering sector, which is one of the most active in the industry. Electricity applications and demand continue to grow worldwide, replacing other types of energies and allowing technological innovations that are otherwise impossible. Electrical engineering, although being a traditional discipline with a strong background, is of great importance for the current challenges of society. Electrical engineering covers multiple and interdisciplinary fields of research and applications, ranging from the traditional ones such as the generation, transmission, distribution and consumption of electrical energy to the new challenges in renewable energy generation, electric propulsion in different means of transport and intelligent energy management systems. The current society, to be able to face all these challenges, needs electrical engineers trained to face a changing world, so that they can be the impellers and driving motors of these changes. The Program has as its main objective and justification, the formation of third cycle Electrical Engineers, which are capable of facing the challenges of research and development of the society. The training of highly skilled specialists capable of leading R&D projects in electrical engineering is indispensable for a competitive and sustainable development  The Program belongs to the industrial programs of the Doctoral School of the UPC. Its associated research groups investigate in the priority areas of the UPC corresponding to manufacturing technologies, energetic technologies and environment.  It is important to highlight that the Doctoral Program in Electrical Engineering is the only one in Catalonia on this topic. In practice this means that a certain number of doctoral students from the program come from other Catalan universities. On the other hand, the program attracts a good number of candidates from other state universities and foreigners.  The Doctoral Program in Electrical Engineering gathers the research experience of our University, in the field of electrical engineering over more than sixty years2 of uninterrupted activity, and including a large number of research fields, which can be summarized as,  • Development, modelling and simulation of devices, efficient electromechanical systems for position control, speed and torque applied to industrial processes.  • Integration of renewable energy in the electricity grid as well as intelligent management in smart grids  • Efficient generation through renewable energies such as wind and photovoltaics.  • Modelling, simulation, measurement and audit of quality of the electrical supply.  • Electric propulsion in vehicles, and rail transport.  • Non-propulsive electrical applications in more electric aircrafts.  • Atmospheric electricity in applications such as lightning protection in aircrafts, wind turbines and electrical systems. Also in the fundamental research in electrical discharges, electrical events in the high atmosphere and high energy emission processes in discharge of laboratory of high voltage and lighting.  • High-voltage applications including modelling, simulation and testing of partial discharge events, and corona effect under alternating current and direct current supply.  The program has been associated to the Master's in Energy Engineering of our University and currently, the members of the Program participates in several masters at the UPC such as the master's degree in Industrial Engineering, master's degree in Automatic Systems and Industrial Electronics Engineering and master’s degree in Aeronautical Engineering.  The program is focused so that a series of objectives can be covered, among which can be highlighted the ability to provide:  • Systematic knowledge, rationalized and updated, of the scientific-technological foundations of electrical engineering.  • Knowledge and use of the bibliographical sources necessary to justify, sustain and endorse a research topic in electrical engineering.  • Experimental knowledge of the main methodologies that are applied in the design, control and manufacture of electrical systems.  • Scientific and technological criteria necessary to raise, implement and direct a basic or applied research project, in any subject matter of the field of specialization.  This experience is currently materialized in six recognized groups dedicated to research in this subject, most of them with participation in the National R&D Program in the Electrical and Electronic Engineering areas, European Union H2020 programs such as MSCA ITN and other international programs. These research groups have their quality recognized by the UPC and Generalitat de Catalunya (e.g. SGR3 actions of AGAUR).  To conclude, the mission of the Doctoral Program on Electrical Engineering is to prepare the high qualified engineers for a sustainable future where the world will become more electric.  1http://www.aqu.cat/universitats/mvsma/index.html  2Since the chairs (‘cátedras’) by the activity of the former (UPC) professors: Enrique Ras, Manuel Cortes, Alfonso Enseñat and Juan Corrales.  3http://agaur.gencat.cat |

**Agents who had participated in the elaboration of the report (Internal Committee of evaluation)**

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| **Names** (alphabetic order) | **Position** | **Colective** |
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| Balduí Blanqué Molina | Faculty | Faculty (PDI) |
| Ferran Fabró Tàpia | Postdoc | Graduated students |
| Samuel Galceran Arellano | Head of Department and member of the Academic Comission | Faculty (PDI) |
| Oriol Gomis Bellmunt | Member of the Academic Commission | Faculty (PDI) |
| Núria Góngora Mora | Technical Management Support Unit (UTG) | Support (PAS) |
| Joan Montañá Puig | Responsible of the Doctoral Program | Faculty (PDI) |
| Daniel Montesinos Miracle | Member of the Academic Commission | Faculty (PDI) |
| Jordi-Roger Riba Ruiz | Faculty | Faculty (PDI |
| Luis Sainz Sapera | Member of the Academic Commission | Faculty (PDI) |
| Joan Sau Bassols | Student | Students |

# Procedure of elaboration of the accreditation report

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| The elaboration of the Accreditation report has been done according to the Plan of the Accreditation Report. This plan can be summarized by the following steps:   * Initial meeting of the Academic Commission of the Program: plan elaboration. * Constitution of the Internal Evaluation Commission * Actions for preparation of the data needed for the report. * Elaboration of the Work Packages resulted from the plan. * Merging the WP to create the first draft of the report. * Submission the draft for review at the GPAQ. * Analysis, inclusion (if proceed) of the comments/suggestions from the GPAQ. * Final draft for public exhibition. * Final review and approval of the final draft as the Accreditation Report. * Submission of the Accreditation Report.  |  |  | | --- | --- | | **Date** | **Item** | |  | The academic coordinators were called to attend the Assembly of Doctorate (Junta de Doctorado). In this meeting, the Doctoral School (ED) and the Office of Planning and Quality (Gabinete de Planificación y Calidad) GPAQ announced the calendar for submitting the Accreditation reports, provided orientation and reviewed the available sources of information. | | 20171025 | **Meeting of the Academic Commission**  Attendants: Galceran, Gomis, Gongora, Montañá, Montesinos.  Review the SEGUIMIENTO report received on  Review the procedure of Accreditation  Definition of the work plan for elaboration of the Accreditation report.  Phase 1: We organized the work in Work Packages (WP).  Phase 2: First draft.  Phase 3: Submission to the GPAQ for review.  Phase 4: Public exhibition and approval. | | 20171026 | **Call for the Internal Evaluation Commission**  Call to the faculty members of the Doctoral Program to participate in the elaboration of the Accreditation report.  This call is extended to the students and graduated. | | 20171026 to 20171105 | **Data request to the** **Technical Management Support Unit UTG**  Responsible: N. Góngora.  After determining the data needed for the Acreditation report, we verified the available data of the Academic Commission of the Program, data available at the Technical Management support Unit (UTG) and the data available in different sources e.g.: Llibre de Dades UPC (<https://gpaq.upc.edu/lldades/>), Doctorate School (<https://doctorat.upc.edu/es>), AQU (<http://www.aqu.cat> accreditation, data, ….), etc. We listed the missing data and requested to the UTG. Deadline was 20171105. | | 20171103 | **Creation of the** **Internal Evaluation Commission (kickoff)**  Composed by members of the Academic Commission of the Program: S. Galceran, O. Gomis, N. Góngora, J. Montañá, S. Montensinos, L. Sainz  Faculty members of the Program: B. Blanqué and J.-R. Riba.  Graduate student: F. Fabró.  Student: Joan Sau Bassols  Assignment of the work packages (WP):  WP 1: Compilation and analysis of data for elaboration of the report (Montañá and Góngora)  WP 2: Estandard 1, 2 and 5 (Responsibles: Montañá)  WP 3: Estandard 4 (Responsibles: Galceran and Montesions)  WP 4: Estandard 6 (Responsibles: Gomis and Sainz)  WP 5: Description of the Doctoral Program (Responsibles: Blanqué and Riba)  Deadline 20171114 | | 20171115 | **First draft**  Meeting of the Internal Evaluation Commission. Merging the WP, discussion and preparation of the manuscript. | | 20171116 | **Circulation of the draft**  Draft is circulated to the Internal Evaluation Commission for comments. | | 20171120 | **Corrections and modifications of the draft**  J. Montañá corrected and modified the draft according to the received comments. | | 20171120 | **Final draft submission** the GPAQ for the first revision. | |  | **Analysis of the comments from the GPAQ**. Analysis of the received comments and suggestions. Inclusion of the suggestions, if proceed. | |  | **Public exhibition**. The proposed Accreditation report will be available to the general public at the website of the Program for 5 days. | |  | **Approval of the Accreditation Report.** Final review and submission for approval by the Board of the Department of Electrical Engineering (Junta del Departamento de Ingeniería Eléctrica) | |  | **Submission** of the Accreditation Report for evaluation of the program |   **Documents of reference**  RD 99/2011; Memoria Verificación (ID: 726853793); Informe AQU de la evaluación de la solicitud de Verificación de título oficial (ID: 5600071); Informe de Seguimiento (ISPD 5600071); Informe AQU valoración Seguimiento (ID: ISPD-12-IPD 5600071); Normativa académica de los estudios de doctorado de la UPC (ID: 117/2017); Reglament de règim intern de l’Escola de Doctorat de la Universitat Politècnica de Catalunya; Modelo de informe de acreditación; Guia per a l’acreditació dels programes oficials de doctorat de la AQU July 2017. |

1. **Evaluation of the degree of achievement of the standards**

# STANDARD 1: QUALITY OF THE FORMATIVE PROGRAM

* 1. The program has the mechanisms to guarantee the adequacy of the profile of the admitted students. The number of the students is coherent with the characteristics and distribution of the research lines of the program and the number of offered admissions.

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| The admitted students to the Doctoral Program are according to the profile described in the VERIFICACION1. A 94 % of the admissions (2012-17) have an engineering profile as specified in the VERIFICACION. In A 43 % of the students have studies of Industrial Engineering, a 23 % studies of masters in electrical engineering, power systems, renewable energy etc. and a 8 % corresponds to the Master in Engineering of the Energy of the UPC where the Doctoral Program is associated.  In the period of 2012-17 the admission profiles are according to the criteria of the program (VERIFICACION). We have experienced the extinguishing of the old RD 778 and RD 1393 syllabuses. The criteria are appropriate but it is indicated that the admissions are restricted to masters in engineering. However, the general growing increase in the interdisciplinarity of research requires to open to other different studies. As example, nowadays economics is an important part of the electric energy. Also, physics is necessary for solving complex problems (e.g. electric insulation, lightning). The program has been flexible to the specific cases (about 6 %) with origin of other disciplines not related to engineering (e.g. physics/meteorology, law, history of science). These cases have been treated especially by the Academic Commission. To satisfy the multidisciplinarity of research the program shall to be open to the admission of other disciplines that have incidence on electricity. We have proposed the improvement 901.M.9.2017 in order to include those students with a master’s degree not from engineering but form other areas that can be suitable for certain thesis (e.g. physics).  The origin of our students 64 % come from Spain whereas a 36 % come from foreign universities. 55 % of the admitted students are from the UPC, 4 % from other universities in Catalonia and 5 % from other Spanish universities. A 15 % of the foreign students of the program come from masters from countries of the European Union. The rest, more than 10% come from Latin American countries and more than 10 % from other countries, especially from middle east. The trend for the last three years suggest that the program is receiving about 50 % of the students from the UPC, a 15 % from other national universities and a 35 % from foreign universities. The indicators of the origin show the growing internationalization of the program. The program is becoming more attractive for international students and we are proud of that. That is probably associated to the growing number of the H2020 Marie Curie grants offered by the research groups of the Program.  In average, more than 40 % of the students have a grant. One of the strengths of our Doctoral Program is the variety of grants that are offered (or students get). Those are from the Spanish MINECO (FPI), Catalan AGAUR (FI and Industrial Doctorate), European Union H2020 (e.g. Marie Curie ITN), KIC program of the EU, IREC (Catalonia Institute for Energy Research) and grants from country of origin (e.g. Colciencias in Colombia and Conacyt in Mexico). It is important to underline the efforts of our faculty members on finding fellowship resources and cooperation with foreign countries. Also highlight the increase of H2020 Marie Curie grants during the last years. CITCEA got 3 grants in the MEDOW project. In 2017 the LRG group got 2 grants in the SAINT project and for 2018 CITCEA got 4 more grants for the InnoDC project.  The number of students at part time is ~10 %. In general students that courses the studies at part time combine their studies with professional work.  Students are distributed to the different research groups associated to the program. The distribution is appropriate according to the capacity, projects and facilities of the associated research groups. The group CITCEA has more of 50 % of the students. CITCEA has also the largest number of the faculty members of the program (36 %). Groups LRG, MCIA, QSE and SEER have had each about 10 % of the students of the program. To highlight that although LRG and MCIA have only one and two faculty members in the program, respectively, the number of students is high. Most of the students that apply for admission have had previous contact with any of the faculty members of the program and then are assigned to a supervisor accordingly. The program established a mechanism for those students that have not contact previously with a supervisor. According to the profile of the students and their interests the program suggest to contact the most suitable faculty members (or research groups).  The number of offered admission is 30 per year (admissions that effectively enrol to the program). However, the number of students that enrol to the program oscillated from a maximum of 21 in 2014-15 to a minimum of 7 in 2015-16 (see table in the indicators below this standard). But on the other hand, the number of the applications for admission ranged from a maximum 46 in 2016-17 to a minimum of 17 in 2012-13 (see data below this standard). The reasons that conduced to a lower number of enrolled students compared to the offered admissions can be attributed to several factors:   * RD 779 and RD 1391 had extinguished and students from these syllabuses changed from one to the other. That implied more enrolments. * The number of faculty members of the Doctoral Program decreased from the VERIFICACION in 2012 to the present. In the VERIFICACION a large number of members were included, basically all the members of the involved research group at that time. However, the number of faculty has been reduced because not all the initially proposed members fulfilled the rules2 to supervise a PhD thesis. * The evolution of the number of the offered PhD positions related to completive projects (e.g. MINECO, H2020). * Effects related to the gap between the end of the studies on Industrial Engineering and the first class of students with master in Industrial Engineering. Industrial Engineering have been one of the most typical profile of our students. * Three active members of the group SEER left the program. SEER was a growing group but currently only one member of SEER remains in our program. * CITCEA is the largest group. The rest of the groups, although are very active, the number of faculty members associated to the Program is low. * Retirement of some members and disengagement from the institution.   On the other hand, some new active members had enrolled the Doctoral Program (e.g. LRG and MCIA members). In addition, in terms of funding in competitive projects some of the groups associated to the program (e.g. CITCEA, MCIA, SEER and LRG) are within the first quartile within the UPC groups and departments. But that is not proportional to the number of PhD fellowships. The tendency in the last two years is a growth with H2020 Marie Curie and AGAUR Industrial Doctorate.  We propose in the improvement 901.M.8.2017 to adjust the number of offered admissions (enrolments) according to the experience of the admissions during the period 2012-17 and the future years. The experience showed an average number of admissions of 14 students (2017 not included). We propose to reduce the offered admissions to 20. We believe that this number is more adjusted to the current situation and strategically suitable because we expect that the number of admissions will slightly grow in the next years due to the consolidation of some groups, increase of experience of some groups in H2020 projects and the addition of new faculty able to supervise thesis.  IMPROVEMENTS:  901.M.9.2017: Open admissions to students with degrees in masters nor from engineering.  901.M.8.2017: Modification of the number of admissions from 30 to 20.  1 Application: Memoria Verificación (ID: 726853793); Evaluation report of the application: Informe AQU de la evaluación de la solicitud de Verificación de título oficial (ID: 5600071).  2 Reglament de règim intern de l’Escola de Doctorat de la Universitat Politècnica de Catalunya. |

* 1. The program has the mechanism to supervise doctoral students and, if the case, formative activities.

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| The supervision of the PhD students (hereby students) comprises three actions:   * Director/s or supervisor: they direct and supervise the work program of the PhD including formative activities (*actividades formativas*) such as short courses, seminars, assistance at conferences, writing articles, etc). Each year the director/s write a report indicating the progress and emitting an evaluation (Pass/Fail). A positive evaluation is needed to continue being enrolled. The Academic Commission evaluates every year the director/s report. The compromises between the assigned director/s and the student is reflected in the *Document of Compromise* between the student and the director/s (document de Compromiso entre el Doctorando y el/los Director/es). That includes compromises related to the work and ethics. * The program has available the Document of Activities of the PhD student (DAD, Documento de Actividades del Doctorando). This document is a register of the activities of the student that includes all the formative activities (courses, seminars, conferences, journal papers, mobility, etc). The student with the approval of the director/s shall keep this document updated. Once a year the students shall submit the document to the PhD Program and these are revised by the Academic Commission. * Research Plan (Plan de Investigación): Besides the previous supervision mechanisms, the presentation of the Research Plan is a key supervision activity. During the first year of enrolment the students shall submit a Research Plan and defense it in a panel. In this Research Plan the student describes the proposed PhD thesis and specifies the activities and their schedule to complete it in the remaining duration of his PhD studies. In most of the cases the defences are satisfactory. The mission of the panel has been adapted to the actual syllabus (plan de estudios). Now the panel is focused on the adequacy of the activities and schedule in the scientific and academic (duration and formative) point of views. In the SEGUIMIENTO phase, an improving activity was proposed. The improving activity 901.M.1.2016 requests to include the formative activities in the Research Plan. Another improving activity (901.M.6.2016) described in the SEGUIMIENTO is the documents with rubrics for the Research Plan and thesis (e.g. document RUB-PR-01) that is available to the members of the evaluation panels and to the students. Although we still do not have much experience with the defined rubrics we grade as very positive and helpful for the panels in order to evaluate the normative requirements and provide suggestions. On the student side, rubrics helped to not miss contents and know how the panels will grade.   It is also under the Academic Commission the evaluation and approval of the thesis at the time of submission for defense. Before accepting for submission (depósito) the commission reviews the quality of the thesis including the formative activities of the student and results related to the thesis (reflected at the DAD). The commission verifies if the thesis had produced a minimum of two JCR papers. If that is not the case the commission asks for the reports of a minimum of two external reviewers. The external reviewers must be recognized researchers in the field of the thesis, not related with the PhD program and not related with the thesis to submit.  We have proposed three improvements. The 901.M.1.2016 is related to the supervision of the formative activities. We propose to include a plan of formative activities in the Research Plan that the student has to present during the first year. The second is to increase the quality of the Research Plan in terms of evaluation. In 901.M.6.2016 we propose rubrics for the evaluation of the Research Plan including the object of providing suggestions. Finally, we are still suggesting the Doctoral School to develop an online application of the report of the activities of the student (DAD). That corresponds to 901.M.2.2016.  IMPROVEMENTS:  901.M.1.2016: To include the formative activities in the Research Plan (still under implementation)  901.M.6.2016: Rubrics for the Research Plan (implemented).  901.M.2.2016: Online information of the Activities of the Students (DAD). |

* 1. The program collects the modifications that have been introduced to the title (syllabus).

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| Changes that not require application to Modification procedure:   |  |  | | --- | --- | | Direction | New coordinator of the PhD Program: In 2014 the program changed the coordinator.  This was indicated at the Seguimiento phase. | | Description of the studies: context | The context is modified since the Verification included the access by means of the old study plans of Industrial Engineering.  This was indicated at the Seguimiento phase. | | Description of the studies: cooperation | New cooperation with international institutions: KUL Leuven, Belgium; MIT, USA; Cardiff University; UK; Manchester University, UK; FHWS, Germany; University of L’Ille 1, France; University of Bergen, Norway; Universidad Nacional de Colombia.  This was indicated at the Seguimiento phase. | | Organization: Normative of submission of thesis | Specific normative  The normative for the presentation of the thesis as a compendium of articles has been defined and approved in January 2017.  This is indicated in the present Accreditation phase. |   The following changes are presented for Modification:   |  | | --- | | Modification 1: Academic personnel and lines: Faculty members of the program and research groups | | Faculty members of the program:  The following members abandoned the PhD program:   * Pedro Rodríguez: former director of the SEER group. He is no longer at the UPC. * José Ignacio Candela and Álvaro Luna: both from the SEER changed his membership to another PhD program which is directed now by José Ignacio. * Antoni Sudrià has retired.   The following members do not agree with the requirement to direct a PhD thesis and are not currently members of the Doctoral Program.   * E. Aldabas; J.R. Hermoso; A. Jornet (no longer at UPC); E. Martínez; I. Perat; J. Rocabert; R. Ramirez (changed area);   The following faculty members enrolled to the PhD Program:   * Joan Montañá (LRG group). * Jordi Roger Riba (MCIA group) and Antonio Garcia Espinosa (MCIA group).   The current list of the members can be found in the website of the Program.  Comments on the change of the overall number of the faculty members of the program:   * These changes were indicated at the Seguimiento phase. * At the Verificación the total number of the faculty associated to the program was 30 members. However not all the listed faculty at the Verification had the requirements to direct a thesis. At the time of the Verification, the number of faculty that could direct thesis at that time was 26 (e.g. some of the indicated members were even not PhD at that time). * The current number of the faculty members of the program is 25 members. * The difference is the number of faculty members is less than 25 %. | | Research lines of the program:  The research groups related with the program was been upgraded with two more groups at the Seguimiento phase:   * MCIA which is focused on motion control, renewable energies, electric vehicles and high voltage. MCIA has members from the Department of Electronics and Electrical Engineering. Jordi Roger Riba and Antonio Garcia Espinosa are faculty of the Department of Electrical Engineering associated to this group.   LRG which is focused on lightning and high voltage research. Joan Montanyà is the director of this group and the current responsible of the PhD Program. The LRG investigates from fundamental aspects of electrical discharges and atmospheric electricity to the lightning effects and protection of wind turbines and aircraft.  Comments on the change of the associated research lines:   * These changes were indicated at the Seguimiento phase. * The research lines indicated at the Verificación were: CITCEA, SEER, GAECE and QSE. * At the Seguimiento, two more research lines were added: LRG and MCIA. * That is an increase of the number of groups in 50 % from the number of groups indicated at the Verificación. |  |  | | --- | | Modification 2: Centers: Offered number of admissions | | At the Verificación, the offered number of admisions was 30. At this time, we propose to reduce the number of admissions to 20. This reduction implies a 33 % of the  See the previous section 1.1 and the proposed action 901.M.8.2017. |   General:  A minimum of once a year the public information (e.g. web site) is updated with the list of the members of the PhD Program.  In general, the modifications improve the quality of the program. Some are needed in order to adapt the current regulation of the PhD studies. As the university, our program is not a static system, so new members are now included and some others for several circumstances abandoned the Doctoral Program. Similarly, the intensity in the research activity of the faculty changes in time, that implies changes in the associated personnel.  We consider modifications as a resource of our program to be able to adapt to the circumstances (regulations, personnel, groups, academic, etc). Thus, modifications are appreciated positively.  In SEGUIMIENTO we proposed the improvement 901.M.3.2016 because it was not a systematic procedure to update the members and groups of the Program. It was updated in 20161110 and established a periodic update in the Planning of the Doctoral Program (schedule).  IMPROVEMENTS:  901.M.3.2016: Updating of the members and groups of the Program.  901.M.8.2017: Modification of the number of admissions. |

**INDICATORS**

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Note: current syllabus is RD99. RD1393 and RD 778 are now extinguished.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Year** | **RD 99** | **RD 1393** | **RD 778** | **TOTAL** | | **2012-13** | 14 | 41 | 11 | 66 | | **2013-14** | 22 | 30 | 8 | 60 | | **2014-15** | 38 | 22 | 8 | 68 | | **2015-16** | 45 | 11 | 4 | 60 | | **2016-17** | 49 | 6 | 0 | 55 | | **2017-18** | 32 | 0 | 0 | 32 | |  |  |  | Average | 57 |  |  |  |  |  | | --- | --- | --- | --- | | **Year** | **Number of new enrolled students**  **(only RD 99)** | **Total number of enrolled students**  **(all RD)** | **Percentage of enrolled foreign students**  **(all RD)** | | **2012-13** | 14 | 66 | 34.6 | | **2013-14** | 11 | 60 | 60 | | **2014-15** | 21 | 68 | 35 | | **2015-16** | 14 | 60 | 33.3 | | **2016-17** | 8 | 55 | 25 | | **2017-18** | 10\* | 32 | 33.3 | | Average | 12 | 57 | 37 |   \*The value corresponds to the number at the end of 2017. The year 2017-18 ends on July 2018.   * + - Percentage of students coming from studies/masters from other universities: average: ~50 %  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Year** | **UPC** | **other universities in Catalonia** | **universities**  **rest of Spain** | **EU universities** | **Latin American universities** | **Other universities (countries)** | | **2012-13** | 61.5 | 1.9 | 1.9 | 7.7 | 19.2 | 7.7 | | **2013-14** | 30 | 0 | 10 | 40 | 0 | 20 | | **2014-15** | 55 | 5 | 5 | 25 | 5 | 5 | | **2015-16** | 50 | 16.6 | 0 | 0 | 0 | 33.3 | | **2016-17** | 50 | 12.5 | 12.5 | 12.5 | 0 | 12.5 | | **2017-18** | 50 | 0 | 16.6 | 16.6 | 0 | 16.6 | | Average | 49.4 | 6 | 7.6 | 16.9 | 4.0 | 15.8 |  * + - Number and percentage of the academic origin of the students of the program:  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **Studies** | **Number of students** | | | | | | **Percentage**  **(%)** | | **2012-13** | **2013-14** | **2014-15** | **2015-16** | **2016-17** | **2017-18** | | Industrial Engineering | 26 |  | 12 | 2 | 1 | 2 | 42.6 | | Physics | 1 |  |  |  |  | 1 | 2.0 | | Electronic Engineering | 2 |  |  |  |  |  | 2.0 | | Automation Engineering | 1 |  |  |  |  |  | 1.0 | | Electrical Engieenring | 4 |  | 3 |  |  |  | 6.9 | | Telecomunication Eng. | 1 |  |  |  |  |  | 1.0 | | Master Elecrti/Power/Energy (abroad) | 8 | 4 | 5 | 2 | 2 | 2 | 22.8 | | Tech. Engineering Electric | 4 |  |  |  |  |  | 4.0 | | Law licenciature | 1 |  |  |  |  |  | 1.0 | | Master meteorology | 1 |  |  | 1 | 1 |  | 3.0 | | Mechanic. Engineering |  | 2 |  |  |  |  | 2.0 | | Master Eng. Energy UPC |  | 3 |  | 2 | 3 |  | 7.9 | | Master Hist. Science |  |  | 1 |  |  |  | 1.0 | | Master Industrial Eng |  |  |  |  | 1 | 1 | 2.0 | | Master Telecomuniations |  |  |  |  |  | 1 | 1.0 |  * + - Percentage of students with grants (data from presented thesis):  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Spanish MINECO | Catalonia AGAUR | EU H2020 | UPC | IREC | Country of origin | EU KIC program | Total | | 2012-13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 % | | 2013-14 | 0 | 0 | 0 | 0 | 43 % | 14 % | 0 | 57 % | | 2014-15 | 12.5 % | 0 | 0 | 0 | 25 % | 12.5 % | 0 | 50 % | | 2015-16 | 12.5 % | 0 | 0 | 0 | 12.5 % | 12.5 % | 0 | 37.5 % | | 2016-17 | 12.5 % | 0 | 0 | 12.5 % | 0 | 0 | 0 | 25 % | | 2017-18 | 0 | 33.3 % | 16.7 % | 0 | 0 | 16.7 % | 16.7 % | 83.5 % | |  |  |  |  |  |  |  | Average | 42 % |   Note: These percentages are uniquely from the presented thesis. That does not reflect the 9 H2020 grants and the 6 Industrial Doctorate, and one MINECO FPI. |  * + - Applications of enrollement  |  |  |  |  | | --- | --- | --- | --- | | **Year** | **Nbr of applications** | **Admitted\*** | **Denied** | | **2012-13** | 17 | 7 | 0 | | **2013-14** | 18 | 5 | 1 | | **2014-15** | 42 | 19 | 13 | | **2015-16** | 34 | 7 | 11 | | **2016-17** | 46 | 14 | 1 | | **2017-18** | 30 | 7 | 0 | | **Average** | 31 | 10 | 4 |   Note: \*Admitted status is when a supervisor or director has been assigned. Then, applications that fulfil the requirements to be admitted are not formally admitted until a supervisor is assigned. Enrolled can differ from admitted because admitted have one year to enrol. Denied are those that not fulfilled the requirements. Many applications are not processed due to lack of information.   * + - Percentage of enrolled students at part time: average:  |  |  |  | | --- | --- | --- | | **Year** | **Full time** | **Part time** | | **2012-13** | 78.6 | 21.4 | | **2013-14** | 72.7 | 27.3 | | **2014-15** | 89.5 | 10.5 | | **2015-16** | 95.6 | 4.4 | | **2016-17** | 91.8 | 8.2 | | **2017-18** | 90.9 | 9.1 | | **Average** | 86.5 | 13.5 |  * + - Percentage of enrolled students according to the admission requirements: 2012: 4 % (2 cases), 13: 0 %, 14: 4.7 % (1 case), 15:14.3 % (1 case), 16: 12.5 % (1 case), 17: 14.3 % (1 case). Average 6 %.     - Percentage of students by research line:  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Group  (Nbr of faculty members) | **CITCEA**  (9) | **GAECE**  (3) | **INSUP\***  (1) | **LRG**  (1) | **MCIA**  (2) | **QSE**  (6) | **SEER**  (1) | **SEPIC\***  (1) | **ACES\***  (1) | | % of students | 52.9 | 0.3 | 5.7 | 8.9 | 9.2 | 10.1 | 10.6 | 1.1 | 1.1 |   Note: INSUP, ACES and SEPIC are not associated with the Doctoral Program but faculty of the program belongs to these groups. |

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# STANDARD 2 APPROPRIATENESS OF THE PUBLIC INFORMATION

**2.1** The published information of the characteristics of the program, operative and results is true, complete and updated.

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| The information related to the Doctoral Program is available at [http://ee.postgrau.upc.edu/](http://ee.postgrau.upc.edu/ca). This site contains the specific information of the program that is listed below. In addition the web site of the Doctoral School (Escuela de Doctorado) <http://doctorat.upc.edu/> offers additional information about doctorate studies at the UPC and links our web site. In addition, the UPC offers a web site with indicators related to the university, research, academic, etc <https://gpaq.upc.edu/lldades/>.  Among other, the information that can be found at the Doctoral Program website is:   * Access to the program: Objectives, profile of admission, profile after finish the studies, number of offered admissions, dates and deadlines of enrolment, procedure of enrolment, requirements and criteria of admission, procedure and assignment of a mentor and thesis director (supervisor), supplementary training, grants. * Organization: Research lines of the program, training activities, procedure for the elaboration and presentation (including defence) of the Research Plan (Plan de Investigación). * Operative Planning: Academic normative, duration of the studies and continuation (permanence), academic agenda, learning resources, system of internal quality guarantee. * Faculty: faculty members of the program, academic and research profiles, contact. * Mobility programs. * Doctoral thesis: Normative and legal frame, presented thesis in the last years. * Labour insertion.   The following indicators are available in the Indicators section:   * Quality of the formative program: offered admissions, requests of admissions, first time enrolments, total number of enrolled students, percentage of foreign students, percentage of students from masters from other universities, percentage of students at part time, percentage of students with grants. * Qualification of the faculty: number of directors (supervisors) of presented thesis, percentage of active six-year term positive qualification (sexenios). * Effectiveness of the systems of learning support: satisfaction of the students with the studies, satisfaction of the directors (supervisors) of thesis with the studies. * Quality of the results: Percentage of the abandonment of the program, percentage of thesis with cum laude qualification, percentage of graduated (doctors) with international mention, number of scientific results of the thesis, percentage of the students with mobility of research, employment rate, rate of job adequacy to the studies. |

**2.2** It is guaranteed an easy Access to the relevant information of the program to all groups of interests that include the results of the Follow up phase (Seguimiento) and if the case Accreditation?

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| In the previous section (2.1) it has been verified that the listed information is visible and accessible. Actions to improve the information of the website have been done during the period 2012-17. Here a summary of some of the main updates:   * Creation of the current website: May, 2013 * Feb, 2015: Update of academic information of admissions, etc. * August ,2015: Update of English version. * 2017 (July, October, November): General update of visibility. Rearrangement of the information. Improvement the English version.   Annually, the website is updated with the academic calendar. List of the faculty members and groups of the Program are updated when these are revised. Also indicators and other information is periodically update.  The website is now much more useful and with easy-to-reach of the information than two years ago. However, there are always room for improvements. We propose an action to continue improving:   * The improvement 901.M.4.2016 was proposed in the SEGUIMIENTO and was focused on the improvement of the English version of the website. We plan to continue improving the English version. That will significantly contribute to our visibility. * We have extended the improvement 901.M.4.2016 to include other information in the website. We plan include information related to grants, thesis proposals and news * We detected a lack of guidance of foreign students. The Office of Foreign Relations (equivalent to an International Scholar Office of other universities) does not do always do the reception and guidance of new enrolled foreign students. In particular, we detected that foreign students do not always know the procedures of immigration. In the 901.M.4.2016 we propose to add a section in the website of the program with practical information for foreign students.   IMPROVEMENTS:  901.M.4.2016: To continue updating the website including information of grants, mobility, practical information for foreign students. In particular to continue improving the English version. |

**2.3** The internal quality assurance system (SIGQ) of the doctoral program is published

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| See the University report prepared by the Doctoral School. |

**Evidences**

**Checklist of the public information of the program:**

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| **Taula 1.1. Contingut de la informació pública sobre el desenvolupament operatiu dels programes de doctorat** | |
| **DIMENSIÓ** | **CONTINGUTS** |
| ***ACCÉS AL PROGRAMA DE DOCTORAT*** | * Objectius del programa * Perfil d’ingrés * Perfil de sortida * Nombre de places ofertes * Període i procediment de matriculació * Requisits i criteris d’admissió * Procediment i assignació de tutor i director de tesi * Complements de formació * Beques   Beques |
| ***ORGANITZACIÓ*** | * Línies de recerca * Activitats formatives * Procediment per a l’elaboració i defensa del pla de recerca |
| ***PLANIFICACIÓ OPERATIVA*** | * Normativa acadèmica * Durada dels estudis i permanència * Calendari acadèmic * Recursos d’aprenentatge: * Espais virtuals de comunicació * Laboratoris * Biblioteca * Altres * Sistema de garantia interna de la qualitat |
| ***PROFESSORAT*** | * Professorat del programa * Perfil acadèmic i investigador * Informació de contacte |
| ***PROGRAMES DE MOBILITAT*** | * Objectius * Normativa general * Beques |
| ***TESI DOCTORAL*** | * Normativa i marc general (avaluació, dipòsit, defensa, menció internacional al títol, estructura, etc.) * Tesis defensades els darrers cursos acadèmics |
| ***INSERCIÓ LABORAL*** | * Principals sortides laborals (empreses, universitats i altres institucions) dels doctorands del programa |

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| **Taula 1.2. Indicadors mínims que haurien de ser públics** | |
| **DIMENSIÓ** | **INDICADORS** |
| ***QUALITAT DEL PROGRAMA FORMATIU*** | * Oferta de places * Demanda * Estudiants matriculats de nou ingrés * Nombre total d’estudiants matriculats * Percentatge d’estudiants estrangers matriculats * Percentatge d’estudiants provinents d’estudis de màster d’altres universitats * Percentatge d’estudiants matriculats a temps parcial * Percentatge d’estudiants amb beca |
| ***ADEQUACIÓ DEL PROFESSORAT*** | * Nombre de directors de tesis defensades * Percentatge de sexennis vius dels directors de tesis defensades |
| ***EFICÀCIA DELS SISTEMES DE SUPORT A L’APRENENTATGE*** | * Satisfacció dels doctorands amb els estudis * Satisfacció dels directors de tesi amb els estudis |
| **DIMENSIÓ** | **INDICADORS** |
| ***QUALITAT DELS RESULTATS*** | * Nombre de tesis defensades a temps complet * Nombre de tesis defensades a temps parcial * Durada mitjana del programa de doctorat a temps complet * Durada mitjana del programa de doctorat a temps parcial * Percentatge d’abandonament del programa * Percentatge de tesis amb la qualificació de cum laude * Percentatge de doctors amb menció internacional * Nombre de resultats científics de les tesis doctorals * Percentatge d’estudiants del programa de doctorat que han realitzat estades de recerca * Taxa d’ocupació * Taxa d’adequació de la feina als estudis |

# STANDARD 3 EFFECTIVENESS OF THE INTERNAL QUALITY ASSURANCE SYSTEM (SGIQ)

**3.1** The implemented SIGQ eases the procedures of design and approval of the doctoral program, its following up and accreditation

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| See the report of the University elaborated by the Doctoral School. |

**3.2** The implemented SGIQ guarantee the collection of information of the relevant results for an efficient management of the doctoral program, in especial the satisfaction of the groups of interest.

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| See the report of the University elaborated by the Doctoral School. |

**3.3** The implemented SGIQ is periodically revised to analyze its adequacy, and if the case, an improvement plan is proposed.

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| See the report of the University elaborated by the Doctoral School. |

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# STANDARD 4 ADEQUACY OF THE ACADEMIC PERSONNEL (FACULTY MEMBERS OF THE PROGRAM)

**4.1** Faculty have an accredited research activity.

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| The faculty staff of this doctoral program belongs to one of the following UPC research groups, most of which have been recognized by the Generalitat of Catalonia (AGAUR agency) as consolidated groups (GRC) or emergent groups (GRE):   * CITCEA (9 prof.): Research group in static converters and drives (GRC). * QSE (6 prof.): Research group on quality of electrical supply. * GAECE (3 prof.): Research group on electric drives (GRE). * LRG (1 prof.): Research group in protection against lightning strike, atmospheric electricity and high voltage (GRC). * SEER (1 prof.): Renewable electric power systems research group (GRC). * MCIA (2 prof.): Motion control and industrial applications research group (GRC). * SEPIC (2 prof.): Electronic power and control systems research group (GRC). * InSup (1 prof.): Research Group on Interaction of Surfaces in Bioengineering and Materials Science. * ACES (1 prof.): Advanced control of energy systems (GRC).   To be a professor of this program, the requirement is the one established by the university: to direct at least one competitive active research project and / or having a positive last six-year research evaluation and / or having conducted at least one thesis in the last five years. The table 4.1 (at the end of this Standard) details the program's professors who meet one or more requisites with parameters that accredit their research activity.  The quality of the scientific contributions of the program's researchers is very high. It is worth highlighting the 378 indexed publications (JCR) carried out by members of this program in the last six years (2012-2017). 94 of these publications are at JCR listed journals at the first quartiles (Q1). See table 4.4 at the end of this Standard.  Table 4.2 reflects the active regional, national, and international competitive research projects directed by professors in this program. Table 4.3 presents the active projects in which the members of the program are participating.  We value positively the research activity of our faculty members. The quality of the research is demonstrated by the number of JCR publications, JCR Q1 and the competitive projects. WE would like to highlight the fact that research of our members has even appeared in the Nature journal (see: <https://www.nature.com/articles/506268a>). Moreover, we consider that our number of the active H2020 projects is high compared to the size of the program. |

**4.2** Number of faculty is enough and has a proper dedication to develop their functions.

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| There are about 26 permanent professors and researchers within this program, and others from other foreign universities, who carry out management or collaborative tasks with the research carried out within the program. It is worth mentioning that in the last five years 47 theses have been presented and directed by 18 faculty members of the program, 35 of which have received the mention CUM LAUDE.  The Academic Commission also monitors the different lines of research and associated faculty in order to detect problems or lines that have insufficient level of activity or that do not make them suitable for their participation in the program. To do that, the Academic Commission plans in its Planning of the Doctoral Program periodic actions to evaluate the faculty members and research groups that belongs to the program.  The number of members of the program is valued positively. However, the presented thesis falls on 70 % of the members. About 50 % of the members have supervised more than 1 defensed thesis. We find this value low and that should be improved. Improvement 901.M.5.2016 will help to promote the direction of thesis.  According to the surveys of the UPC (GPAQ) to all the industrial doctoral programmes, the average satisfaction of the students with the doctoral programmes is 3.76 over 5. Students grade with an average of 3.3 over 5 the satisfaction on the orientation and support given by the directors/supervisors of the thesis in the election of the subject of the thesis. In general, a grade of 3 over 5 is given to the satisfaction of the students in relation to the satisfaction of the directors/supervisors. The UPC (GPAQ) has not conducted specific surveys for our doctoral program. On this line, the Doctoral School is preparing a proposal of survey related to the satisfaction of the students with the programs (see the proposal of survey in the report of the Doctoral School). |

**4.3** The doctoral program conducts actions to promote the direction of thesis.

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| According to the agreement 139/2016 of the Consell de Govern 139/2016 of the UPC it is contemplated that the thesis direction will be valued with 4,5 educational activity points (PAD) that will be counted to the directors in the three years following the date of the thesis reading.  The UPC is developing a new model that promotes the increase of thesis read and the quality publications derived from these, this will be reflected in additional PAD points by the participating professors.  The improvement action 901.M.5.2016 was proposed in the SEGUIMIMENTO and still is active. This action corresponds to an internal procedure with reference PFT. In this procedure we promote personalized actions to the faculty of the Department and organize meetings/workshops. Until now we have done informative actions during meetings of the Electrical Engineering Department.  IMPROVEMENTS:  901.M.5.2016: To promote direction of thesis. |

**4.4** The degree of participation of foreign collaborators and participation of international members in the committees of evaluations (e.g. examining panels of thesis) are suitable for the scientific area of the program.

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| Per donar resposta a aquest apartat s'ha de valorar la participació de professorat estranger en la direcció de tesis doctorals i en la impartició d'activitats formatives.  Of the 47 theses directed by the PDI of this program in the last five years, 16 (34 %) have a European or International mention. This fact implies that these doctors have spent a stay outside Catalonia in a foreign research group for a period of more than 3 months; and, at the same time, experts from different nationalities have acted as members for the evaluation of the thesis.  It must be said, also, that there have been five external professors (not belonging to UPC) who have directed or co-directed theses within this program and that in that sense, co-operation agreements are encouraged. Two of these professors are with international research groups.  The program has had a large participation of international researchers in our thesis examining commissions (see table 4.5). The participation in the examining panel and to the process of the review of the thesis demonstrates the internationalization of the program and the interest of the research conducted by our students. |

**INDICATORS**

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| * + - Table 4.1: List of faculty members including research groups, six-year evaluations, number of supervised thesis, h-index and professor rank.  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Full name** | **Research Group** | **Number of six-year positive evaluations** | **Number of conducted thesis in the last five years** | **h-index** | **Professor rank** | | ANDRADA GASCÓN, PEDRO | GAECE | No public | 0 | 7 | CEU | | BARGALLO PERPIÑA, RAMON | QSE | No public | 0 |  | CEU | | BERGAS JANE, JOAN GABRIEL | CITCEA | No public | 2 | 16 | TU | | BLANQUÉ MOLINA, BALDUINO | GAECE | No public | 1 |  | Agregat | | BOGARRA RODRIGUEZ, SANTIAGO | QSE | No public | 0 |  | Col·laborador | | BOIX ARAGONES, ORIOL | CITCEA | No public | 1 | 5 | TU | | BOSCH TOUS, RICARDO | InSup | No public | 4 |  | TU | | CORCOLES LOPEZ, FELIPE | QSE | No public | 2 | 14 | TU | | DE LA HOZ CASAS, JORDI | SEPIC | No public | 0 | 6 | Agregat | | DORIA CEREZO, ARNAU | ACES | No public | 0 | 12 | Agregat | | GALCERAN ARELLANO, SAMUEL | CITCEA | No public | 1 | 13 | Agregat | | GARCIA ESPINOSA, ANTONIO | MCIA | No public | 0 |  | Agregat | | GOMIS BELLMUNT, ORIOL | CITCEA | No public | 12 | 38 | CU | | MARTIN CAÑADAS, MARIA ELENA | SEPIC | No public | 0 |  | TU | | MESAS GARCIA, JUAN JOSE | QSE | No public | 0 | 6 | Agregat | | MONTAÑA PUIG, JUAN | LRG | No public | 3 | 18 | CU | | MONTESINOS MIRACLE, DANIEL | CITCEA | No public | 5 | 13 | Agregat | | MUJAL ROSAS, RAMON MARIA | SEER | No public | 2 |  | Agregat | | PEDRA DURAN, JOAQUIN | QSE | No public | 3 | 16 | CU | | RIBA RUIZ, JORDI ROGER | MCIA | No public | 3 | 20 | Agregat | | RULL DURAN, JUAN | CITCEA | No public | 1 |  | TU | | SAINZ SAPERA, LUIS | QSE | No public | 2 |  | TU | | SUDRIA ANDREU, ANTONI | CITCEA | No public | 1 | 19 | Emèrit | | SUMPER, ANDREAS | CITCEA | No public | 4 | 26 | Agregat | | TORRENT BURGUES, MARCEL | GAECE | No public | 1 |  | TU | | VILLAFÁFILA ROBLES, ROBERTO | CITCEA | No public | 3 | 10 | Agregat |  * + - Table 4.2: Active competitive research projects in which the PI is member of the program:  |  |  |  |  | | --- | --- | --- | --- | | **Name** | **Reference** | **Financial institution** | **Period** | | ANDRADA PEDRO | DPI2014-57086-R | MINECO | 20141001-20171231 | | GOMIS BELLMUNT, ORIOL | ENE2015-67048-C4-1-R | MINECO | 20160101-20181231 | | H2020-765585 | H2020-MSCA-ITN-2017 | 20170901-20180831 | | MONTAÑA PUIG, JUAN | H2020-722337-SAINT | H2020-MSCA-ITN-2016 | 20170301-20210228 | | ESP2015-69909-C5-5-R | MINECO | 20160101-20171231 | | 2015 DI 059 | AGAUR | 20160222 - 20190221 | | MONTESINOS  MIRACLE, DANIEL | RTC-2016-4637-4 | MINECO | 20180101-20181231 | | Desarrollo de convertidores DC/DC | FUNDACIÓN IBERDROLA | 20170901-20180901 | | RTC-2016-4637-4 | MINECO | 20170101-20171231 | | COMRDI15-1-0043-02 | ACC10 | 20160301-20181015 | | COMRDI15-1-0009-01 | ACC10 | 20150101-20181015 | | MUJAL ROSAS, RAMON MARIA | ENE2014-60228-R | MINECO | 20150101-20171231 | | PEDRA DURAN, JOAQUIN |  |  |  | | RIBA RUIZ, JORDI ROGER | 2016 DI 065 | AGAUR | 20170828-20200827 | | RTC-2014-2862-3 | MINECO | 20170101-20171231 | | TRA2016-80472-R | MINECO | 20161230-20191229 | | H2020-755332-AEMSIDFIT | H2020 | 20170701-20200630 | | SUDRIA ANDREU, ANTONI | 2014 DI 015 | AGAUR | 20150101-20171231 | | SUMPER, ANDREAS | 636249 | H2020 | 20150101-201804030 | | ENE2015-67048-C4-1-R | MINECO | 20160101-20181231 | | VILLAFÁFILA ROBLES, ROBERTO | H2020-731148-INVADE | H2020 | 20170101-20191231 |  * + - Table 4:3 Participation in active competitive research projects by faculty members of the program:  |  |  |  |  | | --- | --- | --- | --- | | **Name** | **Reference** | **Financial institution** | **Period** | | ANDRADA PEDRO | DPI2014-57086-R | MINECO | 20141001-20171231 | | BARGALLO RAMON |  |  |  | | BERGAS JANE, JOAN GABRIEL | 636249 | H2020 | 20150101-20180430 | |  | 642201 | H2020 | 20141201-20180228 | | BLANQUÉ MOLINA, BALDUINO | DPI2014-57086-R | MINECO | 20141001-20171231 | | BOGARRA SANTIAGO | H2020-755332-AEMSIDFIT | H2020 | 20170701-20200630 | | BOIX ARAGONES, ORIOL |  |  |  | | BOSCH TOUS, RICARDO |  |  |  | | CORCOLES LOPEZ, FELIPE |  |  |  | | DE LA HOZ CASAS, JORDI | ENE2015-64087-C2-1-R | MINECO | 20160101-20181231 | | PCIN-2015-001 | MINECO | 20150901-20180831 | | DORIA CEREZO, ARNAU | COMRDI15-1-0043-02 | ACC10 | 20160301-20181015 | | DPI2013-41224-P | MINECO | 20140101-20171231 | | GALCERAN ARELLANO, SAMUEL | H2020-731148-INVADE | H2020 | 20170101-20191231 | | 636249 | H2020 | 20150101-20180430 | | GARCIA ESPINOSA | H2020-755332-AEMSIDFIT | H2020 | 20170701-20200630 | | TRA2016-80472-R | MINECO | 20161230-20191229 | | GOMIS BELLMUNT, ORIOL | ENE2015-67048-C4-1-R | MINECO | 20160101-20181231 | | H2020-765585-InnoDC | H2020-MSCA-ITN-2017 | 20170901-20180831 | | H2020-731148-INVADE | H2020 | 20170101-20191231 | | MARTIN MARIA ELENA | ENE2015-64087-C2-1-R | MINECO | 20160101-20181231 | |  | PCIN-2015-001 | MINECO | 20150901-20180831 | | MESAS JUAN JOSE | MTM2014-59179-C2-1-P | MINECO | 20150101-20181231 | | MONTAÑA PUIG, JUAN | H2020-722337-SAINT | H2020-MSCA-ITN-2016 | 20170301-20210228 | | ESP2015-69909-C5-5-R | MINECO | 20160101-20171231 | | 2015 DI 059 | AGAUR | 20160222 - 20190221 | | MISTI Global Seed Funds 2018 | MIT | 20180101-20190831 | | MONTESINOS MIRACLE, DANIEL | RTC-2016-4637-4 | MINECO | 20180101-20181231 | | Desarrollo de convertidores DC/DC | FUNDACIÓN IBERDROLA | 20170901-20180901 | | RTC-2016-4637-4 | MINECO | 20170101-20171231 | | COMRDI15-1-0043-02 | ACC10 | 20160301-20181015 | | COMRDI15-1-0009-01 | ACC10 | 20150101-20181015 | | 2014 DI 015 | AGAUR | 20150101-20171231 | | MUJAL ROSAS, RAMON MARIA | ENE2014-60228-R | MINECO | 20150101-20171231 | | PEDRA DURAN, JOAQUIN |  |  |  | | RIBA RUIZ, JORDI ROGER | 2016 DI 065 | AGAUR | 20170828-20200827 | | RTC-2014-2862-3 | MINECO | 20170101-20171231 | | TRA2016-80472-R | MINECO | 20161230-20191229 | | H2020-755332-AEMSIDFIT | H2020 | 20170701-20200630 | | RULL DURAN, JUAN |  |  |  | | SAINZ SAPERA, LUIS |  |  |  | | SUDRIA ANDREU, ANTONI | ENE2015-67048-C4-1-R | MINECO | 20160101-20181231 | | 2014 DI 015 | AGAUR | 20150101-20171231 | | SUMPER, ANDREAS | 636249 | H2020 | 20150101-201804030 | | ENE2015-67048-C4-1-R | MINECO | 20160101-20181231 | | H2020-731148-INVADE | H2020 | 20170101-20191231 | | 636249 | H2020 | 20150101-20180430 | | TORRENT BURGUES, MARCEL | DPI2014-57086-R | MINECO | 20141001-20171231 | | VILLAFÁFILA ROBLES, ROBERTO | H2020-731148-INVADE | H2020 | 20170101-20191231 | | 636249 | H2020 | 20150101-20180430 |  * + - Table 4.4: Number of scientific contributions by the faculty members of the program:  |  |  |  | | --- | --- | --- | | **Name** | **Publications JCR** | **Publications JCR in Q1** | | ANDRADA PEDRO | 11 | 2 | | BARGALLO RAMON | 1 | 0 | | BERGAS JANE, JOAN GABRIEL | 10 |  | | BLANQUÉ MOLINA, BALDUINO | 9 |  | | BOGARRA SANTIAGO | 6 |  | | BOIX ARAGONES, ORIOL | 1 | 1 | | BOSCH TOUS, RICARDO | 7 |  | | CORCOLES LOPEZ, FELIPE | 20 | 9 | | DE LA HOZ CASAS, JORDI | 9 |  | | DORIA ARNAU | 13 |  | | GALCERAN ARELLANO, SAMUEL | 6 | 2 | | GARCIA ESPINOSA | 8 |  | | GOMIS BELLMUNT, ORIOL | 60 |  | | MARTIN MARIA ELENA | 9 | 9 | | MESAS JUAN JOSE | 6 |  | | MONTAÑA PUIG, JUAN | 25 | 22 | | MONTESINOS MIRACLE, DANIEL | 12 |  | | MUJAL ROSAS, RAMON MARIA | 10 |  | | PEDRA DURAN, JOAQUIN | 15 |  | | RIBA RUIZ, JORDI ROGER | 51 | 22 | | RULL DURAN, JUAN | 3 |  | | SAINZ SAPERA, LUIS | 20 | 1 | | SUDRIA ANDREU, ANTONI | 9 |  | | SUMPER, ANDREAS | 38 | 24 | | TORRENT BURGUES, MARCEL | 9 | 2 | | VILLAFÁFILA ROBLES, ROBERTO | 10 |  | | **TOTAL** | **378** | **94** |  * + - Table4.5: International faculty that directs thesis and give formative activities  |  |  | | --- | --- | | International thesis | 16 (34 %) | | International directors of thesis | J. Driesen (KU Leuven, BE) | | International members of examining panels | Dirk Van Hertem (Leuven, BE), Jun Liang (Cardiff, UK), Lie Xu (Strath, UK), Remus Teodorescu [(Aalborg, DK),](mailto:ret@et.aau.dk) Massimo Bongiorno (Chalmers, SE), E. Williams (MIT, US), S. Soula (CNRS, FR), M. Rubinstein (Heigh-vd, CH),  Andrea Cavallini (U. Bologna, IT). | | Formative activities | * Offshore wind power plants - 2h [(Medow project)](mailto:Dirk.VanHertem@esat.kuleuven.be), Nicolaos Antonio Cutululis, DEU, DK. * Transmission systems for offshore wind power (Medow project) 2 h, Jun Liang, Cardiff, UK. * Multiterminal HVDC grids (Medow project) 2h,  Dirk Van Hertem, KU LEUVEN, BE. * Modular multilevel converters (Medow project) 2h,  Remus Teodorescu, Aalborg, DK. * Power systems with power electronics 2h (Medow project),  Reza Iravani, Toronto, CA. |  * + - Resultats de les accions de foment de la direcció de tesis doctorals   Si escau, es poden considerar un pla de formació o documents del SGIQ relacionats amb l’assegurament de la qualitat del professorat, polítiques de recursos humans, etc*. FALTA COMPLETAR, on hi ha dades? Potser evolució dels sexenis*     * + - Number of supervisors to defenced thesis.  |  |  |  | | --- | --- | --- | | **Full name** | **Research Group** | **Number of thesis (2012-2017)** | | BERGAS JANE, JOAN GABRIEL | CITCEA | 2 | | BLANQUÉ MOLINA, BALDUINO | GAECE | 1 | | BOIX ARAGONES, ORIOL | CITCEA | 1 | | BOSCH TOUS, RICARDO | InSup | 4 | | CORCOLES LOPEZ, FELIPE | QSE | 2 | | GALCERAN ARELLANO, SAMUEL | CITCEA | 1 | | GOMIS BELLMUNT, ORIOL | CITCEA | 12 | | MONTAÑA PUIG, JUAN | LRG | 3 | | MONTESINOS MIRACLE, DANIEL | CITCEA | 5 | | MUJAL ROSAS, RAMON MARIA | SEER | 2 | | PEDRA DURAN, JOAQUIN | QSE | 3 | | RIBA RUIZ, JORDI ROGER | MCIA | 3 | | RULL DURAN, JUAN | CITCEA | 1 | | SAINZ SAPERA, LUIS | QSE | 2 | | SUDRIA ANDREU, ANTONI | CITCEA | 1 | | SUMPER, ANDREAS | CITCEA | 4 | | TORRENT BURGUES, MARCEL | GAECE | 1 | | VILLAFÁFILA ROBLES, ROBERTO | CITCEA | 3 |  * + - Percentage of the six-year term merits (sexenio) of the directors of presented thesis:  |  |  |  | | --- | --- | --- | | **Year** | **Percentage of directors of the presented thesis that have a live six-year term merits (sexenio)** | **Percentage of directors of the presented thesis that NOT have a live six-year term merits (sexenio)** | | **2013-14** | 100 % | 0 % | | **2014-15** | 100 % | 0 % | | **2015-16** | 100% | 0 % |   Note: Data from the GPAQ: <https://gpaq.upc.edu/lldades/indicador.asp?index=1_4_10> |

# STANDARD 5 EFFECTIVENESS OF THE LEARNING SUPPORT SYSTEMS

**5.1** Material resources are convenient to the number of students and to the characteristics of the program.

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| Resources are suitable for the number of students and the capacity is consistent with the necessities of the Doctoral Program:   * Available spaces for doctoral students (Department/Program): The spaces are suitable for the number of enrolled students in the program (~60). The Department of Electrical Engineering has specific offices for doctoral students in its centers in Barcelona (ETSEIB and EEBE), Terrassa (ESEIAAT), Vilanova (EPSEVG) and Manresa (EPSEM). At the end of this Standard the spaces are summarized. In total, the spaces offered by the Program/Department are 19. These spaces are generic and do not belong to research groups. Most of the students are located in offices of the different research groups. These spaces are also summarized at the end of this Standard and form a total of 42.   Some students are located in offices shared with faculty personnel and in laboratories. As the university staff, doctoral students settled at the offices/laboratories are included under the services of prevention of occupational risks of the UPC.   * Laboratories of the Department/Program: One of the strengths of the Doctoral Program is related to the number of laboratories available for the students. Some of these laboratories are managed by the Department of Electrical Engineering and thus available for our all of our students. The most important laboratories of the Department/Program are listed at the end of this Standard. Laboratories available to the students range from high voltage (50 Hz, DC and impulses), electrical machines, electronic drives and control of electrical machines, automation, electric vehicles, energy, etc. The total capacity for doctoral students is for 43 students.   Besides the laboratories of the Department/Program, research groups have their own specific laboratories. Those laboratories are managed by each research group. Commonly students access the laboratories of the research group where they are related. However, the policy is that laboratories can be used by other students under request. Laboratories associated with research groups are also summarized at the end of this Standard. Typically, these laboratories provide very specific equipment for research, we can highlight:   * CITCEA group: Programmable generators and power supplies; power network analysers; voltage sags simulators; simulators of HVDC networks; benches for testing electrical machines; drives of electrical machines. * GAECE group: Bench for testing electrical machines; configurable power converter; optical and electronic measurement instruments. * QSE group: Programmable wave generators; power network analysers; motor drives, dSpace control systems. * LRG group: Impulse current generators; impedance analyser; spectrum analysers; vector analysers; signal generators; RF generators up to 21 GHz; precision multimerters and electrometers; high speed video cameras up to 500 kfps; image intensifiers; UV sensitive cameras. Facilities: Eagle Nest instrumented tower for lightning measurements; Lightning Mapping Array networks in Ebro’s river delta and Colombia; ELF sensor in Cape Verde; High speed observation of gigantic jets in Curaçao and Colombia. * SEER group: laboratory of photovoltaic energy with panels; working benches; power network simulator; micro-grid simulator; advanced dSPACE control. Laboratory of wind energy with working bench for generators, converters and dSPACE systems; adjustable power networks. Laboratory of power grid connection with power network simulator. Bench for PCB design, DC and AC controllable power supplies, analysers. * MCIA group: Laboratory of electronics; micro gird laboratory; laboratory of mechatronics; simulation laboratory and high voltage AC DC laboratory.   We are proud of the large number of available equipment, laboratories and facilities. We found that these are appreciated by the students and are attractive when candidates consider our program to course their doctoral studies. As summary, the total capacity of the program is for 134 students (61 in offices and 73 in laboratories).  Student satisfaction related to the resources of the industrial area programs is 3.65 over 5. For computer resources the satisfaction is 3.61 over 5. We still don’t have surveys individual of our program. In the available surveys conducted by the GPAQ, It has been joined the survey to all the industrial programs. We propose the improvement 901.M.11.2017. In this improvement we plan to conduct our own surveys using tools such as Google Forms.  On the other hand, the UPC has convenient library resources. For our students, the most used resources are the access to scientific journals. Due to financial limitations of some years ago (initial period 2012), the UPC reduced the number of subscriptions to some journals of interest of our program (e.g some journals in Wiley and Science Direct). However, during the last two years the number of subscribed journals had increased again. Our main journal resources that are available: IEEE, Wiley, Springer, Science Direct (Elsevier), etc (see list below at the end of this Standard). In case of particular journals, books, documents that are not available from the library there is the Service of Documentation (SOC service) that can look for the requested document in national libraries and worldwide. Currently, the UPC provides the UPCommons where research works such as papers (journal and conferences), thesis, etc can be found in open access. Also the TDX repository of dissertations. Besides the UPC libraries, the Department/Program has its own library. In ESEIAAT (Terrassa) TR1 there is a library with a documentary collection related to design of electrical machines and some journals (listed below). This collection is often consulted by international researches and is a value of our Department/Program. Satisfaction related to the library resources has been graded to 3.8 over 5 by doctoral students of the industrial programs.  In addition, the UPC libraries offer courses and training for the information resources and writing documents. Among courses, there are resources available to our doctoral students such as Publica! (see table below) that provides support for writing a thesis and scientific texts. These courses and resources are offered to our students and the program takes care of that (e.g. information in our web and e-mail).  The Program has not funding for attending conferences. In most of the cases that depends on the resources of the research group. However, the Program encourages to participate in conferences and disseminate the results of the thesis. The same situation occurs with mobility, the Program has not its own resources but we provide information in our website and inform of opportunities by email to our students and/or supervisors.  Among other services, the Doctoral School organizes welcome orientation sessions and ceremonies (e.g. the recent <http://doctorat.upc.edu/ca/nous-doctorands>) and other activities to support integration of students and future professional support after the studies. The Program offers support of orientation to our students when it is requested. In most of the cases this orientation is about the important times (e.g. deadlines) of the studies and the procedure for submitting a thesis. This support is offered by the secretariat and/or the coordinator of the program.  We propose the improvement 901.M.10.2017 with the following objectives: To increase the cooperation between research groups, to approach unique facilities/techniques/models to our students, to cooperate with international collaborators and to promote mobility of our students.  The second improvement 901.M.11.2017 is to conduct our own surveys of the Program in relation to the satisfaction of the students with the program, to obtain data for future improving actions and to promote the participation of the students in the Academic Commission.  IMPROVEMENTS:  901.M.10.2017: To facilitate access to facilities/equipment/models between groups and international collaborators. To improve mobility.  901.M.11.2017: Development of survey tools for the participation of the students and evaluation. Promote the participation at the Academic Commission. |

**5.2** The service for the students support the learning process and facilitate the incorporation of the students into labor.

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| The Program is the responsible to provide (and/or inform) about the services available to support the development, progress and future professional insertion of our students. The Academic Commission is the unit that takes care for the quality and excellence of the Program.  Welcoming of students and arrival orientation: The Program offers personalized services of orientation of our students that are commonly under request by the students. But the Program has additional support of the following services for our students. First the Doctoral School organizes welcoming and orientation sessions and our students participate. We value positively these initiatives. In particular, these sessions are highly useful for foreign and new students at the UPC. That also helps to our students to interact with others. On the other hand, the Program counts with the Office of International Relations for orientation to new foreign students. Specially in terms of immigration procedures (e.g. NIE, Social Security) and living information (housing and health care). We grade the services provided by the Office of International Relations sufficient but could be improved. Our experience is that the Program has to organize every time appointments of our students with personnel of the Office International Relations. We believe that regularly orientation sessions (e.g. each 15 days) by the Office International Relations would be more efficient and save time in finding appointments.  Academic orientation: Academic orientation in terms of the doctoral studies is provided by the secretariat of the Program by the technical management support unit (UTG) of the UPC. The secretariat has an office for the public (our students) at the ETSEIB (Barcelona). Students can visit the office at the opening times, call or send an email to: doctoratb.utgaeib@upc.edu. Some students also contact the academic responsible of the Program. In terms of grants, mobility, projects and actions the students are informed through the website of the Program and the Doctoral School. Sometimes workshops of projects and/or actions are organized by the Technology Transfer Centre (CTT) or external agencies such as the Catalan AGAUR. If the workshops are of interest to our students the Program informs to the students and/or the supervisors (e.g. Industrial Doctorate workshops, postdoctoral positions and grants such as Ramón y Cajal, Marie Curie, Staring grants of the H2020).  The degree of satisfaction of the students is obtained by the surveys that the GPAQ carries out. In our case the survey was grouped to all the programs of the industrial area. Here some indicators (from 1 minimum satisfaction to 5 maximum satisfaction)   * Satisfaction with the information, assessment and support related to admissions and enrolment: 3.63 * Satisfaction with the information, assistance and administrative services of the program: 3.63. * Satisfaction with the assistance and administrative services of the program (department): 3.65 * Satisfaction with the assistance of the technical services and administrative of the Doctoral School: 3.51 * Satisfaction with the assistance of the Unit of Assessment and Labor Support to the Research (grants): 2.99   Although the results of the survey are positive, these results do not reflect the particular case of the Program. The availability of meaningful data of our program will be a powerful tool in order to organize activates for improving the Program. The current level of implementation of the surveys is not enough and only few experiences has been carried out by the University. But it is highly desirable to implement as soon as possible. As indicated, we plan the improvement 901.M.11.2017 where we will conduct our own surveys.  In similar way, in the improvement 901.M.12.2017 we plan to conduct surveys to our faculty members of the program in order to investigate their satisfaction and recommendations. Currently, the feedback is coming from the supervisor reports and from the questions and comments addressed to the secretariat or the Academic Commission of the Program. But we want to establish a systematic procedure. On this line, the Doctoral School is working on a proposal of survey to directors/supervisors of thesis. See the proposal of surve in the report of the Doctoral School.  IMPROVEMENTS:  901.M.11.2017: Development of survey tools for the participation of the students and evaluation. Promote the participation at the Academic Commission.  901.M.12.2017: Development of tools for evaluation and participation of the faculty members in the program |

**INDICATORS**

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| **RESOURCES**   * + - Offices and facilities of the associated research groups:  |  |  |  | | --- | --- | --- | | **Group** | **Capacity of offices for students** | **Laboratories and capacity** | | CITCEA (ETSEIB) | Offices: 20 students | Laboratory micro-grids: 3 students  Laboratory of control of electrical machines: 2 students  Laboratory of power electronics: 3 students | | LRG (ESEIAAT) | Offices: 6 students | Instrumentation, fabrication laboratory: 3 students  Composite material, UAV, drone lightning laboratory: 3 students | | QSE (ETSEIB/ESEIAAT) | Office ETSEIB: 4 students | ETSEIB Power Quality laboratory: 3  ESEIAAT TR1 Electric machines and netwrok lab: 2 students | | MCIA (ESEIAAT) | PhD student office 1: 4 students  PhD student office 2: 3 students  Technical office: 1 student | High voltage laboratory (AMBER): 3 students  Simulation office: 3 students  Electronic development laboratory: 1 student  Electrical machine test laboratory: 1 student | | SEER (ESEIAAT) | Office at TR1: 1 student | Laboratory of photovoltaic energy: 1 student  Laboratory of wind energy: 1 student  Laboratory of power grid connection: 1 student | | GAECE (EPSEVG) | Office: 3 students | Laboratory: 4 students | | **TOTAL** | 42 students in offices | 32 students in laboratories |   Note: The capacity of some offices and laboratories are much higher than the indicated. Here we have indicated the capacity only for doctoral students of the program.   * + - Offices and facilities of the Doctoral Program/Department of Electrical Engineering  |  |  |  | | --- | --- | --- | | **Campus** | **Capacity of offices for students** | **Laboratories and capacity** | | ETSEIB (Barcelona) | Office: 3 students | ETSEIB Pavilion B  Power frequency high voltage laboratory: 4 students  Electrotechnical laboratory: 4 students  High voltage impulse laboratory: 2 students  ETSEIB Pavilion H  Automation laboratory and energy: 4 students  ETSEIB rooms L  Automation laboratory: 4 students | | EBEE (Barcelona) | Office: 6 students | Laboratory of Electrical Machines: 2 students  Laboratory of Electric Installations: 2 students  Laboratory of Electric Circuits: 2 students  Laboratory of Energy: 2 students | | ESEIAAT (Terrassa) | TR 1 Office for doctoral students: 5 students | TR1 building  Electrical machines and high voltage laboratory: 5 students  Laboratory of Electric Vehicles: 2 students  Electric drives and control of electrical machines: 4 students | | EPSEVG (Vilanova) | Office D156: 3 students | Laboratory AA001: 4 students | | EPSEM (Manresa) | Office: 2 students | Laboratory of electrical machines: 2 students | | **TOTAL** | 19 students in offices | 43 students in laboratories |   Note: The capacity of some offices and laboratories are much higher than the indicated. Here we indicate the capacity only for doctoral students of the program.   * + - Bibliographic resources (non exhaustive list):  |  |  |  | | --- | --- | --- | | **Provider** | **Resource** | **Format** | | UPC libraries | IEEE journals: Transactions on Power Delivery, Transactions on Power Systems; Transactions on Industry Applications; Transactions on Industrial Electronics; Transactions on Energy Conversion; Transactions on Sustainable Energy; Transactions on Smart Grid; etc. | Online, accessible from university subscription | | UPC libraries | Springer journals: Electrical Engineering; Journal of Modern Power Systems and Clean Energy; Protection and Control of Modern Power Systems; | Online some accessible in open access | | UPC Libraries | IET: High Voltage; | Online, some accessible in open access | | UPC libraries | Wiley journals: International Transactions on Electrical Energy Systems; IEEJ Transactions on Electrical and Electronic Engineering; etc. | Online, some accessible in open access | | UPC libraries | Science Direct: Energy; Renewable Energy; Journal of Electrostatics; Renewable and Sustainable Energy Reviews; Electric Power Systems Research; etc. | Online, some accessible in open access | | UPC libraries | International Electrotechnical Commission (IEC), European Standards (EN) and Sapnish standards (UNE) | Accessible from libraries | | Department | The International Council on Large Electric Systems (CIGRE): Brochures and Electra journal | By participation in working groups and currently the Department is subscribing | | Department | ABB journal, Siemens Review, Siemens Power Engineering; Power Engineering & Automation; Energy and Automation; Siemens Research; Teknos; Automática e Instrumentación; CIGRE Electra | Department’s library at ESEIAAT TR1 | | Department | Documentary collection of AEG and ABB designs of electrical machines | Department’s library at ESEIAAT TR1 | | UPC | UPCommons: UPC's institutional repository collects, manages, disseminates and preserves the UPC's teaching and research output in open access. | Accessible online open access | | Consortium of universities | TDX: Theses and Dissertations Online) is a digital cooperative repository of doctoral theses presented at some Spanish universities. | Accessible online open access | | UPC | Publica!: Guidelines for the submission of doctoral theses | Online access |  * + - Survey by the GPAQ about the satisfaction of the students with the studies (for all the industrial programs):       * + 2011-2012: <https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat/curs-2011-2012/Dadesenquestesdoctorands1112perprograma.zip>         + 2015-2016: <https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat/curs-2015-2016/enquesta-doctorat-15-16-enginyeria-industrial.xlsx>         + There is no individual of our program (see improvement 901.M.11.2017)     - Satisfaction of the thesis supervisors with the studies.       * + Not available. (see improvement 901.M.12.2017) |

# STANDARD 6: QUALITY OF RESULTS

**6.1** The thesis, formative activities and their evaluation are coherent with the formative profile.

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| All doctoral theses follow the process established by the regulations of the doctoral program. This ensures the coherence of the theses and their evaluation in accordance with the training objectives of the program. The process includes admission to the program, the preparation and evaluation of the research plan and is completed with the preparation and evaluation of the doctoral thesis. The goals of the student instruction are the following:   * Rigor in research tasks. * Quality in the written informs and reports. * Critical analysis of results and obtaining conclusions. * Correct expression of results in plots, tables and figures. * Deepen the contents of the field of electrical engineering. * Conception of the state of the art of the current electrical problems. * Use of measurement devices.   The evaluation of the Research Plan during the first year ensures the coherence and viability of the doctoral thesis proposal. The program has encouraged during the last two years that this evaluation is complemented with suggestions for the doctoral student, which reinforces the training part. The evaluation system of the students is the following:   * Thesis supervisor: Help the student with the choice of the research task providing references and information about it. * Once the student starts the research, the progress is evaluated from the DAD where the student indicates the research stages, the publications, the research formation. These activities are recommended by the thesis supervisor and the academic commission evaluates the report presented by the student each year. This document is used for detecting any problem in the thesis progress. * The final report of the student progress is given to the doctoral tribunal in order to give an insight about the work of the student during the doctorate.   Consistency is continuously ensured through the monitoring by the Academic Committee of the program of activities (including training) of the doctoral student. The DAD register offers additional information to the doctoral work on the adequacy of the thesis and its results (eg publications, presentations at conferences, mobility, collaborations, training activities, etc.). The program checks the quality of the theses through the reports of experts external to the program and also through publications related to the theses. The program encourages that the theses have at least two publications in indexed journals. This has resulted in an average of 2.75 indexed journal publications per doctoral thesis, 1.4 journal publications in first quartile of their category. The evaluations of the research plans and doctoral theses are public and there are rubrics for the evaluators. In summary, the doctoral theses are coherent and their evaluation ensures consistency with the objectives of the program.  As for the training activities, currently the directors / tutors are the ones who guide and supervise the doctoral students to achieve the competences established in the program. The commission carries out periodic monitoring through the DAD register.  The program encourages the international research stages of the students considering the collaborations with other universities looking for the international mention of the doctoral degree. Also, the approach of the doctoral students to the industrial sectors is promoted.  Transversal formation focusing on entrepreneurship and innovation is encouraged. UPC is committed to the KIC Innoergy initiative, and several professors of the doctoral program are heavily involved to it. A number of students (5 in the last years) have participated in the KIC Innoenergy PhD school, which basically supports research with impact. It enables doctoral candidates to complement their research with essential entrepreneurial, innovation, business and personal skills. It additionally strengthens connections between individual researchers across Europe. It supports cross-cultural collaboration and teamwork – and helps to bring research labs and universities closer to industry. |

**6.2** The academic indicators are convenient to the characteristics of the doctoral program.

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| See table 6.1 and other indicators at the end of this standard.  In the Verificación application, a forecast was made based on a 2006-11 record in an RD prior to 2011. The number of theses submitted has increased with respect to the forecast. This is placed in 7.8 theses per year compared to the forecast of 6.6 theses per year.  This ratio can be considered positive if it is taken into account the negative influence of the UPC masters on the doctoral program. The no existence of an electrical master influence negatively on the inscription of the students in the Electrical engineering doctorate.  More than 34 % of the graduates obtain the international doctorate thanks to the collaboration with research groups of other international universities or companies. The international research stays are increasing and they last between 3 and 6 months. These stays allow to include innovation in the electrical engineering doctorate and to increase significantly the quality of the investigations and the obtained results. Moreover, the knowledge of the research in other universities allow the diversification and renovation of new challenges in the electrical engineering area.  Most of the students obtain the qualification of Cum Laude (76.6 %) which validate the quality of the electrical engineering PhD. These results are on the top of the UPC results. Moreover, different PhD thesis have obtained the Doctoral Extraordinary Prize during the last years.  As far as abandonment is concerned, in the Verificación a 0% abandonment was foreseen. However, this forecast was not realistic because there will always be a number of doctoral students who leave for very different reasons. The drop-out rate for doctoral students of the program is 12.7%. For the last three years our abandonment has been at a 9.3 % which is aligned with the average 9.5 % corresponding to the industrial Doctoral Programs of the UPC. A survey has been conducted with the abandoning students, and it has been concluded that the main reason for the full time students to abandon is that they have moved to a job in industry and they have realized they could not continue with the doctoral program as a part time activity. For the part time students, the main reason is the lack of time and that they have realized it was no possible in practice to conduct a part time doctorate.  The percentage of theses with qualification cum laude has decreased. This is due to the different method of evaluation of doctoral theses adapting to RD 99/2011. UPC has adopted the secret vote to determine the “cum laude” mark.  According to the following indicators, the doctoral program can be located in top 25 % (first quartile) of the university:   * Three theses have obtained the extraordinary doctoral award from the UPC. * The scientific results of doctoral theses are clearly above the expectations, 103 indexed journal publications have been produced (17.2 per year), yielding 53 journal publications in the first quartile of the corresponding category (8.8 per year). The number of results derived from the theses clearly improved the number of results (more than double). This is due to several factors, on the one hand the improvement of results of the research groups of the program and on the other the incentive from the program. * Six patents have been filed, related to the work of doctoral students. Most of them in close relationship with research conducted in collaboration with industry.   The information related from the previously mentioned indicators is annually collected in the DAD. The overall data from all the students is collected and analyzed annually by the doctoral commission. Appropriate actions are taken to ensure the overall quality of the system whenever it is needed, to advise the doctoral thesis supervisors to ensure that all the thesis meet the required quality standards. |

**6.3** The indicators of labor insertion are convenient for the characteristics of the doctoral program.

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| On the part of the UPC data of labor insertion of doctors (2008 to 2010) of the set of the programs of industrial doctorate are arranged. Some indicators:  • 96.4% of the doctors are working (100% women and 95.4% men).  • 57% of the doctors are working in the university while 11% in research centers and 32% in companies.  • The degree of satisfaction with the current job is almost 6 points out of 7.  In the specific case of the program, the survey conducted shows that 100 % of the doctors are working. 46.15 % of them are working in the university, 23.08 % in research centres and 30.77 % in companies. From those working in companies, 100 % are working in R&D, which it is considered very positive.  On the part of the program, this topic has been addressed during the follow-up process and information has been collected:  • The program has promoted the grants of Industrial Doctorates. We are currently one of the leading programs in the UPC with 5 industrial doctoral students.  • There are also PhD students linked to companies such as Solvay, etc.  • An important number of doctoral students are involved in collaborative research projects with industry or large European research projects.  • Almost half of the doctoral students have conducted research stays abroad, in R&D intensive companies or leading universities.  • And companies that have hired PhD students from our program: Siemens-Gamesa, Siemens, Schneider, Enaire (formerly AENA), Alstom Wind (now GE), EGO products, Tecnolama, Abengoa, Omicron, ABB Sweeden, SBI Connectors, etc. These companies are leaders in their markets.  • A number of students are involved in the KIC Innoenergy PhD School, focusing on boosting their entrepreneurship and innovation capabilities, which will allow a better employability.  In short, the employment rate of doctoral students of the program is very high and consistent with the objectives of the program as well as the quality of the companies, institutes and universities where they practice their professional lives.  A survey is conducted annually to evaluate the current situation of graduates of the last year and the information collected is analyzed and discussed. We obtained an 80 % of responses by the graduated students of our program. From 100 % of the graduated that responded are working. From these, a 94.8 % have an employment related to his/her doctoral studies. From the total, 33.2 % are employed in faculty positions at universities.  We value the employment of our former students positively. Actually, that shall be one of the strengths of the program due to the expected increase of electrical energy in the future (e.g. due to electric vehicles and sustainability). |

**EVIDENCES**

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| * + Number of doctoral thesis per year:  |  |  | | --- | --- | |  | **Number** | | 2012-13 | 9 | | 2013-14 | 7 | | 2014-15 | 8 | | 2015-16 | 9 | | 2016-17 | 8 | | 2017-18\* | 6 | | Average | 7.8 |   \*Data of the course 2017-2018 is not complete.   * + Information related to the formative activities.  |  |  | | --- | --- | |  | **Average number formative activities per student** | | 2012-13 | No data | | 2013-14 | 5.7 | | 2014-15 | 1.75 | | 2015-16 | 4.1 | | 2016-17 | 4.75 | | 2017-18\* | 7.16 | | Average | 4.7 |   Note: Data has been extracted from the DAD documents. This date includes the old RD1393 and the current RD99 syllabuses. |

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| Table 6.1. Summary of the indicators related to the results (2012-2017)   |  |  |  | | --- | --- | --- | | **Indicator** | **Result** | **Expected** | | Number of theses (full time students) | 7.8 theses/year | 6.6 theses/year | | Number of theses (part time students) | No thesis presented. |  | | Median duration of the full-time doctoral program | 4 years  (includes syllabuses RD779 and RD1393) | 3 years | | Median duration of the part-time doctoral program | No thesis ended | 5 years | | Abandonment of the program | 12.7 % | 0 % | | Percentage of thesis with cum laude | 76.6 % | 93 % | | International mention (international doctorate mention) | 34.4 % |  | | Number of scientific results of doctoral theses | 28.3 /year | 10 /year | | Average anual number of JCR articles (and JCR Q1) | 16.8/year (8.6/year) |  | | Average number of JCR papers (and JCR Q1) paper per thesis | 2.75 (1.4) |  | | Number of patents | 5 |  | | Percentage of research stays | 57 % | Not indicated | | Extraordinary doctoral awards | 5 |  |  * + Percentage of abandonment:  |  |  | | --- | --- | |  | **Abandonment** | | 2012-13 | No data | | 2013-14 | No data | | 2014-15 | 23.1 | | 2015-16 | 7.27 | | 2016-17 | 12.12 | | 2017-18\* | 8.47 | | Average | 12.7 |   \*Data of 2017-18 is not complete.   * + Percentage of thesis qualified as *cum laude*  |  |  | | --- | --- | |  | **Percentage of *cum laude*** | | 2012-13 | 77.8 % | | 2013-14 | 71 % | | 2014-15 | 75 % | | 2015-16 | 77.8 % | | 2016-17 | 75 % | | 2017-18\* | 83 % | | Average | 76.6 % |   \*Data of 2017-18 is not complete.   * + Percentage of thesis with international mention  |  |  | | --- | --- | |  | **Percentage of thesis with international mention** | | 2012-13 | 11.1 % | | 2013-14 | 42.8 % | | 2014-15 | 37.5 % | | 2015-16 | 22.2 % | | 2016-17 | 37.5 % | | 2017-18\* | 66.7 % | | Average | 34.4 % |   \*Data of 2017-18 is not complete.   * + Number of scientific results of the thesis:  |  |  |  | | --- | --- | --- | |  | **JCR papers** | **JCR that are at Q1** | | 2012-13 | No complete data | No complete data | | 2013-14 | 26 | 15 | | 2014-15 | 31 | 11 | | 2015-16 | 16 | 13 | | 2016-17 | 18 | 10 | | 2017-18\* | 10 | 3 | | Average | 16.8 | 8.6 |   \*Data of 2017-18 is not complete.   * + Employment, adequacy of the employment with the studies and percentage of employment related to faculty postions at university.  |  |  |  |  | | --- | --- | --- | --- | |  | **Percentage of employment** | **Employment related with the thesis** | **Percentage of the employment related to faculty positions at universities** | | 2012-13 | 100 % | 100 % | 44 % | | 2013-14 | 100 % | 100 % | 40 % | | 2014-15 | 100 % | 100 % | 50 % | | 2015-16 | 100 % | 85. 7 % | 28.7 % | | 2016-17 | 100 % | 83.3 % | 20 % | | 2017-18\* | 100 % | 100 % | 16.6 % | | Average | 100 % | 94.8 % | 33.2 % |   \*Data from the internal Doctoral Program survey. Percentages are from the responses received. Number of responses received 38 of 47 (80 %).   * + Number of presented thesis at part time and duration  |  |  |  | | --- | --- | --- | |  | **Number of presented thesis at part time** | **Duration of the program at part time** | | 2012-13 | 0 |  | | 2013-14 | 1 | No reliable information. In 2012 had his files transferred from another program | | 2014-15 | 0 |  | | 2015-16 | 0 |  | | 2016-17 | 0 |  | | 2017-18\* | 1 | 5 years | | Average | 4.25 % of the presented thesis are at part time |  |   \*Data of 2017-18 is not complete.   * + Number of presented thesis at full time and duration  |  |  |  | | --- | --- | --- | |  | **Number of presented thesis at full time** | **Duration of the program at full time** | | 2012-13 | 9 | 6 years | | 2013-14 | 6 | 4.16 years | | 2014-15 | 8 | 4.12 years | | 2015-16 | 9 | 4.2 years | | 2016-17 | 8 | 4.6 years | | 2017-18\* | 5 | 4 years | | Average | 95.75 % of the presented thesis are at full time |  |   \*Data of 2017-18 is not complete.   * + Percentage of thesis with associated mobility:  |  |  | | --- | --- | |  | **Percentage of thesis with mobility** | | 2012-13 | No complete data | | 2013-14 | 57 % | | 2014-15 | 50 % | | 2015-16 | 44 % | | 2016-17 | 50 % | | 2017-18\* | 83.3 % | | Average | 57 % |   \*Data of 2017-18 is not complete. |

# 3. Improvement plan

**List of the proposed improvements**

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| In relation to the proposal of transverse improvements see the report of the University elaborated by the Doctoral School. List of the proposed improvements  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **901.M.1.2016** | **Información de actividades formativas en el Plan de Investigación / Planning of formative activities in the Research Plan**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 1: Qualitat del programa formatiu | | **Diagnòstic:** | Se han detectado carencias en el seguimiento y adecuación de las actividades formativas transversales. Muchos documentos de actividad del doctorando (DAD) no incluyen las actividades formativas realizadas. En el contenido del Plan de Investigación que debe presentar el doctorando durante su primer año no es obligatorio indicar las actividades formativas realizadas y previstas. It has been detected lacks in the follow-up and adequacy of the transverse formative activities. Many documents such as the Activities of the Student (DAD) do not include the coursed formative activities. In the Research Plan that must be presented during the first year of the studies it is not mandatory to indicate the coursed and scheduled formative activities. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Tener una mejor trazabilidad de las actividades formativas de los doctorandos. To have a better traceability of the formative activities of the students | | **Accions proposades:** | Realizar acciones informativas a doctorandos/tutores/directores sobre las actividades formativas previstas en el programa. Se propone que el candidato incluya en la programación temporal del Plan de Investigación las actividades formativas realizadas y las planificadas. To conduct informative actions to the students and supervisors about the formative activities considered in the program. | | **Abast:** |  | | **Prioritat:** | alta | | **Termini:** | 31/7/2017 | | **Estat:** | En curs | | **Actuacions realitzades:** | - Students and supervisors have been informed (e.g. notice of 20161205 bu doctoratb.etgaeib). Periodic notices have been scheduled in the Plan of Doctoral Program. - Document RUB-PR-01 with rubrics for the Research Plan (20170718). - Updating the information in the website of the program. | | | **901.M.2.2016** | **Registro informatizado de las actividades del doctorando (DAD) / Online registration of the Activities of the Student (DAD)**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 1: Qualitat del programa formatiu | | **Diagnòstic:** | Las actividades del doctorando (DAD) se registran y actualizan en un fichero de editor de texto. Esto dificulta el seguimiento pues los registros DAD deben mandarse periodicamente a la secretaría del programa. The Activities of the Student are logged in a text file. That difficult the supervision due to that the DAD register is required periodically to the secretariat of the program. But in practice reminders have to be sent to those that not submitted the DAD. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Disponer de una aplicación informática accesible vía red para mantener al día las actividades del doctorando para mejorar el seguimiento. To have an online application to keep updated the activities of the students. | | **Accions proposades:** | Proponer a la Escuela de Doctorado la realización de un portal vía red para la gestión del DAD. To propose to the Doctoral School the development of an online application for the DAD. | | **Abast:** |  | | **Prioritat:** | alta | | **Termini:** | 31/7/2017 | | **Estat:** | En curs | | **Actuacions realitzades:** | - Discussed in the 20170710 meeting of the Doctoral School board meeting: that is under development. - Discussed in the 20171019 meeting of the Doctoral School board meeting: that is under development. | | | **901.M.3.2016** | **Actualización de modificaciones: personal y grupos de investigación / Updating of the faculty members and research groups**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 1: Qualitat del programa formatiu | | **Diagnòstic:** | Incluir los nuevos grupos asociados al programa y causar baja del personal que deja el programa, To include the new faculty members associated with the program and to withdraw the members that had leaved the program. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Actualización de las modificaciones. Updating modifications. | | **Accions proposades:** | Actualización del listado de miembros del programa de doctorado, Actualización del listado de grupos de investigación del programa de doctorado. Actualización de la información en la web del programa de doctorado. Planificar la siguiente revisión en el Plan del Programa de Doctorado. To update the list of the members of the Program. To update the list of the research groups of the Program. To update the information related to members and groups in the website of the Program. To Schedule the next update in the Planning of the Doctoral Program. | | **Abast:** |  | | **Prioritat:** | alta | | **Termini:** | 1/8/2017 | | **Estat:** | Finalitzada | | **Actuacions realitzades:** | Recogida información de los profesores / Information of the faculty (October/November 2016). Se ha actualizado el listado de miembros del programa de doctorado, / The list of the members has been updated. (20161110) Se ha actualizado el listado de grupos de investigación del programa de doctorado./ The list of the groups has been updated. (20161110) Se ha actualizado la información en la web del programa de doctorado./ The information of members and groups has been updated in the website (20161110) Planificar próxima revisión. Actualización del Plan del Programa de Doctorado. / Schedule of the next review. Update of the Doctorate Program. | | **Resultats obtinguts:** | Se ha actualizado la lista de miembros y grupos. / Update of the faculty and groups of the program. Se empieza una sistemática para revisiones periódicas (actualizado el Plan del Programa de Doctorado). / Establishment of periodic evaluations (Planning of the Doctoral Program) | | | **901.M.4.2016** | **Mejora de la información de la web del programa / Improvement of the information in the website**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 2: Pertinència de la informació pública | | **Diagnòstic:** | En general la información es completa, actualizada y disponible en catalán y español pero en inglés se han detectado ciertas carencias y falta de actualización. In catalan and spanish languages the information is complete and updated. But in english the information has been detected to be incomplete. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Disponer en la web del programa de doctorado información completa y actualizada en inglés. To have complete information in English | | **Accions proposades:** | Verificar y actualizar si es el caso la información existente en inglés. / Review the current information in english. Comprobar que la información publica necesaria esté disponible en inglés. / To determine the public information to be published in English. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 1/8/2018 | | **Estat:** | En curs | | **Actuacions realitzades:** | Desde hace varios meses estamos verificando y actualizando la información en la web del programa incluyendo la versión en inglés. We are verifying and updating the information of the website including the English version. | | | **901.M.5.2016** | **Sistemática para la realización de acciones que fomenten la dirección de tesis / Procedure to conduct actions to promote thesis direction**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 4: Adequació del professorat al programa formatiu | | **Diagnòstic:** | El programa no dispone de una sistemática establecida para la realización de acciones que fomenten la dirección de tesis./The program has not a procedure to conduct actions to promote the direction of thesis. Actualmente el programa aprovecha las reuniones del Departamento de Ingeniería Eléctrica para la realización de estas acciones./ Currently the program takes advantage of the meeting of the Electrical Engineering Department to conduct these actions. También realiza acciones de comunicación. Sin embargo, no hay una sistemática establecida. / Additionally, the Program conducts informative actions but a procedure is not established. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Disponer de una sistemática para la realización de acciones del fomento de dirección de tesis. / To have a procedure to conduct actions to promote the direction of thesis. | | **Accions proposades:** | Relaización de una sistemática (períodica) que incluya: To conduct periodic actions to: - Análisis de la experiencia investigadora acreditada: Listado actualizado de los miembros de departamento que hayan dirigido tesis, co-dirigido tesis, dispongan de sexenio, dirección de proyectos competitivos. / Analysis of the acreditated reserach experience: direction or co-direction of thesis, six-year merits (sexenio) and PI of competitive projects. - Obtención de información actualizada de incentivos de la UPC (p.e. puntos PAR, PAD, etc) / Updated information of incentives promoted by the UPC. - Obtención de inforamción actualizada de becas y ayudas./ Information of grants. - Realización de una acción de divulgación por ejemplo alguna de las seiguientes: reunión, taller, información promocional, etc. / To conduct an action to promote the direction of thesis in the form of : meeting, workshop, etc.. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 1/8/2018 | | **Estat:** | En curs | | **Actuacions realitzades:** | - Información del profesorado durante 2017 / Information of faculty for 2017. - Programación de una actividad (taller) en el Plan del Programa de Doctorado / Schedule of an activity (workshop) at the Planning of Doctoral Program. | | | **901.M.6.2016** | **Mejora de las rúbricas para la evaluación de los Planes de Investigación / Improvement of the rubrics related to the evaluation of the Research Plans**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 6: Qualitat dels resultats dels programes formatius | | **Diagnòstic:** | Existen carencias en las rúbricas para la evaluación de los Planes de Investigación. There are lacks in the reubrics to evaluate the Research Programs. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Mejora de la sistemática de evaluación del Plan de Investigación. / Improvement of the systematic for the evaluation of the Research Plans Que la información resultante de la evaluación sea más útil al doctorando / The rubrics shall be useful to the students as well. | | **Accions proposades:** | Realización de un documento de rubricas que incluya las actuales sugeridas y las complemente. / To create a documents with the rubrics. El documento será publico. / The document shall be open access. | | **Abast:** |  | | **Prioritat:** | alta | | **Termini:** | 1/8/2017 | | **Estat:** | Finalitzada | | **Actuacions realitzades:** | 20170718: Publicación del documento RUB-PR-01 con las rúbricas. 20170718: The document RUB-PR-01 with the rubrics has been released. Programación de informar a los estudiantes y miembros de tribunales / Schedule to inform faculty of the panels and students. | | **Resultats obtinguts:** | Mejora de la efectividad de los Planes de Investigación, presentación y evaluación. Improvement of the effectiveness of the Research Plans, its presentation and evaluation. | | | **901.M.7.2016** | **Sistemática para la recogida de datos indicadores y su análisis periódico / Schematic for the data collection of indicators and periodic analysis**   |  |  | | --- | --- | | **Càrrec:** | Coordinador | | **Origen:** | seguiment | | **Estàndard:** | Estàndard 6: Qualitat dels resultats dels programes formatius | | **Diagnòstic:** | No existe una sistemática por parte del Programa de Doctorado para la recogida de datos y análisis periódico de estos datos de forma periódica (p.e. anual). There is no a systematic of the Doctoral Program to collect data and conduct periodic analysis of the data. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | Disponer de una sistemática periódica para la recogida de datos indicadores del Programa con el fin de poder evaluar el estado del programa. / To stablish a systematic. Poder realizar una evaluación periódica a partir de los datos recogidos. / To be able to conduct evaluations from the data. Poder realizar el seguimiento de una forma más eficiente y, si es el caso, realizar acciones / To improve the effectiveness of the Program and the reaction time. | | **Accions proposades:** | Establecer sistemática para el seguimiento del Programa. Esta sistemáticas incluirá, al menos, la recogida de datos anuales sobre: inserción la inserción laboral y la satisfacción de los doctores a partir de las encuestas de AQU y también, si es el caso, a partir de encuestas propias a los doctores, estudios de opinión de los empleadores, observatorios del mercado laboral, etc. Por otro lado también se recogerán los datos de seguimiento como el número de estudiantes matriculados, seguimiento de su actividad, tesis finalizadas, tesis a tiempo completo, tesis a tiempo parcial, duración, etc. A partir de los datos se establecerá el análisis de los indicadores con el fin de realizar el seguimiento y, si es el caso, proponer acciones. To establish a systematic for the monitoring of the Program: admissions, students, academic origin, nationality, full or part time,grants, thesis presented, grades, duration, international mention, results from the thesis, faculty, publications, projects and six-year merits, graduate employment. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 24/10/2018 | | **Estat:** | En curs | | **Actuacions realitzades:** | Hemos creado los siguientes registros/ We have created the following registers: - LAD: Lista de admisiones con solicitudes, admitidos, no admitidos, motivos / List of admissions, requested, admitted, rejected, reasons.... - LED: Lista de estudiantes matriculados inclyendo estudios, nacionalidad, dedicación, beca / List of the enrolled students including academic origin, nationality, part or full time..... - LPD: Lista del profesorado del programa incluyendo altas y bajas, prublicaiones JCR y JCR Q1, proyectos competitivos y sexeniso /List of the members of the program including publications (JCR and JCR Q1), competitive projects and six-year merits. - LTD: Lista de las tesis presentadas incluyendo la información de la tesis, cualificación, resultados y empleo de los doctorados / List of presented thesis including, author, supervisors, results, qualification, and graduate employment. | | | **901.M.8.2017** | **Modification of the number of admissions**   |  |  | | --- | --- | | **Càrrec:** | academic coordinator of the Doctoral Program | | **Origen:** | acreditacio | | **Estàndard:** | Estàndard 1: Qualitat del programa formatiu | | **Diagnòstic:** | Since 2012 we have offered a number of admissions of 30. The maximum number of new enrolments has been 21. During this period we experienced the extinguishing of the RD778 and RD1393 syllabuses, retirements of faculty, a research group that had abandoned the program, reduction of the number of grants (e.g. MINECO FPI) Now, although the number requests for admission is high we propose to decrease the number of offered admissions to 20. This number is appropriate since two new research groups has joined the program, the increasing number of projects with grants (e.g. H2020 Marie Curie), faculty candidates that can join the program in the future. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | To have a balanced number of admissions. | | **Accions proposades:** | Modification of the number of admissions. Actions to increase the number of faculty members of the program. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 19/11/2019 | | **Estat:** | En curs | | **Actuacions realitzades:** | - Modification of the number of admissions. - Action of information/encouragement to PhD faculty that can join the program in a future to apply for the six-year merits (sexenios), submit a project proposal and to co-direct thesis. | | | **901.M.9.2017** | **Addition of students with master's degree not of the aera of engineering**   |  |  | | --- | --- | | **Càrrec:** | Responsible of the Academic Commission of the Doctoral Program | | **Origen:** | acreditacio | | **Estàndard:** | Estàndard 1: Qualitat del programa formatiu | | **Diagnòstic:** | In the report of VERIFICACION it was considered the following cases of the origin on our students: 1.a) Students with master's degree in the area of engineering. 1.b) Studnets without master's degree but had coursed 60 ECTS in the area of engineering. Although in the VERIFICACION it is indicated that for students of other masters it will be valued those that can demosntratebasic knowledge in electrical engineering. | | **Implica modificació de la memòria verificada?:** | Sí | | **Objectius a assolir:** | We propose to include a profile of students with master's degree ooutside the engineering (e.g. physics). That is aligned with the interdisciplinarity of reserach in our area. | | **Accions proposades:** | To modify the profile of our students to inclue the situations of students with a master degree in areas outside of the engineering. To define the necessity and type of formative complements for those students. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 20/11/2019 | | **Estat:** | No iniciada | | | **901.M.10.2017** | **Cooperation between research groups and promoting the mobility of the students to international universities**   |  |  | | --- | --- | | **Càrrec:** | Coordinator of the Doctoral Program | | **Origen:** | acreditacio | | **Estàndard:** | Estàndard 5: Eficàcia dels sistemes de suport a l'aprenentatge | | **Diagnòstic:** | Research groups associated with the program as well the external co-operators have been developed techniques, models and facilities that can help to our students to improve the quality of their research. That also contributes to guarantee the quality of the international training of our students. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | To promote collaboration with research groups. To increase the number of techniques and equipment to be used for our students. To promote mobility to foreign universities. That will allow to increase the quality of the thesis. | | **Accions proposades:** | - To Establish mechanisms to facilitate to our students the use of equipment and facilities between research groups of the program and external collaborators. - To promote mobility of the students by using facilities/techniques of other groups (international). - To promote international co-directors to the thesis. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 20/11/2019 | | **Estat:** | No iniciada | | | **901.M.11.2017** | **Development of survey tools for the participation of the students and evaluation**   |  |  | | --- | --- | | **Càrrec:** | Coordinator of the Academic Commission of the Program | | **Origen:** | acreditacio | | **Estàndard:** | Estàndard 5: Eficàcia dels sistemes de suport a l'aprenentatge | | **Diagnòstic:** | The reports of the supervisors and the document of activities (DAD) are not enough for the evaluation of the Program including the participation of the students. The surveys done by the GPAQ are grouped by several programs resulting in a lack of particular data of our program. On the other hand, students do not participate at the Academic Commission although there is a vacancy for the representative of the students. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | To develop a tool that survey the opinion of our students. To incentive the participation of the students in the Academic Commission meetings. | | **Accions proposades:** | Survey: 1.- To organize a meeting of the Academic Commission to design and approve a survey in order to collect the opinion of our students in the different subjects: Quality of the program, supervision by the supervisors/directors, access to facilities, access to services, mobility, quality of research, formative activities, etc. 2.- To setup a survey tool based on Google Forms. 3. To conduct the survey. 4. To analyse the results during a meeting of the Academic Commission and determine improving actions, if needed. Representative of the students 1.- Circulation a mail with a call for representatives. 2. Organize a Doodle (Google tool) to voting the representative. 3. When the representative will finish his/her enrolment with the program or resign, a new call will be open. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 20/11/2019 | | **Estat:** | En curs | | **Actuacions realitzades:** | - We are currently designing a survey. See here the current version: https://goo.gl/forms/1hYeo7J2f3coow992 | | | **901.M.12.2017** | **Development of tools for evaluation and participation of the faculty members in the program**   |  |  | | --- | --- | | **Càrrec:** | Coordinator of the Academic Commission of the Program | | **Origen:** | acreditacio | | **Estàndard:** | Estàndard 5: Eficàcia dels sistemes de suport a l'aprenentatge | | **Diagnòstic:** | No surveys related to the satisfaction with the supervisors of thesis of the program are done by the UPC. Currently, the feedback comes from the supervisor reports and from the questions and comments addressed to the secretariat or the Academic Commission of the Program. | | **Implica modificació de la memòria verificada?:** | No | | **Objectius a assolir:** | To develop a tool that survey the opinion of the faculty members of the Program. | | **Accions proposades:** | Survey: 1.- To organize a meeting of the Academic Commission to design and approve a survey in order to collect the opinion of our faculty memberss in the different subjects: Quality of the program, supervision by the supervisors/directors, access to facilities, access to services, mobility, quality of research, formative activities, etc. 2.- To setup a survey tool based on Google Forms. 3. To conduct the survey. 4. To analyse the results during a meeting of the Academic Commission and determine improving actions, if needed. | | **Abast:** |  | | **Prioritat:** | mitja | | **Termini:** | 20/11/2019 | | **Estat:** | No iniciada | | |

**Global evaluation of the Improvement Plan**

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| The highest priority actions are the modification of the number of offered admissions and the modification of the profile of admissions to include students with masters from areas out of the engineering but suitable for the studies (e.g physics). Next is the update of the information in the website which has been already started. The procedures of collecting information to evaluate the program will be the main tasks during the next period. That includes the information related to the program, the satisfaction and suggestions from the students, the participation of the students and the satisfaction and suggestions from the faculty. It is also of importance the promotion to increase the number of faculty members that supervises thesis and the promotion of the cooperation between groups and international collaborators. |

# 4. Evidences

General

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| Report of *Verificación* and evaluation of AQU  Filename:  VERIFICA.rar | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/qMiucF1cR6wYkU5>  Password: accreditation |
| Report of *Seguimiento* and evaluation of AQU  Filename:  SEGUIMENT.rar | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/wEz5uUtTdVG3dYW>  Password: accreditation |

**Standard 1**

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| **Evidence** | **Location (URL)** |
| **Provides evidences to sections: 1.1**  List of students: including year, name, director, research group, previous studies, university of origin. Summary of data  Filename:  Llistat estudiants 2012-2017\_v1\_20171107.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/ipOKGXe14JUbeKq>  Password: accreditation |
| **Provides evidences to sections: 1.1**  List of presented thesis: Year, date, RD, student’s name, title of the thesis, grade, international (y/n), director, co-director, results JCR, results JCR Q1, grants, patents, current occupation, part/full time, formative activities, mobility.  Document LTD  Filename:  LTD\_Historial\_Tesis\_Llegides\_v2\_20171106.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/Y2JyEC5GAAxxhDW>  Password: accreditation |
| **Provides evidences to sections: 1.1**  Full time, part time and abandonment  Document LED  Filename:  LED\_LListat\_DedicacioComplert\_Parcial\_Abandonament\_v1\_20171110.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/t1g8RK8NB41IDRM>  Password: accreditation |
| **Provides evidences to sections: 1.1**  Register of admission applications  Document LAD  Filename:  LAD\_Estadistiques admissio 2012-2017\_v2\_20171220.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/TNrrVFZAZFJhel9>  Password: accreditation |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of admissions | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_6 |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of new enrolled students and gender | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_1 |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of students and gender | <https://gpaq.upc.edu/lldades/indicador.asp?index=1_4_2> |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of students family residence (national, foreign, EU, …) | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_3 |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of students nationality (national, foreign, EU, …) | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_4 |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  Number of students origin (universities) | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_7 |
| **Provides evidences to sections: 1.1**  Public information of the UPC for doctoral programs.  General data of the doctoral programs of the UPC including number of programs, admissions, results, faculty, satisfaction, labor insertion. | <https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat> |
| **Provides evidences to sections: 1.2**  Rubrics of the research plan  Document RUB-PR-01  Filename:  Rubriques\_Pla\_Recerca\_Rev1.docx | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/qL1pzbAatrK2dCA>  Password: accreditation |

**Standard 2**

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| **Evidence** | **Location (URL)** |
| **Provides evidences to sections: 2.1 and 2.2**  Website of the program | <https://ee.postgrau.upc.edu/ca>  <https://ee.postgrau.upc.edu/es>  <https://ee.postgrau.upc.edu/en> |

**Standard 4**

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| **Evidence** | **Location (URL)** |
| **Provides evidences to sections: 4.1, 4.2**  List of faculty members: Number of thesis; faculty at Verificación, Seguimiento, Acreditación; projects, papers JCR, JCR Q1, research projects as IP and participation; six-year term positive qualification (sexenios); type of faculty.  Document LPD  Filename:  LPD\_Professorat\_v3\_20171120.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/tUrGkxTnovJjkzv>  Password: accreditation |
| **Provides evidences to sections: 4.2**  List of presented thesis: Year, date, RD, student’s name, title of the thesis, grade, international (y/n), director, co-director, results JCR, results JCR Q1, grants, patents, current occupation, part/full time, formative activities, mobility.  Document LTD  Filename:  LTD\_Historial\_Tesis\_Llegides\_v2\_20171106.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/Y2JyEC5GAAxxhDW>  Password: accreditation |
| Journal publications, books, competitive projects of the faculty members of the program. | https://futur.upc.edu/ |
| Public information of the UPC for doctoral programs.  Directors/co-directors, external and six-year term positive qualification (sexenios) | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_10 |
| **Provides evidences to sections: 4.2**  Improvement action: 901.M.11.2017  Survey proposal for the student satisfaction with the program. | <https://goo.gl/forms/1hYeo7J2f3coow992> |
| **Provides evidences to sections: 4.3**  Procedure for promoting the direction of thesis  Document PFT  Filename:  PFT\_PromocionDireccionTesis\_Rev1.docx | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/ewp6UhybYGnvCl8>  Password: accreditation |

**Standard 5**

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| **Evidence** | **Location (URL)** |
| **Provides evidences to sections: 5.1**  Website of the CITCEA research group. Facilities |  |
| **Provides evidences to sections: 5.1**  Website of the GAECE research group. Facilities |  |
| **Provides evidences to sections: 5.1**  Website of the QSE research group. Facilities |  |
| **Provides evidences to sections: 5.1**  Website of the LRG research group. Facilities |  |
| **Provides evidences to sections: 5.1**  Website of the SEER research group. Facilities |  |
| **Provides evidences to sections: 5.1**  Website of the MCIA research group. Facilities |  |
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| **Provides evidences to sections: 5.1 and 5.2**  Public information of the UPC for doctoral programs.  Survey by the GPAQ about the satisfaction of the students with the studies (for all the industrial programs). | 2011-2012: <https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat/curs-2011-2012/Dadesenquestesdoctorands1112perprograma.zip>  2015-2016: <https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat/curs-2015-2016/enquesta-doctorat-15-16-enginyeria-industrial.xlsx> |
| **Provides evidences to sections: 5.1**  Improvement action: 901.M.11.2017  Survey proposal for the student satisfaction with the program. | <https://goo.gl/forms/1hYeo7J2f3coow992> |

**Standard 6**

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| **Evidence** | **Location (URL)** |
| List of presented thesis: Year, date, RD, student’s name, title of the thesis, grade, international (y/n), director, co-director, results JCR, results JCR Q1, grants, patents, current occupation, part/full time, formative activities, mobility.  Document LTD  Filename:  LTD\_Historial\_Tesis\_Llegides\_v2\_20171106.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/Y2JyEC5GAAxxhDW>  Password: accreditation |
| Documents of activities of the PhD students period 2013-2017  Filename:  DAD.zip | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/Oi5nVfp2lTeCd6o>  Password: accreditation |
| Public information of the UPC for doctoral programs.  Qualification of the presented thesis. | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_8 |
| Public information of the UPC for doctoral programs.  International mention of the presented thesis. | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_9 |
| Public information of the UPC for doctoral programs.  Results of the thesis: journals, books, patents. | https://gpaq.upc.edu/lldades/indicador.asp?index=1\_4\_11 |
| Public information of the UPC for doctoral programs.  Percentage of abandonment. | <https://gpaq.upc.edu/lldades/indicador.asp?index=1_4_12> |
| Public information of the UPC for doctoral programs.  General data of the doctoral programs of the UPC including number of programs, admissions, results, faculty, satisfaction, labor insertion. | https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat |
| Full time, part time and abandonment  Document LED  Filename:  LED\_LListat\_DedicacioComplert\_Parcial\_Abandonament\_v1\_20171110.xls | <https://nuvol.terrassa.upc.edu/owncloud/index.php/s/t1g8RK8NB41IDRM>  Password: accreditation |
| **Other doctoral programs in electrical engineering (national level)** | |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical Energy Systems  Universidad de Sevilla | https://www.etsi.us.es/doctorado/electrica |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical, Electronic and Automation Engineering  Universidad Carlos III de Madrid | <https://www.uc3m.es/ss/Satellite/Doctorado/es/Detalle/Estudio_C/1371210539831/1371210298470/Ingenieria_Electrica,_Electronica_y_Automatica#acceso> |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical Engineering  Universidad Politécnica de Madrid | <http://www.dinel>.upm.es/doctorado.html |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical and Electronic Engineering  Universidad de Oviedo | http://www.uniovi.es/-/programa-de-doctorado-en-ingenieria-electrica-y-electronica |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical Energy Systems  Universidad del País Vasco | http://institucional.us.es/doctoradosee/index.php/doctorado-see-doctorado/sedes/universidad-del-pais-vasco-euskal-herriko-unibertsitatea |
| Doctoral programs in electrical engineering (Spain):  Doctoral Program in Electrical Energy Systems  Universidad de Málaga | http://www.uma.es/doctorado-see/ |