CDIO Standards and Quality Assurance:
From Application to Accreditation

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ABSTRACT

With so many Collaborators in so many countries and regions of the world it is essential that the CDIO Council promulgate processes to assure internal and external stakeholders that member institutions and programs are adhering to the 12 CDIO Standards. The Standards are what make CDIO a unique initiative and that provide a vehicle for realizing the CDIO vision *to transform the culture of engineering education*. Therefore, the Council has developed five quality assurance processes that begin with the application to become a CDIO Collaborator and include self-evaluation, certification, and accreditation based on the CDIO Standards.

KEY WORDS

CDIO standards, application, self-evaluation, CDIO study, certification, accreditation

In the 1980s and 1990s, engineering leaders in industry and government, along with university program leaders, began to discuss improvement in the state of engineering education. These discussions were stimulated by the realization that, over the preceding twenty to thirty years, engineering education program evolved from a practice-based to an engineering science-based model. The intended consequence of this change was to offer students a rigorous, scientific foundation that would equip them to address unknown future technical challenges. The unintended consequence of this change was a shift in the culture and context of engineering education. This shift diminished the perceived value of key skills and attitudes that in the past had been the hallmark of engineering, and were still critical to practice. Clearly, engineering education and real-world demands on engineers have drifted apart over the last 50 years. (See Crawley et al [1] and the CDIO website <http://www.cdio.org/>.)

Realizing that this widening gap must be closed, leading engineering schools across the globe have established the Conceive-Design-Implement-Operate Initiative (CDIO™): A worldwide collaborative intended to foster a new vision of engineering education. The CDIO Initiative, begun in the early 2000's has as its vision *to transform the culture of engineering education, producing a new synthesis of engineering science and practice, informed by scholarship on learning*.

CDIO is based on a commonly shared premise that engineering graduates should be able to Conceive – Design — Implement — Operate complex value-added engineering systems in a modern team-based engineering environment to create systems and products. The CDIO Initiative thus offers an education model stressing engineering fundamentals, set in the context of the Conceiving — Designing — Implementing — Operating process. The CDIO Initiative's goals are to educate:
- students to master a *deeper working knowledge* of the technical fundamentals,
- engineers to lead in the *creation and operation* of new products and system, and
- future researchers to understand the importance and *strategic value* of their work.

The CDIO Initiative was specifically designed as a template that can be adapted and adopted by any university engineering school. By 2010, there were over 50 collaborating institutions in over 25 countries worldwide in the CDIO Initiative including a number of programs outside traditional engineering disciplines.

Because CDIO is an open architecture model, it is available to all university programs to adapt to their specific needs. CDIO has open and accessible channels for disseminating and exchanging resources. Participating universities and programs ("Collaborators") regularly develop materials and approaches to share with others. CDIO collaborators have assembled a unique development team of curriculum, teaching and learning, assessment, design and build, and communications professionals. They are helping others to explore adopting CDIO in their institutions. (Extensive information about the CDIO Initiative may be found at <http://www.cdio.org/>.)

The International CDIO Council oversees the CDIO Initiative. The International Council consists of the original developers (Chalmers University of Technology, Linköping University, and KTH Royal Institute of Technology in Sweden and The Massachusetts Institute of Technology in the United States), the early collaborators (Technical University of Denmark; Queen's University, Belfast, Northern Ireland; Queen's University, Ontario, Canada; and The US Naval Academy, Annapolis, Maryland), and one representative of each of the CDIO Regional Centers (North America, Latin America, UK-Ireland, Nordic, South African, Australia and New Zealand, and the Asian Regional Group with affiliated Regional Centers). The International Council is responsible for developing and implementing policies and procedures related to the governance and organization of the CDIO Initiative.

In January 2004, the CDIO Initiative adopted 12 standards to describe CDIO programs. These guiding principles were developed in response to program leaders, alumni, and industrial partners who wanted to know how they would recognize CDIO programs and their graduates. As a result, the CDIO Standards define the distinguishing features of a CDIO program, serve as guidelines for educational program reform and evaluation, create benchmarks and goals with worldwide application, and provide a framework for continuous improvement. The standards may also be used as a framework for quality assurance purposes as discussed in this paper.

The 12 CDIO Standards address program philosophy (Standard 1), curriculum development (Standards 2, 3 and 4), design-implement experiences and workspaces (Standards 5 and 6), methods of teaching and learning (Standards 7 and 8), faculty development (Standards 9 and 10), and assessment and evaluation (Standards 11 and 12). The CDIO Standards address 12 characteristics of engineering education that define the CDIO approach:

Standard   1   The Context
Standard   2   Learning Outcomes
Standard   3   Integrated Curriculum
Standard   4   Introduction to Engineering
Standard   5   Design-Implement Experiences
Standard   6   Engineering Workspaces
Standard   7   Integrated Learning Experiences
Standard   8   Active Learning
Standard   9   Enhancement of Faculty Competence
Standard 10   Enhancement of Faculty Teaching Competence
Standard 11   Learning Assessment
Standard 12   Program Evaluation

Each standard is elaborated with a description and a rationale. The description elaborates the statement of the standard, explaining its meaning. It defines significant terms and provides background information. The rationale highlights reasons for the adoption of the standard based on educational research and best practices in engineering and higher education. The rationale explains ways in which the standard distinguishes the CDIO approach from other educational reform efforts. The CDIO Standards v 2.0 are listed in the Appendix and the full descriptions and rationales may be found at <http://www.cdio.org/implementing-cdio/standards/12-cdio-standards>.

With so many Collaborators in so many countries and regions of the world it is essential that the Council promulgate processes to assure internal and external stakeholders that member institutions and programs are adhering to the 12 CDIO Standards. The Standards are what make CDIO a unique initiative and that provide a vehicle for realizing the CDIO vision *to transform the culture of engineering education*. Therefore, the Council has developed five quality assurance processes that answer the following questions:

- How can the Council make sound decisions about new members (i.e., potential Collaborators)?
- How can Collaborators (institutions and programs) evaluate their efforts and guide continuous improvement relative to the standards, and determine if the resources that are being put into CDIO are having the desired impact?
- How can the Council determine the current status of the Initiative, the progress that has been made over time in the adoption of the Standards across Collaborators, and the world-wide impact being achieved by the Initiative?
- How can CDIO Collaborators at the Regional Level certify a Collaborator's level of adoption of the CDIO Standards?
- How can the CDIO Standards be used to meet accreditation expectations intended to assure internal and external stakeholders that CDIO Collaborator institutions and programs are of the highest quality?

THE APPLICATION PROCESS

The CDIO Council oversees the CDIO Initiative application process. When an institution wishes to join the CDIO Initiative it must develop a proposal in response to the following questions:

- Why does your institution wish to join the CDIO Initiative?
- What goals do you hope to achieve?
- To which of your programs do you plan to initially apply CDIO?
- How do you expect CDIO to impact these programs?
- What experience do you have in educational reform (engineering or otherwise) at your institution that could form a foundation for your work as a CDIO Collaborator and that could contribute to the CDIO Initiative in general?
- As a CDIO Collaborator, how might you reach out to other local and regional higher education institutions and programs, participate in regional activities, and contribute to worldwide CDIO efforts?
- What level of commitment and support do you have from your program, school or college, and institutional leadership? (Attach supporting letters, if applicable.)
- Who will be the key two to five participants in your effort? (Attach short CVs as appropriate.)

A prospective member formally applies first to its Regional Council. The Regional Council consists of the leaders of each of the member institutions (Collaborators) in the Regional Center. Typically, a presentation to support the application will be made by the prospective member either during a regional meeting or teleconference.

The purpose of having the Regional Council initially vet proposals is to take advantage of the first-hand knowledge that the Regional Collaborators have regarding institutional and programs in their region. In essence, this is the beginning of the CDIO quality assurance process, which is based on the professional judgement of its members.

If approved by the Regional Council, then the proposal is forwarded to the International CDIO Council for action either during a teleconference or, if at all possible, at an international meeting. All institutions that are approved by the International Council to join the CDIO Initiative are designated as CDIO Collaborators.

CDIO COLLABORATOR SELF-EVALUATION

The second quality assurance process is the CDIO Program Self-Evaluation. Its goal is to give CDIO Collaborators the opportunity to reflect on their current implementation of CDIO, relative the 12 CDIO Standards, and to provide guidance for the continuous improvement of their program(s). Within six months of joining the CDIO Initiative, it is expected that an institution and the programs to which it plans to apply CDIO will create a baseline for their efforts by conducting a CDIO Program Self-Evaluation. Self-evaluation by Collaborators is intended to set them on a journey to full implementation of the CDIO Standards.

The central document for the self-evaluation process is *The CDIO Standards v 2.0 (with customized rubrics)* <http://www.cdio.org/implementing-cdio/standards/12-cdio-standards>. The rubrics are intended to serve as self-evaluation benchmarks of each standard and to guide efforts to increase the level of adoption over time.

Each self-evaluation rubric is a scoring guide for evaluating levels of implementation, compliance, and/or performance related to each CDIO Standard. The rubrics consist of a six-point rating scale indicating with 0 being the lowest and 5 being the highest level of adoption. Criteria for each level are based on the description and rationale of the Standards and highlight the nature of the evidence that indicates compliance at each level. The rubrics are cumulative, that is, each successive level includes those at lower levels. For example, Level 5 that addresses continuous process improvement presumes that Level 4 has been attained.

General Rubric:

Scale	Criteria
5	Evidence related to the standard is regularly reviewed and used to make improvements.
4	There is documented evidence of the full implementation and impact of the standard across program components and constituents.
3	Implementation of the plan to address the standard is underway across the program components and constituents.
2	There is a plan in place to address the standard.
1	There is an awareness of need to adopt the standard and a process is in place to address it.

0	There is no documented plan or activity related to the standard.

The evaluation of compliance with the CDIO Standards is a voluntary self-reporting process. An Collaborator gathers evidence and uses the rubrics to rate its status with respect to adoption of each of the 12 CDIO Standards. While the rubrics are customized to each CDIO Standard, they follow the pattern of this general rubric.

A useful accompanying document is *Examples of Evidence of Compliance with the CDIO Standards v 2.0.* This document gives examples of evidence that have been provided by collaborators drawn from their program documents. It is purely advisory, but very helpful.

A third document is the *CDIO Self-Evaluation Template* (see Appendix). This serves as a guide to the process, and a record of the results of the self-evaluation. As the template suggests, a program should:

- Become familiar with each standard, its description, and rationale using *The CDIO Standards v 2.0*.
- Gather and record evidence of the level of compliance with the standard guided by samples in the *Examples of Evidence of Compliance with the CDIO Standards v 2.0*.
- Assign a ranking based on the six levels of compliance described by the customized rubric found in *The CDIO Standards v 2.0 (with customized rubrics)*.
- Identify actions that the program can take in the next year to enhance its level of compliance with the standards.

This last step is ultimately the most important as it provides concrete steps on how the program can improve over time, which embodies the spirit of the CDIO Standards and Self-evaluation Process.

CDIO INITIATIVE COLLABORATOR SURVEY

Using the same metrics as the Program Self-evaluation the CDIO Survey, the third quality assurance process is conducted periodically under the auspices of the CDIO Leadership Council to assess the overall status of the CDIO Initiative. All Collaborators as requested to complete the CDIO Self-evaluation form and to provide evidence of compliance with the 12 CDIO Standards.

A survey of CDIO collaborators was authorized in 2008 by the CDIO leadership as a follow up to an earlier study, *Evaluation of CDIO Programs Based on the CDIO Standards 2000 to 2005* [2] Twenty-three out of 27 institutions responded to the 2008 survey [3].

The survey has three main sections. The first includes demographic items about CDIO collaborating institutions and programs. The second section includes a rating of the extent to which CDIO Standards have been implemented as well as a request for descriptions of any major improvements with respect to the standards since the adoption of the CDIO approach. And the third section asks questions about the use of the CDIO Standards related to quality assurance.

Among the 23 collaborating institutions that responded to the survey, there are over 60 degree programs represented, which typically require 3 – 4 years for completion. Overall there is a fairly even distribution of programs related to their duration of involvement with CDIO, ranging from 1

to 5 years plus. In addition, there are typically 10 or fewer CDIO instructors out of 20 or more program instructors.

The number of students per cohort over the last 5 years has ranged from under 50 to over 4,700. However, most programs have 200 or fewer students in future cohorts with typically fewer than 100 graduates per cohort thus far.

A rating scale ranging from 0 (No initial program-level plan or pilot implementation) to 4 (Complete and adopted program-level plan and comprehensive implementation at course and program levels, with continuous improvement processes in place) was used to quantify the extent that the CDIO Standards had been implemented. Ratings of use consistently rise from institutions with 2 years or less experience with CDIO to those with 5 or more, except for the Standard 10 -- Enhancement of Faculty Teaching Competence.

There were many excellent examples of improvement that are related to the adoption of the CDIO Standards. As noted above, these examples are in the document, *Examples of Evidence of Compliance with the CDIO Standards v 2.0*. The last set of items asked about the extent and nature of the use of the standards regarding various quality assurance purposes; quality assurance within a program and for external accreditation were the two most often cited uses.

CDIO REGIONAL CERTIFICATION PROGRAM

The fourth quality assurance process is the CDIO Regional Certification Program. The goal of the Program is to establish an agreed-upon process in order to assure the quality of the CDIO Initiative, consistency of approaches to implementing the CDIO Standards, and protection of the CDIO brand. In addition, the CDIO Regional Certification Program is intended to provide Collaborators with a means for having the quality their efforts "certified".

In the CDIO Initiative *certification* and *accreditation* are defined as distinctly different activities. Certification here is defined as being synonymous with *attest, confirm, declare,* or *verify the quality* of a CDIO compliant program. In comparison, accreditation is a more stringent form of quality control synonymous with such terms as *officially state, recognize, sanction,* or *authorize*. Accreditation often involves both internal self-evaluation, external review by peers, and then a formal designation by a sanctioned accrediting body as will be discussed in the next section of this paper.

Certification may be important in order to establish a program's credibility within an institution or a national educational system. The CDIO Initiative and Standards are being advanced as national models and criteria for recognition, and, in some cases, special financial and other support. In this regard, national policies or practices create incentives for programs to adopt CDIO. The CDIO certification process can serve as a mechanism for determining whether a particular program is successfully implementing the CDIO Standards, and, therefore, worthy of such recognition and support. In other cases, where there are no national or regional quality assurance processes or standards, CDIO certification can serve as an independent means of verifying program quality.

All programs accepted as members of the CDIO Initiative are automatically CDIO Collaborators. The CDIO Initiative is a voluntary organization and, therefore, certification is a voluntary process of self-evaluation on the part of collaborating institutions and programs. The CDIO Regional

Certification Program's specific objective is to create a certification process with procedures, rubrics, evidence, and certification criteria related to the CDIO Standards.

Within this context, the CDIO Regional Certification Program is completely voluntary and an institution and/or program can become and remain a CDIO Collaborator never having engaged in this formal program. In addition, it is intended to be a simple and transparent process that meets the needs of both the CDIO Initiative and Collaborators.

Certification occurs at the regional level at the discretion of the CDIO Regional group. There is no international certification of programs. However, in order to provide consistency of certification processes and criteria across regions, the following procedures have been developed and approved by the CDIO Council as a means for a CDIO institution and/or program to seek certification.

1. CDIO Collaborator institutions and/or programs seeking certification notify their respective regional group.
2. The regional group appoints at least two reviewers who are independent from the program applying for certification. If there is no regional group, then reviewers may be designated at the discretion of the CDIO Council.
3. CDIO Collaborator institutions and/or programs submit a **CDIO Certification Self-Evaluation Survey** to their regional group. The survey consists of:
   a. program demographics of the institution and/or program seeking certification (a brief narrative description of the CDIO effort, years as a Collaborator, student body currently enrolled and graduated, instructor profile, etc.);
   b. a summary of the self-ratings for the CDIO Standards and evidence as indicated on the CDIO Self-Evaluation Template;
   c. supporting documentation based on the specific rubrics for each Standard and the *Examples of Evidence of Compliance with the CDIO Standards v 2.0.* In general the evidence to support each of the 12 standards will be a short document not more than two pages in length.
4. A rating of **4 or higher** on CDIO Standards 1, 2, 3, 5, 7, 9, and 11 is required for **Certification**. If one of these standards has a rating of 3, a program may petition for certification. In addition, a rating of **2 or higher** is required on the other standards (4, 6, 8, 10, and 12).
5. Based on the presented evidence and other knowledge of the program, the reviewers evaluate the CDIO Certification Self-Evaluation Survey information to determine whether they agree or disagree with the ratings. The reviewers submit their comments, observations and recommendations to the regional group using the **CDIO Regional Certification Recommendation Form**.
6. After reviewing the **CDIO Regional Certification Recommendation Form**, the regional group will determine if the Collaborator may be designated as a **CDIO Certified**.
7. The duration of the certification is decided by the regional group but, in general, it should be not less than three and not more than six years.
8. A program that is certified following these procedures has the right to call itself a **Certified CDIO Program**.

CDIO STANDARDS AND ACCREDITATION

There is a growing body of cases where the reference to the CDIO Standards has had a positive influence on accreditation. Various local and national authorities and professional associations accredit programs for engineering and technology. As noted by Malmqvist [4], p. 1,

A CDIO programme needs a quality assurance system which also fulfils national requirements, and that is able to produce the evidence and documentation needed for a national evaluation with minimal additional effort. Efficient execution of this task requires understanding of the similarities and differences between CDIO Standards and national quality assurance systems.

Hanrahan [5] describes "three interacting elements [that] are involved in the provision of quality education" (p. 52). The first element is "the standards set by the accrediting body" (p.52). The second element is the program design intended to meet the standards, especially those program processes related to achieving intended educational outcomes and providing evidence that the program's graduates attain these outcomes. The third element is the "external quality assurance process that evaluates the achievement of the programme against the standard and other criteria such as program structure, the quality of teaching and learning and the resourcing and sustainability of the programme" (p. 53). The CDIO Standards and Self-evaluation process have been used to provide the foundation for meeting accreditation expectations.

One such accreditation system is the EUR-ACE (*EUR*opean-*AC*redited *E*ngineer) formulated Framework Standards for the European Accreditation of Higher Education Programs in Engineering as described by Augusti [6]. Malmqvist [4] has compared the CDIO and EUR-ACE standards and drawn the following conclusions (p.1):
- The CDIO syllabus reflects a more encompassing view of engineering than EUR-ACE's, by considering the full product/system/process lifecycle, including the implementing and operating life phases. The proficiency levels of the CDIO and EUR-ACE are, however, difficult to compare.
- The EUR-ACE accreditation requirements are extensive and include elements not addressed in the CDIO framework, e.g., concerning financial resources and decision making. The CDIO standards provide "solutions" on how to work with about ¾ of the issues raised in a EUR-ACE accreditation.
- Four of the CDIO standards (4, 5, 7, and 8) define educational elements which are not explicitly discussed in EUR-ACE accreditation requirements.
- An evaluation process based on a rating scale, such as the CDIO self-evaluation model, is more useful for continuous improvement than a threshold value scale, such as used in a EUR-ACE accreditation.

Another more specific effort by Brennan and Hugo [7] is related to meeting Canadian Engineering Accreditation Board (CEAB) expectations: "Historically, the CEAB accreditation process has been very quantitative, focusing heavily on curriculum component minimums" (p. 1). Beginning in 2005, the CEAB has moved toward a model that emphasizes continuous improvement, and more specifically, program outcomes. As a result of these changes to the CEAB's criteria and procedures, Canadian engineering schools need to create new processes that focus on outcomes assessment and curriculum improvement. Similar to the EUR-ACE/ CDIO comparison by Malmqvist; Cloutier, Hugo, and Sellens [8] analyzed the CEAB expectations and found that, "An engineering program can meet all of the CEAB Graduate Attribute requirements by addressing a subset of the CDIO Syllabus, however a CEAB accredited program may not meet all of the requirements of CDIO"(p. 1).

Rocha, Costa, and Martins [9], propose combining CDIO and EUR-ACE approaches since "CDIO is more oriented to program operation and EUR-ACE is more oriented to program manage" (p. 1). The corresponding Standards and Guidelines for Quality Assurance in the European Higher Education Area (2005) are concerned with ensuring the quality of educational processes in all higher education programs which is certainly consistent with the CDIO ideal.

Further the Portuguese National Agency for Program Evaluation and Accreditation (A3ES) provides explicit accreditation conditions. Rocha, Costa, and Martins [9] suggest a number of considerations under the following conditions that are especially important in terms of CDIO (see Appendix 2):

- Quality Assurance Mechanisms
- Teaching objectives, curricular structure and syllabus
- Organization of curricular units
- Teaching/learning methodologies

The CDIO Syllabus embodied in CDIO Standard 2, Learning Outcomes as well as the ideal of continuous improvement that underlies the CDIO Self-evaluation process are also compatible with and provide the foundation for the ABET, Inc. accreditation process (EC2000). As noted by Crawley [10] the CDIO "Syllabus can be utilized to define new educational initiatives, and it can be employed as the basis for a rigorous assessment process, such as is required by ABET" (p. 1). In addition as Brodeur and Crowley [11] note, the "CDIO program evaluation approach expands the Quality Assurance criteria of ABET EC2000 particularly in the areas of teaching and learning, and the consequent need for faculty development" (p. 219). They provide a comprehensive comparison of the CDIO Standards and the ABET evaluation criteria in EC2000 and conclude that "the 12 standards developed by the CDIO Initiative serve as a useful framework for internal program evaluation and external Quality Assurance" (p. 221) [11]. It is likely that a rigorous comparison of the CDIO Standards and most accreditation schemes will show the same types of similarities and differences.

The last example is from Sweden where the CDIO self-evaluation model was introduced into the 2005 nation-wide evaluation of higher education. In general, Swedish evaluation of higher education follows a theory-driven approach that includes conditions (inputs)-processes-results (outputs). Self-evaluation relative to the CDIO Standards was incorporated in the 2005 evaluation "as a model for engineering education development and as an instrument for continuous self-improvement" (p. 137), Malmqvist and Sadurskis [12]. The CDIO self-evaluation process and the self-evaluation rubrics described earlier, along with the rating form shown in Appendix 1 were used to guide the process. The results of this effort indicate that the CDIO Standards are relevant to a wide-range of programs and that using the Standards has the potential to improve program quality. In conclusion, Malmqvist and Sardurskis [12] found that the Standards' "most important benefit is that they provide that basis for systematic program development" (p.141).

Along with the exponential growth of CDIO since 2005 have come concerns about quality assurance within the CDIO Initiative. The various quality assurance methods adopted by the CDIO Leadership Council described in this paper are intended to address those concerns. Together they attempt to answer the question, how can the Initiative ensure that the integrity of its *brand* is maintained?

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Appendix 1: CDIO Standards and Self-evaluation Template

Institution:
Program:
Evaluators:
Date:

	CDIO STANDARD	RATING	EVIDENCE OF COMPLIANCE	ACTIONS
1	**CDIO as Context** Adoption of the principle that product and system lifecycle development and deployment – Conceiving, Designing, Implementing and Operating - are the context for engineering education			
2	**CDIO Syllabus Outcomes** Specific, detailed learning outcomes for personal, interpersonal and product and system building skills, consistent with program goals and validated by program stakeholders			
3	**Integrated Curriculum** A curriculum designed with mutually supporting disciplinary subjects, with an explicit plan to integrate personal, interpersonal and product and system building skills			
4	**Introduction to Engineering** An introductory course that provides the framework for engineering practice in product and system building, and introduces essential personal and interpersonal skills			
5	**Design-Build Experiences** A curriculum that includes two or more design-build experiences, including one at a basic level and one at an advanced level			
6	**CDIO Workspaces** Workspaces and laboratories that support and encourage hands-on learning of product and system building, disciplinary knowledge, and social learning			
7	**Integrated Learning Experiences** Integrated learning experiences that lead to the acquisition of disciplinary knowledge, as well as personal, interpersonal and product and system building skills			
8	**Active Learning** Teaching and learning based on active, experiential learning methods			
9	**Enhancement of Faculty CDIO Skills** Actions that enhance faculty competence in personal, interpersonal and product and system building skills			
10	**Enhancement of Faculty Teaching Skills** Actions that enhance faculty competence in providing integrated learning experiences, in using active experiential learning methods, and in assessing student learning			
11	**CDIO Skills Assessment** Assessment of student learning in personal, interpersonal and product and system building skills, as well as in disciplinary knowledge			
12	**CDIO Program Evaluation** A system that evaluates programs against these twelve standards and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement			

Appendix 2: Accreditation conditions especially important in terms of CDIO (p. 5) [9]

Quality assurance mechanisms;
- There is a quality assurance system with designated responsibility;
- This system includes the collection of information and the monitoring and periodic evaluation of the study cycle as well as the check of qualifications and competencies of the academic staff;
- The results of assessment are largely discussed and used to improve the quality of the study cycle;
- The quality assurance system has been certified.

Teaching objectives, curricular structure and syllabus
- There is a periodic mechanism for revision of the curricular structure to ensure that scientific updating of the study cycle and the work methodologies;
- The curricular structure is compatible with the Bologna process
- The objectives of the study cycle were implemented and are easily measured.

Organization of the curricular units
- There is an effective coordination between the curricular units and the contents in order to ensure their coherence with the defined objectives
- The objectives of each curricular unit are known by the academic staff and students;
- The competencies to be acquired in each curricular unit are defined.

Teaching/learning methodologies
- The teaching methodologies and the didactic techniques are adapted to the teaching objectives and facilitate the student participation in research;
- The average of the needed study time corresponds to the estimated (ECT);
- The student evaluation is made by considering the objectives of each curricular unit.