MASTER MANUAL FOR THE WASHINGTON ACCORD ACCREDITATION
FOR SCIENCE-BASED ENGINEERING PROGRAMMES

VERSION 1.0

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This Master Manual for the Washington Accord Accreditation is complementary to the following documents:

- Background Form for the Washington Accord Accreditation.
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2. INTRODUCTION

Acredita CI makes available to higher education institutions, this Manual which establishes the evaluation criteria for the development of the Washington Accord Accreditation processes for science-based engineering programmes.

The Washington Accord Accreditation is a guarantee of quality in the engineer’s training, because it ensures that the programme incorporates in its training process the graduate attributes\(^1\) proposed by the Washington Accord, attributes agreed among the 20 signatory countries\(^2\). Therefore ensures that the programme is training engineers prepared to practice the profession in an international field. The Washington Accord Accreditation assures the substantial equivalence of that engineering education in the 20 member countries of the Accord and of those countries that are incorporated as new signatories, because the graduate has demonstrated its capacity to solve complex engineering problems.

Notwithstanding the foregoing, the Washington Accord Accreditation respects the characteristics and purposes of the institution that provides the programme, which normally consider the culture of the country, the region in which the institution is inserted and its contribution to the national development.

The accreditation issued by Acredita CI is recognized, as comparable, by the 20 signatory members of the Accord.

3. THE WASHINGTON ACCORD

Originally signed in 1989, the Washington Accord is a multi-lateral accord between bodies responsible for accreditation or recognition of tertiary-level engineering qualifications within their jurisdictions that have chosen to work collectively to assist the mobility of professional engineers.

In order to contribute to the increase of mobility for professional engineers around the world, the signatories or full members of the Accord are committed to the development and recognition of good practices to carry out the process of accreditation of engineering programmes. The activities of the signatories of the Accord (for example, in the development of graduate profiles) are aimed at helping the growing mutual recognition of engineering qualifications internationally. The Washington Accord focuses specifically on careers that culminate in the professional practice of science-based engineering.

\(^1\) Page 6, Graduate Attributes
\(^2\) Signatory members of the Washington Accord: Australia, Canada, China, Chinese Taipei, Hong Kong China, India, Ireland, Japan, Korea, Malaysia, New Zeland, Pakistan, Peru, Russia, Singapore, South Africa, Sri Lanka, Turkey, United States, United Kingdom. Along with Chile, the other provisional signatory members are: Bangladesh, Costa Rica, Mexico and Philippines.
For the Accord it is very important that engineering programmes are accredited in their respective countries. The Accord recognizes that the accreditation of engineering programmes is a fundamental basis for the practice of engineering at the professional level in each country or territory covered by the Accord.

The Accord establishes the mutual recognition of the graduate attributes of accredited programmes in the member countries is substantially equivalent.

The Washington Accord is administered by the International Engineering Alliance, IEA. IEA is a global, non-profit organization, whose members belong to 36 jurisdictions in 27 countries, which administers seven international agreements. These international agreements rule the recognition of academic qualifications and professional engineering competencies.

An engineering programme must ensure that the following definitions are present in its design:

**Knowledge profile of an engineering programme.**

<table>
<thead>
<tr>
<th>WK1</th>
<th>A systematic, theory-based understanding of the natural sciences applicable to the discipline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WK1</td>
<td>Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline.</td>
</tr>
<tr>
<td>WK3</td>
<td>A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.</td>
</tr>
<tr>
<td>WK4</td>
<td>Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is as the forefront of the discipline.</td>
</tr>
<tr>
<td>WK5</td>
<td>Knowledge that supports engineering design in a practice area.</td>
</tr>
<tr>
<td>WK6</td>
<td>Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.</td>
</tr>
<tr>
<td>WK7</td>
<td>Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.</td>
</tr>
<tr>
<td>WK8</td>
<td>Engagement with selected knowledge in the research literature of the discipline.</td>
</tr>
</tbody>
</table>

A programme that builds this type of knowledge and develops the attributes listed below is typically achieved 4 to 5 years of study, depending on the level of students at entry.
Through educational accords and accords on competencies for professional performance, IEA members establish international reference standards, named **graduate attributes** of engineering education, and **establish professional competencies** expected for the practice of engineering.

The graduate attributes are indicators of the potential of the graduate to acquire the necessary skills for the practice of engineering. An accredited programme ensures that includes these attributes in its educational process because it demonstrates the achievement of its graduation profile\(^3\).

In this way, the quality of a programme depends on the objectives and attributes to be evaluated, and also on its design, the resources committed, the teaching and learning process and the evaluation of the students, including the confirmation that the graduate attributes are satisfied.

Attributes are chosen to be universally applicable, to reflect minimum acceptable standards and to be objectively measured, and while all attributes are important, individual attributes do not necessarily have the same weight. These are established generically, being applicable to all engineering disciplines. The programme applies them within a disciplinary context, giving them a particular emphasis, but they should not be altered in substance nor should the individual elements applicable to each discipline be ignored.

The achievement of the graduate attributes is demonstrated through the achievement of the graduate profile of the programme, therefore through student learning and curricular activities of curriculum design\(^4\).

The definition of the graduate attributes is based on the Knowledge Profile:

**Graduate Attributes**

<table>
<thead>
<tr>
<th>Graduate Attributes</th>
<th>For Washington Accord Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering Knowledge:</strong></td>
<td><strong>WA1:</strong> Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to the solution of complex engineering problems(^5).</td>
</tr>
<tr>
<td><strong>Problem Analysis</strong></td>
<td><strong>WA2:</strong> Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (WK1 to WK4)</td>
</tr>
<tr>
<td>Complexity of analysis</td>
<td><strong>Design/ development of solutions:</strong> Breadth and uniqueness of engineering</td>
</tr>
</tbody>
</table>

---

\(^3\) Criterion 11: Effectiveness and Results of the Educational Process.

\(^4\) Criterion 4: Curriculum.

\(^5\) Page 8: Definition of complex engineering problems.
<table>
<thead>
<tr>
<th>Problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified.</th>
<th>Safety, cultural, societal, and environmental considerations. (WK5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation:</strong> Breadth and depth of investigation and experimentation</td>
<td><strong>WA4:</strong> Conduct investigations of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.</td>
</tr>
<tr>
<td><strong>Modern Tool Usage:</strong> Level of understanding of the appropriateness of the tool</td>
<td><strong>WA5:</strong> Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (WK6)</td>
</tr>
<tr>
<td><strong>The Engineer and Society:</strong> Level of knowledge and responsibility</td>
<td><strong>WA6:</strong> Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (WK7)</td>
</tr>
<tr>
<td><strong>Environment and Sustainability:</strong> Type of solutions.</td>
<td><strong>WA7:</strong> Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (WK7)</td>
</tr>
<tr>
<td><strong>Ethics:</strong> Understanding and level of practice</td>
<td><strong>WA8:</strong> Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (WK7)</td>
</tr>
<tr>
<td><strong>Individual and Team work:</strong> Role in and diversity of team</td>
<td><strong>WA9:</strong> Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.</td>
</tr>
<tr>
<td><strong>Communication:</strong> Level of communication according to type of activities performed</td>
<td><strong>WA10:</strong> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</td>
</tr>
<tr>
<td><strong>Project Management and Finance:</strong> Level of management required for differing types of activity</td>
<td><strong>WA11:</strong> Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</td>
</tr>
<tr>
<td><strong>Lifelong learning:</strong> Preparation for and depth of continuing learning.</td>
<td><strong>WA12:</strong> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</td>
</tr>
</tbody>
</table>

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6 See definition of complex engineering activities in annex of this document.
Complex Engineering Problems have the characteristic WP1 and some or all of the characteristics WP2 - WP7 partially or totally.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Complex Engineering Problems:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Knowledge Required</td>
<td>WP1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical CRITERION</td>
</tr>
<tr>
<td>Range of conflicting requirements</td>
<td>WP2: Involve wide-ranging or conflicting technical, engineering and other issues</td>
</tr>
<tr>
<td>Depth of analysis required</td>
<td>WP3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models</td>
</tr>
<tr>
<td>Familiarity of issues</td>
<td>WP4: Involve infrequently encountered issues</td>
</tr>
<tr>
<td>Extent of applicable codes</td>
<td>WP5: Are outside problems encompassed by standards and codes of practice for professional engineering</td>
</tr>
<tr>
<td>Extent of stakeholder involvement and conflicting requirements</td>
<td>WP6: Involve diverse groups of stakeholders with widely varying needs</td>
</tr>
<tr>
<td>Interdependence</td>
<td>WP7: Are high level problems including many component parts or sub-problems</td>
</tr>
<tr>
<td>In addition, in the context of the Professional Competencies</td>
<td></td>
</tr>
<tr>
<td>Consequences</td>
<td>EP1: Have significant consequences in a range of contexts</td>
</tr>
<tr>
<td>Judgement</td>
<td>EP2: Require judgement in decision making</td>
</tr>
</tbody>
</table>

PRINCIPLES OF SUBSTANTIAL EQUIVALENCE OF ENGINEER EDUCATION

Accredited engineering programmes “form graduates who are able to find employment and go through an educational e process and an experiential learning that leads them to the achievement of substantially equivalent professional competences⁷”. There is not expected to have identical results and contents.

Substantial equivalence is also applied in professional performance: “the results in professional performance in general are similar, even if they are achieved or evaluated by different means⁸”.

This implies that graduates of substantially equivalent programmes are able to move towards a similar level of professional development.

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⁷ www.ieagreements.org: Graduate Attributes and Professional Competencies.  
⁸ www.ieagreements.org: Graduate Attributes and Professional Competencies.
PROFESSIONAL COMPETENCIES PROFILE

To meet the minimum standard of competence a person must demonstrate that he/she is able to practice competently in his/her practice area to the standard expected of a reasonable Professional Engineer.

To evaluate whether the person meets the general standard or not, it is necessary to evaluate the degree to which the person can perform each of the following elements in professional practice.

This suggests incorporating systematic consultations with graduates about the presence of these characteristics in their professional performance and then comparing them with the characteristics detailed below:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Professional Engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehend and apply universal knowledge: Breadth and depth of education and type of knowledge</td>
<td>EC1: Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice</td>
</tr>
<tr>
<td>Comprehend and apply local knowledge: Type of local knowledge</td>
<td>EC2: Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice specific to the jurisdiction in which he/she practices.</td>
</tr>
<tr>
<td>Problem analysis: Complexity of analysis</td>
<td>EC3: Define, investigate and analyse complex problems</td>
</tr>
<tr>
<td>Design and development of solutions: Nature of the problem and uniqueness of the solution</td>
<td>EC4: Design or develop solutions to complex problems</td>
</tr>
<tr>
<td>Evaluation: Type of activity</td>
<td>EC5: Evaluate the outcomes and impacts of complex activities</td>
</tr>
<tr>
<td>Protection of society: Types of activity and responsibility to public</td>
<td>EC6: Recognise the reasonably foreseeable social, cultural and environmental effects of complex activities generally, and have regard to the need for sustainability; recognise that the protection of society is the highest priority</td>
</tr>
<tr>
<td>Legal and regulatory: No differentiation in this characteristic</td>
<td>EC7: Meet all legal and regulatory requirements and protect public health and safety in the course of his or her activities</td>
</tr>
<tr>
<td>Ethics: No differentiation in this characteristic</td>
<td>EC8: Conduct his or her activities ethically</td>
</tr>
<tr>
<td>Manage engineering activities: Types of activity</td>
<td>EC9: Manage part or all of one or more complex activities</td>
</tr>
<tr>
<td>Communication: No differentiation in this characteristic</td>
<td>EC10: Communicate clearly with others in the course of his or her activities</td>
</tr>
</tbody>
</table>

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9 Criterion 11: Effectiveness and Results of the Educational Process.
**Lifelong learning**: Preparation for and depth of continuing learning.

**EC11**: Undertake CPD activities Enough to maintain and extend his or her competence

**Judgement**: Level of developed knowledge, and ability and judgement in relation to type of activity

**EC11**: Recognize complexity and assess alternatives in light of competing requirements and incomplete knowledge. Exercise sound judgement in the course of his or her complex activities

**Responsibility for decisions**: Type of activity for which responsibility is taken

**EC12**: Be responsible for making decisions on part or all of complex activities

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### 4. EVALUATION CRITERIA

The evaluation criteria are defined to identify the quality assurance mechanisms of the programme for the educational process. Therefore, applying the evaluation criteria in a programme and obtaining the Washington Accord Accreditation is synonymous with the fact that the programme satisfies the quality criteria, because it is training suitable and qualified graduates for the practice of the profession.

For this, the accreditation process evaluates 11 criteria\(^{10}\), which are made explicit from "aspects to be considered".

The programme, in particular, is self-evaluated in six of the 11 criteria to account for compliance with the graduation profile.

The programme will take into consideration the **12 graduate attributes of the Washington Accord and will demonstrate that it includes them in their educational process** through the **graduation profile** of the programme, and through the **correspondence matrix**\(^{11}\).

Finally, the programme will make a comparison between the professional skills of its graduates and the professional skills expected by the Washington Accord\(^{12}\), to **demonstrate that education effectively leads to similar professional development**.

In the process, Acredita CI guides the programme to its adjustment to the institutional purposes, to the purposes of the academic unit on which it depends, and to the demands of the relevant external environment, for which it considers the internal and the external consistency of the programme, and also the existence of mechanisms for the programme to demonstrate that students reach the graduation profile:

i) **Internal consistency**: the degree of adjustment of the actions and results of a unit with the institutional priorities and the stated purposes for the programme. The

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\(^{10}\) See point 4 of this document.

\(^{11}\) See Background Form from Acredita CI, obligatory annex.

\(^{12}\) See page 9.
purposes of the programme must be consistent with the mission and purposes of the Institution in which it is imparted.

ii) **External consistency**: it is the degree of adjustment between the graduation profile of the programme and the requirements, standards or criteria established by the academic or professional community, pertinent to the programme.

iii) Systematic monitoring, evaluation and decision mechanisms to collect substantive evidence of compliance with the graduation profile, which includes the student's ability to solve complex engineering problems at the time of graduation.

During the self-evaluation process, the programme could also detect **weaknesses** in relation with the evaluation criteria. In this case it is expected to find evidence that it has made substantive efforts to overcome these weaknesses.

All the efforts made by the programme to overcome the weaknesses are understood as evidence of the commitment it shows to improve the quality of its educational process. In general, Acredita CI understands that the actions, mechanisms or procedures that formally and systematically aim to meet the evaluation criteria and maintain the internal and external consistency of the programme, are intended to support the continuous improvement of the quality of the programme in evaluation.

The evaluation criteria are especially concerned with the results of the education offered by the institution, such as those exemplified below:

**Outcomes Focus**

![Diagram of Outcomes Focus]

- **Processes**: Programs, Support services, Infrastructure access, General context, Didactical methodology, Technical quality management, Strategic management and development, Procedures, regulations and administration.

- **Outcomes**: Student knowledge, Student skills, Student behaviors, Innovation activities, Improvements as a result of the activities of evaluation of the quality of the courses, Impact on the knowledge, skills and behavior of the students, Impact on the virtual offer itself: educational material, courses, innovation strategies, etc.
## 5. Detail of the Evaluation Criteria

### Evaluation Criteria

<table>
<thead>
<tr>
<th>Criteria Applicable to the Scope of the Academic Unit</th>
<th>Criteria Applicable to the Scope of the Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion 1A: Purposes</td>
<td>Criterion 18: Purposes</td>
</tr>
<tr>
<td>Criterion 5: Connection with the environment</td>
<td>Criterion 3: Graduation Profile</td>
</tr>
<tr>
<td>Criterion 6: Organization and Administration</td>
<td>Criterion 4: Curriculum</td>
</tr>
<tr>
<td>Criterion 12: Self-regulation and Continuous Improvement</td>
<td>Criterion 7: Faculty</td>
</tr>
<tr>
<td>Criterion 9: Participation and Student Welfare</td>
<td>Criterion 8: Infrastructure and Learning Resources</td>
</tr>
</tbody>
</table>

- **Graduate Attributes and Professional Competencies**
  - Graduate Attributes / Can solve complex engineering problems related with his or her graduation profile
  - Professional Competencies
The criteria are grouped to represent the evaluation from the unit and from the programme. It is not necessary that all the aspects to be considered are met to comply with the criterion. However, Acredita CI has established that some of the aspects to be considered must be fulfilled in order to adequately satisfy the criterion.

I APPLICABLE CRITERIA AT THE ACADEMIC UNIT LEVEL

CRITERION 1A: PURPOSES

The unit has a clear definition of its objectives and goals, plans the academic and economic management and has mechanisms that allow to evaluate the achievement of the purposes defined for the program.

Aspect to be considered:
1.a. The unit plans its academic activities, sets academic management indicators and deploys goals that guide the allocation of resources.

CRITERION 2: INTEGRITY

The unit demonstrates its capacity to responsibly move forward in the compliance with its purposes through the existence of development plans which include the programme requirements. As well, the programme complies with its regulations, obligations and academic offerings.

CRITERION 5: CONNECTION WITH THE ENVIRONMENT

The link with the community is a key criterion of the labor of the programme, directing and strengthening the graduation profile and the curriculum. There is a systematic, meaningful and mutually beneficial interaction with the public, private and social relevant agents of horizontal and bi-directional nature. There are policies and periodical evaluation and instruments of impact with regard to the link with the community.

Aspects to be considered:
5.a. The unit develops concrete actions of connection with the environment, which allows knowing the requirements of this, in the disciplinary and professional field that are their own, providing feedback on the graduation profile, curriculum and selection of the teaching staff.
5.c. The programme defines and prioritizes the activities related to the connection with the environment in the interaction fields demanded by the social groups regarding its competence, setting clear objectives of the activities related to the connection with the environment.
5.d. The programme facilitates the mutual knowledge among its students and the eventual occupational sources of the profession.
5.e. The unit promotes the linking and connection of the programme.
5.f. The programme monitors the activities related to the environment and evaluates its impact in terms of meeting objectives.

**CRITERION 6: ORGANIZATION AND ADMINISTRATION**

The Unit has an adequate governance system and an effective academic and administration management of the necessary resources for the achievement of a degree.

**Aspects to be considered:**
6.b. The Unit has a qualified directive body which is well-dedicated in the compliance with the established responsibilities, tasks and assignments.
6.c. The programme has, at least, one directive member supervising the assignment of tasks, the supply of resources, the data registration and processing for the management control and calls together to the teachers, the supporting staff and other parties imparting the programme, upon the curriculum.
6.d. The Unit has administrative, technical and support personnel, duly trained, sufficient in number and with time in relation with the day-time/modality, as to comply properly with the tasks and cover the development need of the curriculum.
6.e. The unit has information systems and academic and administrative management tools appropriate to the management and communication needs in the programme.
6.h. The Institution has committed financial resources assuring the programme sustainability, as well as the planned continuation of students thereof along the time.
6.i. The programme has an annual budget which is updated and backed up and which it keeping adequate conditions for its operation with efficient budget control instruments.

**CRITERION 9: PARTICIPATION AND STUDENT WELFARE.**

The institution facilitates the arrangement and participation of its students in all its locations, sessions and modalities. Likewise, it is provided with services in which the students are able to be informed and gain access to funding and benefits.
CRITERION 12: SELF-REGULATION AND CONTINUOUS IMPROVEMENT

The programme has the self-regulation instruments, performs the self-evaluation processes in a systematic manner and applies the available information derived from effected diagnoses, with the purpose of designing and introducing ongoing improvement actions. In addition, the programme proves that applies the actions engaged in the improvement or development plans.

Aspects to be considered:

12.f. The self-evaluation process considers the participation of key internal/external informants - teachers, students, graduates and employers– and the self-evaluation report is known and supported by the programme community.
12.g. The programme has the suitable systems allowing to be provided with the valid and reliable information about its different action fields.
12.h. The improvement plan for the programme is supported by the institution and unit management body, which is stated in an investment plan with the necessary funding.
12.i. The programme consistently meets its established goals, ensuring the quality of the education provided.
II CRITERIA APPLICABLE TO THE SCOPE OF THE ACADEMIC UNIT

CRITERION 1B: PURPOSES

The programme has a clear definition of its objectives and has mechanisms that allow it to evaluate the achievement of them.

Aspects to be considered:

(All of mandatory compliance for the evaluation of the criterion)
1.b. The programme declares its reason for being and makes explicit the student population to which it is oriented, the occupational field for which the students are prepared and the educational project that guides the respective educational process.
1.c. The purposes of the programme are coherent with the institutional mission and have clear and verifiable management objectives.

CRITERION 3: GRADUATION PROFILE

The programme has a relevant graduation profile, updated, validated, disseminated and known by the community. The programme shows that the graduation profile includes the graduate attributes of the Washington Accord.

Aspects to be considered:

(All of mandatory compliance for the evaluation of the criterion)
3.a. The institution has quality assurance policies and mechanisms that reaffirm the consistency among the graduate profile, mission, vision and institutional purposes.
3.b. The graduation profile is consistent with the offered degree. The graduation profile is related to the educational level of the programme.
3.c. The unit has policies and mechanisms designed to capture the requirements of the environment in the disciplinary and professional field that are its own, providing feedback of its action in the area of graduation profile.
3.d. The Unit demonstrates to have policies and mechanisms that allow knowing the state of art of the scientific, disciplinary or technological bases that underlie the academic education intended to be provided, considering them in the definition of the declared graduation profiles. These mechanisms include a periodic review of the graduation profile, with a frequency that is at least equivalent to the duration of the curriculum.
3.e. The graduation profile is expressed in an accurate, complete and explicit way.
3.f. The graduation profile considers the distinctive features of each degree, where appropriate.
3.g. The graduation profile is consistent with the graduate attributes established by the Washington Accord.
3.h. The graduation profile is adequately disseminated, both internally and externally, being known by the academic community and the relevant external community.

**CRITERION 4: CURRICULUM.**

The programme has systematic and documented processes for the design and implementation of its teaching-learning process oriented towards the achievement of the graduation profile. There are periodic evaluation policies and mechanisms for the courses offered, depending on the declared learning objectives.

**Aspects to be considered:**
*(All of mandatory compliance for the evaluation of the criterion)*

4.a. The programme structures its curriculum, subject programs and curricular activities in function of the graduation profile.

4.b. The curriculum identifies the different areas of training that lead to satisfying the graduation profile, making explicit the curricular and personal development activities tending to provide an integral education in the students.

4.c. The programme sets learning objectives and evaluation instruments, subject to verification and relevant to the graduation profile. These learning objectives and evaluations can be established at the level of each subject or educational cycles (class level).

4.d. Curriculum considers theoretical and practical exercises in a consistent and integrated manner. To do this, the programme has, when necessary for the achievement of the graduation profile, effective associations with employers for quality internships during its development, so that students achieve the knowledge, skills and the necessary readiness to effectively exercise their future occupational activity.

4.f. The curriculum and the corresponding curricular activities are formally and systematically made known to students.

4.g. The institution, the unit and the programme have a system that allows to quantifying the real academic work of the students in comparable units (credits or chronological hours), according to a reasoned and proportional standard defined in the academic regulations of the institution in question. It is suggested to adhere, preferably, to the System of Transferable Credits (SCT-Chile).

4.i. For the graduation process, students develop one or more activities in which they demonstrate their ability to integrate the disciplinary and professional training received according to the defined graduation profile. These activities are part of the curriculum and are considered within the declared duration of the programme.

4.j. The unit has policies and mechanisms to periodically evaluate the curriculum and courses offered, propose modifications and keep it updated in all its locations, sessions and modalities, when they exist.
4.k. The unit collects information in the community relevant to the graduates’ occupation and performance situation and uses the obtained background information to update and refine its curriculum.

**CRITERION 7: FACULTY**

The programme has a sufficient and competent academic staff in order to fully comply with the activities and learning processes within the curriculum, allowing the students to systematically trace their paths towards the achievement of the graduation profile.

Aspects to be considered:
*(All of mandatory compliance for the evaluation of the criterion)*

7.a. The number, stay and dedication of time by the faculty ensure the application of the curriculum for the compliance with the direct teaching and activities inherent to the teaching-learning process (evaluations, practical works, preparation of assignments and exercises, the use of information and communication technologies), as well as the supervision of the teaching-learning process and the assistance and guidance for students out of the class time.

7.b. The programme proves to be provided, as a whole, with a qualified and competent faculty in order to develop the curriculum in accordance with its purposes and the graduation profile. The qualification and competence of the faculty will consider the disciplinary needs regarding the academic education received and pedagogical education, as well as the programme path in the scientific, professional, technical or artistic field, as appropriate.

7.c. The programme has a highly dedicated and long standing academic core, leading and giving sustainability to the educational project along the time and allowing covering the needs within the curriculum in all the locations, sessions and modalities.

7.d. There are known standards and instruments for the selection, recruitment, evaluation, promotion and dismissal of the academics, applied systematically and being able to be provided with special regulations for the unit.

7.e.1. Policies and improvement mechanisms are applied that allow updating and training of faculty in disciplinary and professional aspects.

7.e.2 Policies and improvement mechanisms are applied that allow updating and training of faculty in pedagogical aspects.

7.f. Mechanisms are applied that allow to evaluate the activities of the faculty of the programme – particularly the report on the learning results- which are applied effectively and systematically in the administration of the faculty. These instruments consider the opinion of the students, superiors and peers for the qualification of academics.

7.g. The programme has instances of communication and participation of faculty, clearly established and known, that facilitate the coordination with the programme authorities regarding the matters that are specific to their teaching functions.
CRITERION 8: INFRASTRUCTURE AND LEARNING RESOURCES.

The programme is provided with the infrastructure, learning resources and equipment required for the achievement of the expected results in the students. Likewise, the institution applies policies and mechanisms for the development, replacement, maintenance and safety of the said infrastructure and resources.

Aspects to be considered:

8.a. The programme has the infrastructure according to its nature (such as classrooms, laboratories, workshop stations, libraries, equipment, experimental areas, and computing resources, among others) which is sufficient and functional to the needs of the curriculum and the number of students. The ownership of the facilities and infrastructure –or the rights of the institution thereon- ensures the current and potential development of the programme, as well as the quality of the education given to the students.

i. Faculty and students have access to a library provided with the facilities, equipment, expert staff and technical processes allowing giving an appropriate attention. The library is also provided with an information system with network access.

ii. The library has physical and virtual information resources (texts, books, scientific magazines and other necessary materials for the development of the programme activities) duly updated, complying with the rights of intellectual property and in alignment with the needs of the graduation profile, the curriculum, as well as the institutional guidelines and principles. Likewise, there are physical spaces available to study, both in individual or group manner.

iii. The programme has access to the technological, computing and support resources for the teaching-learning process that are enough in number, quality and updating. Such resources help to develop the pedagogical, disciplinary and professional programme activities.

iv. There are the necessary facilities to carry out professional practices, field trips, degree and thesis work or any other activity included in the curriculum.

8.b. There are the necessary financial resources for the systematic fulfillment of supply, replacement, maintenance and updating needs of the teaching infrastructure, equipment and resources.

8.c. There is a concern with the presence of an adequate balance between the number of students admitted to each class and the total amount of the resources available, considering its teachers, its infrastructure, equipment and budget.

8.d. There are protocols for universal accessibility and safety that are strictly applied in the learning venues, facilities and resources.
CRITERION 11: EFFECTIVENESS AND RESULTS OF THE EDUCATIONAL PROCESS

The programme has quality assurance policies and instruments with respect to the admission, the teaching-learning processes and evaluation, and the academic progress towards the graduation. These policies and instruments are objective, effective and consistently applied with regard to the graduation profile. In addition, the programme shows substantive evidence of the compliance of the graduation profile.

Aspects to be considered:
(All of mandatory compliance for the evaluation of the criterion)

11.a. The programme has regulations and admission mechanisms explicit and of public knowledge. These norms are applied systematically in admission and are consistent with the requirements of the curriculum. The programme explains its special admission system when appropriate.
11.b. The programme takes the student's conditions for admission into account with respect to the curriculum requirements and provides leveling resources and activities, when required.
11.c. The programme has articulated policies and instruments to:
   i. Strength the study habits and techniques of its students.
   ii. Identify any problem of retention and progression in an early stage, applying corrective measures.
   iii. Intervene with assistance strategies, in order to enhance the student results, when appropriate.
   iv. Set programme students apart, as the case may be and according to the current regulations.
11.d. The programme has evaluation instruments applied to the students, allowing to check the achievement of learning objectives defined in the curriculum and in the subject programs. Specially, when the curriculum considers professional internships, the programme has designed evaluations in order to measure the depth and extension of the experiences linked therewith which were gained by the students.
11.d.1. The programme shows that the learning results achieved by the students satisfy those established in the declared graduation profile, and therefore, the Graduate Attributes of the Washington Accord. In particular, the evidence shows that students have the ability to solve complex engineering problems, in their field of expertise.
11.e. The programme has systematic records of the academic performance of its students, who can access to the information on their progress. The programme evaluates the progression of all its students in a disaggregated level by location, session and modality, when appropriate.
11.f. The programme systematically analyzes the reasons for dropout, retention, progression, critical subjects and periods for the student's degree according to cohorts and, if necessary, defines and applies actions tending to improve, regarding the compliance with the graduation profile and the decision-making capacity with respect to the obtained results.
11.g. The programme students can access to orientation or mentoring mechanisms, when necessary.
11.h. The programme applies the mechanisms allowing to have information and data analysis on the opinion and track of graduates and employers. Such information is applied to feedback the manner in which the quality assurance policies and instruments are formulated, as well as the graduation profile and the curriculum.
11.i. The programme is informed on the occupancy rates and the employability characteristics of its graduated students and applies this information in order to feedback the graduation profile and the curriculum by doing the necessary adjustments between the imparted education and the requirements of the labor environment.

6. EVALUATION OF CRITERIA AND ASPECTS TO CONSIDER

Each of the criteria and aspects to be considered will be valued according to the following concepts:

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Does not meet-inexistent</strong></td>
<td>it does not have formal or systematic policies or mechanisms, or the policies or mechanisms exist and are known, but do not show evidence of their application.</td>
</tr>
<tr>
<td><strong>Does not meet-developing</strong></td>
<td>there is evidence that policies and mechanisms are known and applied, with preliminary results, but there is no evidence yet that it is systematic.</td>
</tr>
<tr>
<td><strong>Meet</strong></td>
<td>there is evidence that policies and mechanisms are known and applied systematically showing results that are reviewed periodically.</td>
</tr>
</tbody>
</table>

Based on these valuations, Acredita CI will establish the main strengths and weaknesses of the programme, as well as recommendations, with the objective of informing the programme about the areas to which efforts should be focused.

THE CONCEPTS OF STRENGTHS, WEAKNESSES AND RECOMMENDATIONS

It is important to consider that it is the programme or the unit that may present strengths, so that they will not necessarily be assigned to a particular criterion.

On the other hand, a criterion that is met is not a strength and therefore, a set of strengths does not eliminate the capabilities of the process, which are directly related to the lack of compliance with the evaluation criteria.
7. THE SELF-EVALUATION PROCESS AND REPORT

For the accreditation process, the programme must develop a self-evaluation process and prepare a self-evaluation report, taking into consideration the evaluation criteria. The Guide for the Self-evaluation for the Washington Accord Accreditation\(^\text{13}\) guides the programme so that it develops the process and the report.

The programme performs a critical, detailed and reflective analysis about the compliance of the evaluation criteria that are specified at the programme level; and the unit on which it depends, develops a critical, detailed and reflective analysis about compliance with the evaluation criteria that are specified in this guide. Internal consistency is a key element to be taken into consideration in the unit - career relation when assessing compliance with the criteria.

The Background Form of Acredita CI indicates tables that the programme must complete, the obligatory annexes, as well as the opinion information consulted to students, professors, graduates and employers in the self-evaluation process.

The programme prepares its Self-Evaluation Report, presenting an analysis and reflection at the academic unit level and at the programme level, concluding about the degree of compliance with the evaluation criteria. The programme will refer to the Background Form to support the results of its self-evaluation. In addition, both the unit and the programme must present substantive evidence of the work being declared, in particular, referring to the students can solve complex engineering problems. The Self-Evaluation Guide offers examples of what evidence the programme could present to support their evaluative judgments.

Acredita CI requests the presentation of three relevant annexes: correlation table between competences of the graduation profile, curriculum and the graduate attributes\(^\text{14}\); table of activities

\(^{13}\) www.acreditaci.cl
\(^{14}\) See the Self-Evaluation Guide.
developed by students by subjects\textsuperscript{15}; and tables of enrollment, retention, graduation and graduation\textsuperscript{16}.

In addition, the programme will present a comparative analysis between the professional performance of its graduates according to their own statements and the professional competencies defined in this Manual.

From the reflection, the programme will determine its main weaknesses, which will be presented in the Self-Evaluation Report, with an Improvement Plan in which it undertakes to solve them.

\section*{8. EXTERNAL EVALUATION BY THE PEER EVALUATORS COMMITTEE}

The accreditation process includes the visit of a committee of peer evaluators, because the process is not complete if it is not validated by peers of the discipline, who understand the field of action of the programme. The committee is external to Acredit\textsuperscript{a} CI and is proposed to run by the same Agency. The evaluation peer committee is made up of teachers, academics or professionals.

The external evaluation process is enriched when the unit presents the accreditation process to all or several of its programmes simultaneously. This implies a simultaneous analysis of Self-Assessment Reports that allow a better diagnosis of the Unit and the compliance of its purposes and allows for a specific look at the programme, thus achieving an efficient process in the use of resources and a better process for ensure quality by its own characteristics. The proposed analysis of the evaluation criteria in this Manual refers to a process, by definition, of this nature.

Each committee will be headed by one or two evaluator(s) transversal to the Unit, whose function is to analyze and verify the role of the Unit in the performance of programmes and internal consistency in relation to institutional purposes. The transversal evaluators coordinate the entire process and actively participate in the preparation of the Final Visit Report.

Each programme will be in charge of an evaluator, who, accompanied by the visiting Secretary, will carry out the external evaluation process. The role of the evaluation peer committee is to verify on the ground the information provided by the programmes in their self-evaluation reports based on the eleven evaluation criteria. More information about the peer evaluators committee is found in the \textit{Manual of Standards and Procedures for the Washington Accord Accreditation}\textsuperscript{17} and in the \textit{Guide for External Evaluation for the Washington Accord Accreditation}.

Before the visit, the evaluator of each programme, a counselor of the area and a coordinator of the Acredit\textsuperscript{a} CI process will review in depth the self-evaluation report, the background form and

\footnotesize{\textsuperscript{15} See the Self-Evaluation Guide.\
\textsuperscript{16} Annex.\
\textsuperscript{17} www.acreditaci.cl}
the annexes. The Agency will prepare a questionnaire on elements that require more information, which will be sent to the programme to present this information during the visit. The programmes may present new evidence, and even make adjustments to their procedures, which will be assessed by the committee of peer evaluators as a whole. The Manual of Rules and Procedures for the Washington Accord Accreditation describes how this procedure is performed. The visit is made together and simultaneously.

In addition to the background information presented by the course(s) in the self-evaluation report(s), the evaluator(s) may select subjects to be reviewed in depth, in order to verify the achievement of the students’ learning, with special attention to those that have an integrating character, if any, and those that the programme has reported are the key activities for achieving the graduation profile, in particular, those related to the subjects in which students solve Complex Engineering Problems.

9. PARTICIPATION OF OBSERVERS

The visits of peer evaluators may include the presence of observers, according to the purposes of the Agency. Acredita CI will inform the institution in a timely manner of the presence of observers and will ensure that these comply with the conflict of interest policy. The observers do not comply the role of evaluators, but they accompany the committee and they are not allowed to ask questions to the members of the academic community of the institution of higher education or of the programme in evaluation during the visit.

10. THE VISIT PROGRAM FOR QUALITY ACCREDITATION

The visiting program is defined by Acredita CI and is put into consideration for the programme. It will be prepared by the coordinator of the process in relation to the characteristics of the programme and having as orientation that the visit of the peer evaluators committee will focus on the following elements:

a) The institutional policies for teaching and the results of the formative process, the strategic management and institutional resources, the internal quality assurance, and the link with the environment, and how these policies have an impact at the level of the academic unit responsible for the programme.

b) The purposes of the academic unit responsible for the programme, how it defines them in relation to institutional purposes and how it adapts institutional policies for itself and for the programme.

c) The design of the graduation profile and the curriculum and the mechanisms that ensure its permanent revision.

d) The mechanisms to support the learning of students.

e) The physical and educational resources available.

f) Learning activities and mechanisms to demonstrate student achievement.
g) The result of the achievement of the graduation profile.

h) The result of the resolution of complex engineering problems.

i) The analysis of the achievement of professional competences in the graduates.

**Type of visit program**

The following visit program considers that only one programme has been presented to the process and that it is dictated in one venue and one modality. In the case of a visit to more than one location, the necessary adjustments will be made, which may include increasing the number of visiting days. In case of a multiple visit with two or more programmes of the same academic unit, meetings with the institutional authorities and with the authorities of the unit are together, while meetings with students, graduates and employers are divided by programme. The meetings with teachers will be joint or divided according to the characteristics of each programme.

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>20:00</td>
<td>Internal meeting of the Peer Committee in hotel.</td>
</tr>
<tr>
<td>Day 1</td>
<td>08:30</td>
<td>Transfer of the Peer Committee from hotel to the Institution.</td>
</tr>
<tr>
<td></td>
<td>9:00 – 11:00</td>
<td>Meeting with institutional authorities. <em>(For the review of the institutional policies on teaching and results of the educational process, institutional resources, internal assurance of quality and linkage with the community).</em></td>
</tr>
<tr>
<td></td>
<td>11:15 – 12:45</td>
<td>Meeting with authorities of the Unit and with the programme authorities. <em>(For the review of the definition of the purposes of the Unit).</em></td>
</tr>
<tr>
<td></td>
<td>13:00 – 15:00</td>
<td>Lunch and internal meeting of the Peer Committee.</td>
</tr>
<tr>
<td></td>
<td>15:15 – 17:15</td>
<td>Meeting with programme authorities and with those responsible for the design and monitoring of the curriculum. Include representatives of technical units to support the curricular design, if any. <em>(For the review of the design of the graduate profile and the curriculum, as well as the support services for students).</em></td>
</tr>
<tr>
<td></td>
<td>17:30 – 18:45</td>
<td>Meeting with the teachers / academics of the programme, including the core. The assistants must not have managerial positions. <em>(For the revision of the activities of the subjects and of the policies of management of the educational body).</em></td>
</tr>
<tr>
<td></td>
<td>19:00 – 20:00</td>
<td>Meeting with employers of graduates of the programme, <strong>without contractual ties with the Institution, if they are graduates of the programme that have more than 10 years of graduation.</strong> Minimum assistance of 5 employers who are direct managers of the graduates. <em>(For the review of the professional performance of the graduates).</em></td>
</tr>
<tr>
<td></td>
<td>20:05</td>
<td>Transfer of the Committee to Hotel.</td>
</tr>
<tr>
<td>Day 2</td>
<td>08:30</td>
<td>Transfer of the Peer Committee from hotel to the Institution.</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| 09:00 – 11:00| Tour by the facilities.  
(For the visit to laboratories, classrooms, visualization of the use of computer platforms). |
| 11:15 – 12:45| Meeting with students of the programme, representative of each cohort and including students in the graduation process.  
(For the revision of the activities of the subjects, as well as of the services of support to the students), |
| 13:00 – 14:45| Lunch and internal meeting of the Peer Committee.                      |
| 15:00 – 17:15| Second meeting with the authorities of the programme in case it is necessary or space for work of the committee.  
(For the review of the evidence of achievement of student learning). |
| 17:30 – 18:30| Meeting with faculty of the subjects that develop one of the competences of the graduation profile.  
(For the review of consistency in achieving the competence). |
| 18:45 – 19:45| Meeting with the programme self-evaluation Committee.                  |
| 19:00 – 20:00| Meeting with graduates of the programme that represent different generations of graduates, **without contractual ties with the Institution.** Minimum assistance of 10 graduates with 6 months of work experience.  
(For the review of the professional performance of the graduates) |
| 20:05         | Transfer of the Committee to Hotel.                                    |

**Day 3**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Transfer of the Peer Committee from hotel to the Institution.</td>
</tr>
<tr>
<td>09:00 – 13:00</td>
<td>Internal work meeting of the Peer Review Committee.</td>
</tr>
<tr>
<td>13:00 – 14:00</td>
<td>Lunch of the Committee.</td>
</tr>
<tr>
<td>14:15 – 14:30</td>
<td>Socialization of findings between the Peer Evaluators Committee and the programme authorities.</td>
</tr>
<tr>
<td>14:35</td>
<td>End of the visit.</td>
</tr>
</tbody>
</table>

- It is requested to consider a work office for the Peer Evaluators Committee with a computer and printer that is adequate for the work to be performed.
- The programme will make available to the committee a person to support administrative management and rigorous compliance with the program of the visit in the timeliness of the meetings.
- The committee will be accompanied by a visiting secretary.
11. OF THE ACCREDITATION DECISION

The accreditation decision is adopted by the counselors of the area corresponding to the programme, based on the evaluation criteria, the self-evaluation report of the programme, the report of peer evaluators, the observations of the programme to the latter and the opinion of the committee to the observations, when they exist. Together with the information on the programme and the evidence it presents, the counselors decide if the programme is accredited.

When the programme is given in different locations, days and modalities, all of them will be certified as a whole and in the case that any of the variants does not meet the evaluation criteria; the programme reduces its possibility of obtaining accreditation.

The result of the process leads to one of three results:

- Washington Accord Accreditation.
- Conditional Accreditation.
- Not Accredited.

**Washington Accord Accreditation:** If the programme meets the evaluation criteria, it accredits for a period of 7 years, because it has been shown to have solid mechanisms for continuous improvement and achievement of committed education. The programme may have weaknesses, but these do not compromise the achievement of specific criteria at the programme level.

This process contemplates an accompaniment, a process of support in the continuous improvement to the programme, according to the described in the Manual of Rules and Procedures, to the second and fourth year since accreditation is granted.

**Conditional Accreditation:** There are evaluation criteria that are not met, but are in development. The programme will be visited, again in a period of 3 years. In this period, the programme must make substantial efforts to incorporate the improvements recommended by the Agency and those committed to its improvement plan. Only by demonstrating that it overcame the detected weaknesses, will the accreditation be extended for a period of 4 additional years. Otherwise, it is not accredited.

In the event that the programme achieves the extension of the accreditation, a follow-up is contemplated, a process of support in the continuous improvement to the programme according to what is described in the Manual of Norms and Procedures for the Washington Accord Accreditation, by what will be visited the second year since its obtained the accreditation.
Not Accredited: The programme has flaws in its design or does not have formal or systematic policies or mechanisms in its educational process, or there are only statements, but without evidence of its application or there is evidence of internal or external inconsistency.

In any of the indicated cases: Washington Accord Accreditation, Conditional Accreditation, Not Accredited, the Agency will issue an official document called Resolution of Washington Accord Accreditation in which it will inform the decision, the main strengths of the programme, the weaknesses and the recommendations for continuous improvement.

Only in the event that the programme does not achieve accreditation, it can appeal to the Agency about the decision adopted. The evidence that will be considered in this stage is that which existed up to the moment of the observations on the Committee’s Report.

Substantive changes subsequent to the Washington Accord Accreditation decision

The programme requires maintaining the conditions in which the accreditation was granted. In the event that the administration of the Agency has a background that evidences changes or modifications to said conditions, the programme will be asked to report on this, if it has not previously done so, in accordance with the established Substantive Changes procedure. The Agency will analyze the case and from this analysis the need for a field verification visit could arise. The Board will determine whether the accreditation is maintained or revoked.

The Resolution of Revocation of the Accreditation is the official document through which the Agency will communicate to the programme the result of the decision. The programme can appeal to the Agency about the decision adopted to revoke the accreditation, according to what is described in the Manual of Rules and Procedures for the Washington Accord Accreditation, before substantive changes.

12. REQUIREMENTS TO ACCESS ACCREDITATION

A programme may qualify for the Washington Accord Accreditation, when at the time of presenting itself to the process, count, with at least two cohorts of graduates and with graduates practicing the profession.

For programmes that do not have graduates, the process will consist of an evaluation of the design and resources to carry out the educational project. This is an external evaluation, for certification purposes\textsuperscript{18}, but that does not lead to the Washington Accord Accreditation. However, it allows to support the career improvement process since its inception.

\textsuperscript{18} Master Manual for Quality Certification (only in spanish).
13. ANNEXES

COMPLEX ENGINEERING ACTIVITIES

Next is defined what is understood as a complex engineering activity (Engineering Activities):

<table>
<thead>
<tr>
<th>Definition</th>
<th>Complex activities means engineering activities or projects that have all or some of the following characteristics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of resources</td>
<td><strong>EA1</strong>: it implies the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).</td>
</tr>
<tr>
<td>Interactions level</td>
<td><strong>EA2</strong>: it requires the resolution of important problems that arise from the interactions between technical, engineering or other, long-range or conflicting problems.</td>
</tr>
<tr>
<td>Innovation</td>
<td><strong>EA3</strong>: involves the creative use of engineering principles and research-based knowledge to produce changes or new looks.</td>
</tr>
<tr>
<td>Consequences for society and the environment</td>
<td><strong>EA4</strong>: have significant consequences in a variety of contexts, characterized by the difficulty of prediction and mitigation.</td>
</tr>
<tr>
<td>Familiarity</td>
<td><strong>EA5</strong>: it can be extended beyond previous experiences by applying criteria based on principles.</td>
</tr>
</tbody>
</table>

MINIMUM THEMATICS CONTENTS

The minimum thematic contents do not intend to define a unique profile for each of the engineering, but to indicate what are the common knowledge of the Basic Sciences that must share all of them, as well as the indispensable that the professional field of each one of them requires respecting this way the different orientations that the institutions want to give to the engineering programme they teach. Below is a breakdown of these contents.

Engineering Education

The Colegio de Ingenieros de Chile A.G. has defined a basic framework that includes the skills, knowledge and competencies that are specific to the professional engineer and, thinking of a professional profile that ensures the above, is that it proposes the following guide for higher education institutions that teach engineering programmes.
PROPOSAL OF THE COLEGIO DE INGENIEROS DE CHILE A.G.

STRUCTURE 5-YEAR UNDERGRADUATE CURRICULUM - ENABLER FOR PROFESSIONAL EXERCISE
CONDITIONS OF THE NATIONAL FRAMEWORK OF QUALIFICATIONS - MINEDUC

<table>
<thead>
<tr>
<th>Scientific Education Area</th>
<th>Professional Education Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialty Program for Bachelor’s Degree</td>
<td>Professional Engineering Program</td>
</tr>
<tr>
<td>(240 SCT; chronological study hours = 5600 to 6400; minimum 40 subjects)</td>
<td>(60 SCT; chronological hours = 1400 a 1600)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Sciences Subjects (12)</td>
<td>Transversal Engineering Sciences (8)</td>
<td>Fundamental Sciences of the Specialty (8)</td>
<td>Project Management (4)</td>
<td>Specialty Applied Engineering (6)</td>
<td>Graduation Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

60 SCT = Annual load of full-time studies that includes time in the classroom and personal study.
Academic semesters from 700 to 800 hours of study load.
High specialization in postgraduate.

<table>
<thead>
<tr>
<th>Scientific Education Area</th>
<th>Professional Education Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Sciences</td>
<td>Transversal Engineering Sciences</td>
</tr>
<tr>
<td>1.- Introduction to Higher Matemathics.</td>
<td>1.- Materials Science</td>
</tr>
<tr>
<td>2.- Differential Calculation</td>
<td>2.- Computer-Aided Design</td>
</tr>
<tr>
<td>3.- Integral Calculation</td>
<td>3.- General Economy</td>
</tr>
<tr>
<td>4.- Multivariables Calculation</td>
<td>4.- Solid Mechanics</td>
</tr>
<tr>
<td>5.- Differential Equations</td>
<td>5.- Experimental Methods</td>
</tr>
<tr>
<td>7.- Probability and Statistics</td>
<td>6.- Modeling and Experimentation</td>
</tr>
<tr>
<td>8.- Introduction to Physics</td>
<td>7.- Computer Programming</td>
</tr>
<tr>
<td>9.- Newtonian Systems</td>
<td>8.- Thermodynamics</td>
</tr>
<tr>
<td>General Education Subjects</td>
<td>Fundamental Sciences of the Specialty</td>
</tr>
<tr>
<td>1.- English (4 levels)</td>
<td>5.- Oral and Written Expression</td>
</tr>
<tr>
<td>3.- Environmental Management</td>
<td>6.- Labor Law</td>
</tr>
<tr>
<td>4.- Organization of Companies</td>
<td>7.- Ethics</td>
</tr>
<tr>
<td>5.- Innovation and Entrepreneurship</td>
<td>5.- Elective Specialty</td>
</tr>
<tr>
<td>6.- Formulation of the Titling Project</td>
<td>7.- Titling Project</td>
</tr>
<tr>
<td>Specialty Applied Engineering</td>
<td>Graduation Work</td>
</tr>
</tbody>
</table>
Basic Sciences

The engineering study programs, whatever their specialty or mention, must develop in the graduate knowledge and understanding of the Basic Sciences, which correspond to the treatment of mathematics, physics, chemistry and other subjects that support a wide range of disciplines of engineering. The objectives of this area are:

- Contribute to the formation of logical-deductive thinking.
- Provide graduates with the foundations that allow them to successfully face problems that require analytical capacity and innovation.
- Provide sufficient preparation to update and deepen their knowledge.

Transversal Engineering Sciences

It corresponds to the scientific treatment of disciplines related to materials, energies, systems and processes, in order to provide the conceptual basis and analysis tools for the area of Applied Engineering.

Specifically, they must have a content that includes the general disciplines of engineering, such as Materials Science and Technology, Solid Mechanics and Materials Resistance (Theory and Experimentation), Fluid Mechanics and Hydraulic Machines (Theory and Experimentation), Thermodynamics and use of heat energy (Theory and Experimentation), Electrical Engineering, Electronics and Electrical Machines (Theory and Experimentation), Computing and Information Systems, Operations Research with Linear and Dynamic Programming, Environmental Engineering, Economic and Financial Engineering, Planning and Administration of Projects, mainly.

Specialty Applied Engineering

It includes the fundamental elements of engineering that allow the graduate to have a knowledge of the disciplines of each specialty, including the methodologies, standards and practices for analysis, studies and designs, in order to be qualified for the professional practice in the respective specialty.

The curriculum of the different specialties must have a sufficient breadth and level to participate competently in the planning, design and administration of infrastructure projects, productive processes, multidisciplinary projects or research.

It is a main requirement for the study programs to have design workshops in the respective specialties that allow knowing, understanding and applying the methods, calculation rules, legal regulations and in general the updated standards applicable to each specialty.
Project Management

A set of knowledge and skills of the economic and administrative disciplines to understand the impact of the economic environment on engineering projects and plan, manage, and control projects and processes, as well as evaluate and interpret the results. Applied to Engineering, is to be able to recognize objectives, coordinate the use and administration of resources in the most effective and efficient way possible, thus increasing productivity to be able to guarantee the compliance of this objective.

Social Sciences and Humanities

The Colegio de Ingenieros de Chile A.G. recommends that the study programs contemplate the foundations and methodologies that allow to effectively develop the activity of engineering in a business context, facilitate the understanding of the globalized world, the restrictions imposed by finance, legislation, ethics and work with social responsibility.

General Education Subjects

The Colegio de Ingenieros de Chile A.G. recommends that study programs include elective courses that aim to complement professional training, with subjects not included in the other areas of education or to emphasize education in disciplines that are of interest to each student, within the scope of each specialty.