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EUR-ACE

Framework Standards for the Accreditation of Engineering Programmes

including

Template for Publication of Results

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Foreword

1. The principal aim of the EUR-ACE project is to develop a Framework for the accreditation of engineering degree programmes in the European Higher Education Area (EHEA). The Framework Standards that have been developed, and the procedures for their implementation, are intended to be widely applicable and inclusive, in order to reflect the diversity of engineering degree programmes that provide the education necessary for entry to the engineering profession. The proposed Framework affords a means for comparing educational qualifications in the EHEA, and thereby promoting the mobility of engineering graduates.

2. Accreditation involves a periodic assessment of a programme of engineering education against accepted standards. It is a peer review process, undertaken by appropriately trained and independent panels of practicing engineers, both industrial and academic, on behalf of properly constituted agencies. The process normally involves both scrutiny of data about the programme, and a structured visit to the Higher Education Institution (HEI) running the programme.

3. The Standards for accreditation can be used in both the design and the evaluation of programmes in all branches of engineering and for different profiles. They are expressed as Programme Outcomes that describe in general terms the capabilities required of graduates from accredited First Cycle and Second Cycle engineering programmes, as defined in the European Qualification Framework (cf. § 7), or from programmes that are designed to progress directly to a Second Cycle degree (conventionally termed "Integrated Programmes"). Consequently they will have to be interpreted by users to reflect the specific demands of different branches, cycles and profiles.

4. Because the Framework Standards describe the Programme Outcomes of an accredited programme but do not prescribe how they are realised, HEIs retain the freedom to formulate programmes with an individual emphasis and character, including new and innovative programmes, and to prescribe conditions for entry into each programme.

5. Although the Framework is expressed in terms of accrediting degree programmes, it can be used for the accreditation of agencies that accredit (or intend to accredit) engineering programmes, provided their rules and Standards are consistent with the Framework (meta-accreditation); alternatively, it can be used as a guideline for drafting Standards and Procedures for new Agencies. A proposal for the organization and management of the accreditation system is the subject of another EUR-ACE document (Document A2).

6. Throughout the following statements of Standards and Procedures, the term "engineering graduate" has been used to describe someone who successfully completes an accredited programme in engineering. The term 'engineer' has been avoided because of the confusion that could arise from its widely different interpretations within Europe, including specific regulatory meanings in some countries. It is for the appropriate authority in each country to decide if a qualification, accredited or not, is sufficient for engineering registration or qualification in that country, or if further education, training or industrial experience are necessary. The EUR-ACE accreditation label will assist such decisions, and particularly those that involve trans-national recognition.

7. The development of the Programme Outcomes has been informed by the report 'A Framework for Qualifications of the European Higher Education Area' agreed by the Ministerial Conference in Bergen in May 2005, and by the Dublin Descriptors referred to therein. It is also assumed that all programmes to be accredited fulfil the criteria set out in the ENQA 'Standards and Guidelines for Quality Assurance in the European Higher Education Area', and also agreed by the Bergen Conference.

8. A Commentary (EUR-ACE Document C1) is attached to explain the meaning of some of the terms used, and also to give more information about the background and purpose of the EUR-ACE project.

1. Programme Outcomes for Accreditation

The six Programme Outcomes of accredited engineering degree programmes are:

- Knowledge and Understanding;
- Engineering Analysis;
- Engineering Design;
- Investigations;
- Engineering Practice;
- Transferable Skills.

Although all six of the Programme Outcomes apply to both First Cycle and Second Cycle programmes, there are important differences in the requirements at the two levels. These differences in the levels of First and Second Cycle accredited engineering programmes should inform the interpretation of the Programme Outcomes by HEIs and by accrediting panels. The differences are particularly relevant to those learning activities that contribute directly to the three Programme Outcomes concerned with engineering applications, Engineering Analysis, Engineering Design, and Investigations.

Students entering an accredited Second Cycle programme will normally have graduated from accredited First Cycle programmes but the HEI should provide opportunities for students entering without such a qualification to demonstrate that they have satisfied the First Cycle Programme Outcomes. Integrated programmes leading directly to a qualification equivalent to that of a Second Cycle qualification will need to include the Programme Outcomes of both First and Second Cycle Programmes.

No restriction is implied or intended by the Framework in the design of programmes to meet the specified Programme Outcomes. For example the requirements of more than one Programme Outcome could be satisfied within a single module or unit such as project work. Similarly it is possible that some programmes are designed such that the requirements of the Transferable Skills Outcome are taught and assessed entirely within modules or units designed to satisfy the requirements of other Programme Outcomes, whereas in other programmes the Transferable Skills requirements are taught and assessed in modules or units designed specifically for this purpose.

It is envisaged that a graduate from an accredited Second Cycle programme will have obtained from all HE studies a total of not less than 240 ECTS credits and a graduate from an accredited First Cycle programme not less than 180 ECTS credits (or their equivalent if they graduate from HEI that do not apply the ECTS).

Knowledge and Understanding

The underpinning knowledge and understanding of science, mathematics and engineering fundamentals are essential to satisfying the other programme outcomes. Graduates should demonstrate their knowledge and understanding of their engineering specialisation, and also of the wider context of engineering.

First Cycle graduates should have:

- knowledge and understanding of the scientific and mathematical principles underlying their branch of engineering;
- a systematic understanding of the key aspects and concepts of their branch of engineering;
- coherent knowledge of their branch of engineering including some at the forefront of the branch;
- awareness of the wider multidisciplinary context of engineering.

Second Cycle graduates should have:

- an in-depth knowledge and understanding of the principles of their branch of engineering;
- a critical awareness of the forefront of their branch.

Engineering Analysis

Graduates should be able to solve engineering problems consistent with their level of knowledge and understanding, and which may involve considerations from outside their field of specialisation. Analysis can include the identification of the problem, clarification of the specification, consideration of possible methods of solution, selection of the most appropriate method, and correct implementation. Graduates should be able to use a variety of methods, including mathematical analysis, computational modelling, or practical experiments, and should be able to recognise the importance of societal, health and safety, environmental and commercial constraints.

First Cycle graduates should have:

- the ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods;
- the ability to apply their knowledge and understanding to analyse engineering products, processes and methods;
- the ability to select and apply relevant analytic and modelling methods.

Second Cycle graduates should have:

- the ability to solve problems that are unfamiliar, incompletely defined, and have competing specifications;
- the ability to formulate and solve problems in new and emerging areas of their specialisation;
- the ability to use their knowledge and understanding to conceptualise engineering models, systems and processes;
- the ability to apply innovative methods in problem solving.

Engineering Design

Graduates should be able to realise engineering designs consistent with their level of knowledge and understanding, working in cooperation with engineers and non-engineers. The designs may be of devices, processes, methods or artefacts, and the specifications could be wider than technical, including an awareness of societal, health and safety, environmental and commercial considerations.

First Cycle graduates should have:

- the ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements;
- an understanding of design methodologies, and an ability to use them.

Second Cycle graduates should have:

- an ability to use their knowledge and understanding to design solutions to unfamiliar problems, possibly involving other disciplines;
- an ability to use creativity to develop new and original ideas and methods;
- an ability to use their engineering judgement to work with complexity, technical uncertainty and incomplete information.

Investigations

Graduates should be able to use appropriate methods to pursue research or other detailed investigations of technical issues consistent with their level of knowledge and understanding. Investigations may involve literature searches, the design and execution of experiments, the interpretation of data, and computer simulation. They may require that data bases, codes of practice and safety regulations are consulted.

First Cycle graduates should have:

- the ability to conduct searches of literature, and to use data bases and other sources of information;
- the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;
- workshop and laboratory skills.

Second Cycle graduates should have:

- the ability to identify, locate and obtain required data;
- the ability to design and conduct analytic, modelling and experimental investigations;
- the ability to critically evaluate data and draw conclusions;
- the ability to investigate the application of new and emerging technologies in their branch of engineering.

Engineering Practice

Graduates should be able to apply their knowledge and understanding to developing practical skills for solving problems, conducting investigations, and designing engineering devices and processes. These skills may include the knowledge, use and limitations of materials, computer modelling, engineering processes, equipment, workshop practice, and technical literature and information sources. They should also recognise the wider, non-technical implications of engineering practice, ethical, environmental, commercial and industrial.

First Cycle graduates should have:

- the ability to select and use appropriate equipment, tools and methods;

- the ability to combine theory and practice to solve engineering problems;
- an understanding of applicable techniques and methods, and of their limitations;
- an awareness of the non-technical implications of engineering practice.

Second Cycle graduates should have:

- the ability to integrate knowledge from different branches, and handle complexity;
- a comprehensive understanding of applicable techniques and methods, and of their limitations;
- a knowledge of the non-technical implications of engineering practice.

Transferable Skills

The skills necessary for the practice of engineering, and which are applicable more widely, should be developed within the programme.

First Cycle graduates should be able to:

- function effectively as an individual and as a member of a team;
- use diverse methods to communicate effectively with the engineering community and with society at large;
- demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice;
- demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations;
- recognise the need for, and have the ability to engage in independent, life-long learning.

Second Cycle graduates should be able to:

- fulfil all the Transferable Skill requirements of a First Cycle graduate at the more demanding level of Second Cycle;
- function effectively as leader of a team that may be composed of different disciplines and levels;
- work and communicate effectively in national and international contexts.

2. Guidelines for Programme Assessment and Programme Accreditation

2.1 Guidelines for the Criteria and Requirements of Programme Assessment

Each engineering programme for which a Higher Education Institution seeks accreditation or reaccreditation must be consistent with legal national requirements and have in place:

- programme educational objectives consistent with the mission of the Higher Education Institution and the needs of all interested parties (such as students, industry, engineering associations, etc.) and programme outcomes consistent with the programme educational objectives and the programme outcomes for accreditation (cf. section 1);
- a curriculum and related processes which ensure achievement of the programme outcomes;
- academic and support staff, facilities, financial resources and cooperation agreements with industry, research institutions and other Higher Education Institutions adequate to accomplish the programme outcomes;
- appropriate forms of assessment which attest the achievement of the programme outcomes;
- a management system able to ensure the systematic achievement of the programme outcomes and the continual improvement of the programme.

Correspondingly, the guidelines for a programme assessment submitted for accreditation must at least consider the following items:

1. Needs, Objectives and Outcomes;
2. Educational Process;
3. Resources and Partnerships;
4. Assessment of the Educational Process;
5. Management System.

In this context, the “criteria to be assessed” and the associated “requirements” in the form of questions, valid for both FC and SC programmes, listed in the following Table should be addressed when assessing an engineering programme for accreditation.

Table: Criteria and Requirements for Programme Assessment

Guidelines for Accreditation	Criteria to be assessed	Requirements	What the Self-assessment Report (cf. Section 3.1) should give evidence of and the Accreditation Team should check
1. Needs, Objectives and Outcomes	1.1 Needs of the Interested Parties	Have the needs of the interested parties (such as students, industry, engineering associations, etc.) been identified?	Modes and periods of relationships with the interested parties. Needs identified for each of the identified interested parties.
	1.2 Educational Objectives	Are the programme educational objectives consistent with the mission of the Higher Education Institution (HEI) and with the needs of the interested parties (such as students, industry, engineering associations, etc.)?	Programme educational objectives vs. mission of the HEI and needs of the interested parties. Transparency and publicity of the programme educational objectives.
	1.3 Programme Outcomes	Do the programme outcomes cover the programme outcomes for accreditation (cf. Section 1)?	Programme outcomes vs. programme outcomes for accreditation (cf. Section 1).
		Are the programme outcomes consistent with the programme educational objectives?	Programme outcomes vs. programme educational objectives
2. Educational Process	2.1 Planning	Does the curriculum ensure the achievement of the programme outcomes?	Curriculum (syllabus, ECTS credits, credits for course work and personal study), its transparency and publicity. Definition/description of modules' characteristics (credits, contents, specific learning outcomes, assessment methods of individual modules), their transparency and publicity. Integration of professional practice (external practical experience, laboratories, projects, etc.). Final examination, thesis, project, etc.. Correspondence of curriculum and modules' characteristics to the programme outcomes. Planning of the delivery. Teaching methods and techniques (fulltime, part time, parallel to or integrated in professional work, use of multimedia or telematics devices, etc.). Measures to promote students' mobility.
	2.2 Delivery	Is teaching delivered according to planning?	Correspondence of the delivery with the planning. Results of the students' evaluation of taught modules. Results of the students' and tutors' evaluation of external practical experiences. Results of students' mobility.
		Are counselling and support workload offered to the students adequate to promote the achievement of the modules' specific learning outcomes?	Number of staff and their workload for counselling and support to the students.

Guidelines for Accreditation	Criteria to be assessed	Requirements	What the Self-assessment Report (cf. Section 3.1) should give evidence of and the Accreditation Team should check
	2.3 Learning Assessment	Have examinations, projects and other assessment methods been designed to evaluate the extent to which students can demonstrate achievement of the learning outcomes of single modules and programme outcomes respectively throughout the programme and at its conclusion?	Examination papers and coursework (samples of assessed coursework, continuous assessments, project reports). Transparency and publicity of the standards and rules concerning the assessment of student performance.
3. Resources and Partnerships	3.1 Academic and Support Staff	Is the academic staff adequate to accomplish the programme outcomes?	Number, composition, competency and qualification of the teaching staff. Research (publications, participation in research projects, participation in conferences, etc.) and/or professional activities and consulting work of the teaching staff.
		Is the technical and administrative support staff adequate to accomplish the programme outcomes?	Number, composition, competency and qualification of the technical-administrative support staff.
	3.2 Facilities	Are the classrooms adequate to accomplish the programme outcomes?	Classrooms and associated equipment available to students.
		Are the computing facilities adequate to accomplish the programme outcomes?	Computing facilities available to students.
		Are the laboratories, workshops and associated equipment adequate to accomplish the programme outcomes?	Laboratories, workshops and associated equipment available to students.
		Are the libraries and associated equipment and services adequate to accomplish programme outcomes?	Libraries and associated equipment and services available to students.
	3.3 Financial Resources	Are the financial resources adequate to accomplish the programme outcomes?	Budget for teaching and support staff. Budget for running and upgrading facilities. Budget for training.
	3.4 Partnerships	Do the partnerships the HEI and the programme are participating in contribute to accomplish the programme outcomes and facilitate the mobility of the students?	Local / regional / national / international industrial partnerships and cooperation agreements. Local / regional / national / international partnerships and cooperation agreements with research institutions. Local / regional / national / international cooperation agreements, programmes or measures with other Higher Education Institutions.
4. Assessment of Educational Process	4.1 Students	Do the students enrolled in the programme have the right knowledge and attitudes to achieve the programme outcomes in the expected time?	Entrance requirements. Admission requirements *(only for "numerus clausus" programmes)*.
		Do the results related to the students' career attest the achievement of the programme outcomes in the expected time?	Students' career progress. Learning levels achieved. Success rates and time taken to complete the programme.
	4.2 Graduates	Do graduates enter an occupation corresponding to their qualification?	Time taken to enter the workforce. Match between employment and education received.

Guidelines for Accreditation	Criteria to be assessed	Requirements	What the Self-assessment Report (cf. Section 3.1) should give evidence of and the Accreditation Team should check
		Do stakeholders (graduates, employers, etc.) confirm the achievement of the programme's educational objectives?	Graduates' opinions on the education received. Opinion of employers on the graduates' education.
5. Management System	5.1 Organisation and decision-making processes	Are HEI's and programme's organisation and decision-making processes adequate to accomplish the programme outcomes?	Documentation on HEI's and programme's organisational structures and decision-making processes (statutes, organisational charts, management of organisational processes, etc.) Positions of responsibility for the various actions to direct and control the educational process, their relationships of link and dependence. Existence and use of effective co-ordination mechanisms of decision-making processes, both horizontal and vertical. Existence and use of reliable information sources for decision-making.
	5.2 Quality Assurance System	Are HEI's and programme's Quality Assurance Systems effective to ensure the achievement of the programme outcomes?	HEI's and programme's policy and procedures for quality assurance.
		Are the delivery process', students' and graduates' results analysed and used to promote continual improvement of the programme?	Existence of a regulated and systematic process for continual programme review, development and improvement based on the analysis of the delivery processes, students' and graduates' results. Results of improvement actions.
		Are needs, objectives and outcomes, educational process, resources and partnerships, management system periodically re-examined?	Existence of a regulated, systematic and periodic process for re-examining needs objectives and outcomes, educational process, resources and partnerships, management system. Results of re-examination activity.

2.2 Guidelines for the Evaluation of Individual Requirements

To record judgement of the achievement of individual requirements, a scale with at least the following three points should be used:

1. Acceptable;
2. Acceptable with prescriptions;
3. Unacceptable.

The judgment "acceptable" should be awarded to requirements which have been fully met, even if improvements are still possible.

The judgment "acceptable with prescription" should be awarded to requirements which have not been fully met, but are judged to be amendable within a reasonable period of time (as a rule no longer than half the regular full period of accreditation).

The judgment "unacceptable" should be awarded to requirements which have not been met or fully met, and are judged not to be amendable within a reasonable period of time.

2.3 Guidelines for the Criteria of Programme Accreditation

The accreditation of an engineering programme should be subordinated to the fulfilment of the requirements.

To record judgement of the overall achievement of the requirements, a scale with at least the following three points should be used:

1. Accredited without reservation;
2. Accredited with prescriptions;
3. Not accredited.

Accreditation without reservation, with possible specification of recommendations for the improvement of the programme, should be awarded to programmes for which all requirements are judged to be "acceptable". In this case accreditation should be awarded for the full period of accreditation (which should not exceed six years).

Accreditation with prescriptions, with specification of prescriptions and the time in which prescriptions must be carried out, should be awarded if one or several requirements are judged to be "acceptable with prescriptions". If a programme is rated as "accredited with prescriptions", accreditation must be awarded for a shorter period of time after which compliance with the prescriptions is verified.

If any of the above conditions are not satisfied, then the accrediting panel can recommend that accreditation be withheld.

3. Procedures for Programme Assessment and Programme Accreditation

This section lists the steps the programme assessment (based on self-assessment followed by external assessment) and programme accreditation procedures should follow. Individual accreditation agencies may add further requirements to adapt to nationally and culturally distinctive features of Higher Education in engineering and to ensure compliance with national legislation.

3.1 Application by a Higher Education Institution (HEI)

Detailed self-assessment report and documentation should be submitted before the visit of the accreditation team (sufficient time should be allowed for review of the report by peers).

The table in Section 2.1 may serve as guideline for the HEI in producing (and for members of the accreditation team in reviewing) self-assessment report and documentation. In any case the self-assessment report should answer at least to all the questions listed in the table in Section 2.1, taking into account at least all the items listed in the last column of the table.

3.2 Guidelines for the Procedure of Programme Assessment

3.2.1 Composition of accreditation team

The accreditation team should consist of at least two persons, preferably more, representing a balance of relevant experience and expertise. At least one member of the accreditation team should be an academic, at least one a practising engineering professional. All members of the accreditation team should be sufficiently trained for the conduction of the accreditation process. In this regard accreditation institutions should promote short training courses.

To facilitate the dissemination of good practice in accreditation, the accreditation institution should offer the option to include external observers from outside the respective economic region.

From each member of the accreditation team, a statement should be received indicating that a conflict of interest does not exist between the HEI at which one or several programmes are being accredited and the panel members. This statement should be received prior to any documentation being distributed.

3.2.2 Duration of the accreditation visit

The accreditation process should last at least two days, including any preliminary meetings to assess the documentation and the visit to the HEI.

3.2.3 Structure of the accreditation visit

The visit should include:

- preliminary meeting of the audit team prior to the visit to identify what information is to be obtained during the visit;
- meeting with head of department / university;
- meeting with academic staff members;
- meeting with support staff members;
- meeting with students;
- meeting with former students;

- meeting with employers / industry / professional engineering organisations representatives;
- visit of facilities (libraries, laboratories, etc.);
- review of project work, final papers and other assessed work (with regards to the standard and modes of assessment as well as to the learning achievements of the students);
- feedback of the audit team at the end of the visit.

3.3 Guidelines for the Procedure of Programme Accreditation

3.3.1 Verification and validation of the report by the accreditation agency/commission

The members of the accreditation team prepare an accreditation report (cf. Document G4 for template). The accreditation report is then submitted to the HEI to check for factual errors and submit a statement on the report. The statement of the HEI is transmitted to the members of the accreditation team for review of the accreditation report and formulation of recommendation concerning the accreditation decision.

3.3.2 Decision on accreditation

The final decision on accreditation should be taken by an especially designated board of the accreditation institution. The accreditation decision must clearly define the period of validity (the duration of which should not exceed a maximum of six years) and whether it refers to year of entry or year of graduation. After the limited validity of the accreditation has expired, the programme must be submitted to re-accreditation.

The accreditation decision is then communicated to the HEI

3.3.3 Publication

The list of accredited programmes must be made available to the public by each accreditation institution. The following section (Section 4) presents a recommended template for the publication; it will have to be adapted to national legislation.

4. Recommended Template for Publication of Results

Higher Education Institution (name in original language and in English)	
Country	
State/province (where applicable)	
Name of the Programme (name in original language and in English)	
Degree awarded	
Qualification Level (First Cycle / Second Cycle)	
Programme objectives; Profile (where applicable)	
Programme Duration (Semesters; in case of "terms" of different length, indicate them and the equivalent in semesters)	Semesters
Total number of ECTS Credits awarded	ECTS cp
Curriculum analysis (% and credits)**:** ? **engineering fundamentals** ? **advanced engineering subjects (including final thesis)** ? **mathematics / natural sciences fundamentals** ? **interdisciplinary contents**	
Brief description of the programme	
Accredited without / with prescriptions	
Prescriptions (where applicable)	
Accredited by (agency, country)	
Accredited (from ... to …)	