Evaluation of the EUR-ACE outcome criteria for engineering degree programmes in Switzerland

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1 General provisions

This guide governs the preconditions and procedure for the evaluation of EUR-ACE\(^1\) outcome criteria for engineering degree programmes in Swiss higher education institutions (HEI).

1.1 Goal and object of an evaluation

The evaluation of EUR-ACE outcome criteria for engineering degree programmes is a precondition to the award of the EUR-ACE label by the European Network for the Accreditation of Engineering Education, ENAEE.

First cycle programmes leading to a Bachelor in Engineering\(^2\) and second cycle programmes leading to a Master's degree\(^3\) may be subject to this evaluation procedure. The following two situations are distinguished:

1. The engineering programme has been accredited in Switzerland and the accreditation is still valid when applying to be awarded the EUR-ACE label: in this case, the present guide for evaluation of the EUR-ACE outcome criteria has to be applied.

2. The application for accreditation is presented at the same time as the request to be awarded the EUR-ACE label: in this case, the guide for the accreditation procedure has to be followed. The evaluation of the EUR-ACE outcome criteria will be conducted at the same time.

Several engineering programmes may be examined under a single procedure ("cluster" procedure). Such procedures are subject to special conditions determined by AAQ and the management of the HEI.

1.2 EUR-ACE outcome criteria for engineering programmes

Swiss federal regulations on programme accreditation do not set specific quality standards for the outcome of engineering programmes. In accordance with the FTAL\(^3\), AAQ decided to evaluate the outcomes of engineering programmes using the EUR-ACE outcome criteria (see Appendix A). These criteria are part of the EUR-ACE Framework Standards, which are available on the website of ENAEE\(^4\).

The EUR-ACE Framework Standards respect the many traditions and methods of engineering education in Europe. The Framework contains

1. the programme outcomes for accreditation,
2. criteria and requirements for programme assessment and programme accreditation, and a description of
3. procedures for programme assessment and programme accreditation.

This guide exclusively handles the evaluation of the EUR-ACE outcome criteria of engineering programmes (part 1 of the Framework).

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\(^1\) EUR-ACE means European Accredited Engineer

\(^2\) Both referred to by “engineering programmes” in this document.

\(^3\) Specialized Conference in Technology, Architecture and Life Sciences, [http://www.ftal.net/](http://www.ftal.net/)

These criteria are subdivided into the following six programme outcomes:

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

The outcome criteria (see Appendix A) are the core of the evaluation; they constitute the basis for the self-evaluation report, are used by the experts during their external analysis, and allow AAQ to take a final decision. They express in general terms the capabilities required by graduates from accredited Bachelor and Master engineering programmes. No criteria are formulated for specific fields of engineering.

### 1.3 Confidentiality and data protection

Each person participating in the evaluation is obliged to handle information revealed during the procedure in a confidential manner. This confidentiality rule is applicable both to information concerning the evaluated unit and to the personal identity of individuals involved in the procedure.

Likewise, the provisions of the Federal Act of 19 June 1992 on data protection\(^5\) apply to the evaluation procedure.

### 1.4 Costs and payment of the procedure

The costs of the evaluation procedure are payable by the evaluated unit. The “Pricelist – Evaluation of EUR-ACE outcome criteria for engineering programmes” dated May 2014, published on the AAQ website, applies to standard evaluation procedures. In the case of a “cluster” procedure, AAQ presents a budget plan to the applicants before the procedure begins.

### 2 Stages of the procedure

The evaluation of the EUR-ACE outcome criteria comprises the following phases:

1. The preparation and opening of the procedure;
2. The self-evaluation;
3. The external evaluation by independent experts;
4. The decision by AAQ.

#### 2.1 Phase 1: Preparation and opening of the procedure

The higher education institution (HEI) sends a request to AAQ to be awarded the EUR-ACE label for a specific engineering programme. This request must be signed by the management of the HEI. As explained in Section 1.1, two situations will be distinguished:

1. A copy of the valid decision on the accreditation of the engineering programme has to be enclosed if this accreditation is still valid in Switzerland, or
2. The application for accreditation is presented at the same time.

The present guide “Evaluation of the EUR-ACE outcome criteria” is applied under situation 1. Under situation 2, the guide for the accreditation procedure has to be followed.

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\(^5\) “Classified Compilation of Swiss Federal Law” RS 235.1
On receipt of the request, AAQ contacts those responsible for the engineering programme in order to clarify the contents, objectives and deadlines of the procedure. The relevant documents on an existing institutional and/or programme accreditation in Switzerland are examined. The opportunity of a “cluster” procedure for two or more engineering programmes is also examined at this stage.

On this basis, AAQ prepares contractual terms of reference with the engineering programme seeking the award of the EUR-ACE label.

2.2 Phase 2: Self-evaluation of EUR-ACE outcome criteria

The self-evaluation results in a complementary report that will serve as the basis for the external expert evaluation. The relevant interest groups (management, teachers, students) should be included in the project group conducting this process.

The report is a complement to the existing evaluation documents (self-evaluation report, annexes, fulfilment of conditions, etc.). It should present the intended Learning Outcomes and the way in which they are assessed and, by doing so, establish the correspondence with the EUR-ACE outcome criteria (see Appendix A). The engineering programme should present its current practice of achieving the intended Learning Outcomes of the particular field of engineering.

Typically, the self-evaluation will cover an extension of the following subjects, examined during the accreditation procedure:

- Definition of the objectives of the engineering programme;
- Evaluation of its international recognition;
- Issuance of professional qualification by meeting a clear content profile;
- Required competencies for admission and graduation;
- Regular evaluation of the practical relevance and quality of the degree programme.

The self-evaluation of these subjects is presented under these or under slightly different headings in the existing reports. They need not be evaluated again, but considered and recalled when evaluating the EUR-ACE outcome criteria.

Drafting of the complementary report

The complementary report establishes the degree of fulfilment of the EUR-ACE outcome criteria by presenting the intended Learning Outcomes along with the modules where these are taught and assessed in alignment with the criteria. The link with existing self-evaluation documents of the engineering programme must be explained in a general introduction, where the objectives of the engineering programme may be repeated.

The report will indicate how the Learning Outcomes are assessed and describe the conditions under which the Bachelor's or the Master's degree in engineering can be granted.

The engineering programme must produce an analysis of the fulfilment of each category of EUR-ACE outcome criteria including its strengths and weaknesses as well as prospects for improvement.

The main parts of the complementary report will be:

- Introduction;
- Self-evaluation of the EUR-ACE outcome criteria;
- Assessment of the Learning Outcomes and conditions for granting the Bachelor's degree;
- Fulfilment of the EUR-ACE criteria; strengths and weaknesses.
AAQ can provide a template for the preparation of the complementary report (see Appendix B). It shall be sent electronically at the request of the engineering programme. In this template, the EUR-ACE outcome criteria are indicated in English, whereas the report can be written in the original language of the programme or in English.

The programme coordinator signs the complementary self-evaluation report and sends it to AAQ within the agreed deadline.

2.3 Phase 3: External evaluation

The external evaluation allows the engineering programme to be assessed on the fulfilment of the EUR-ACE outcome criteria according to Appendix A. Three independent experts will be mandated, if possible chosen from the panel of the (former) Swiss accreditation procedure, incorporating the following expertise or status:

- Experience in accreditation/evaluation procedures in the higher education sector;
- Appropriate qualifications and scientific and/or professional renown in the field of engineering being examined;
- Experience in engineering education;
- Expertise in the development, design and evaluation of education programmes.

The expert team includes a student representative and a representative from the labour market. The three experts will be prepared by AAQ in order to properly assess the fulfilment of the EUR-ACE outcome criteria. The Swiss Accreditation Council approves the nomination of the three experts.

The experts receive the complementary report prepared by the engineering programme, sent by AAQ, together with the documents of the (former) accreditation procedure, namely the self-evaluation report, the experts report and the accreditation decision.

The experts read the documents and may ask for further information, which AAQ will request from the engineering programme. They conduct their evaluation of the EUR-ACE outcome criteria based on these documents; no on-site visit is planned during this procedure. The three experts develop a common overall judgment as to whether the engineering programme meets the EUR-ACE outcome criteria. They abide by the code of conduct given in Appendix C.

Expert evaluation report

The evaluation report has two purposes: it serves as the basis for a decision on the awarding of the EUR-ACE label, but it is also a tool allowing managers of the engineering programme to continue to develop the quality of their programme.

AAQ has developed a template that the experts use to write the evaluation report. It is sent to them electronically.

For each EUR-ACE programme outcome (see section 1.2), the experts present their observations, followed by an analysis and a conclusion regarding the degree of fulfillment. The experts may issue recommendations to improve the quality of the engineering programme.

The report also contains an overall analysis, a profile of strengths and weaknesses, and concludes with a final evaluation that is positive, positive under conditions, or negative. The final evaluation is based on an overall assessment of the engineering programme with respect to the EUR-ACE programme outcomes. Thus, a programme may obtain the EUR-ACE label even if certain outcome criteria have only been partially fulfilled; the essential criterion is that the experts deem the overall conformity of the programme to be adequate.
Position statement by the engineering programme

AAQ sends the expert evaluation report to the engineering programme for it to take a position.

The management of the engineering programme then expresses its opinion on the contents of the evaluation report. Factual errors may also be corrected. The position statement must take the form of a written response signed by the programme manager. The opinion expressed forms an integral part of the evaluation package.

The experts are free to decide if and how they take account of the position statement. They then draft the final version of the evaluation report and send it to AAQ.

2.4 Phase 4: Decision

Based on the complementary report, the expert report and the position statement by the engineering programme, AAQ takes the decision for a positive or negative evaluation. The full set of papers is then sent to the Swiss Accreditation Council for approval.

Evaluation decision and awarding of EUR-ACE label

The following evaluation decisions are possible:

– Evaluation is positive;

– Evaluation is positive under conditions;

– Evaluation is negative.

If the AAQ considers the engineering programme to have substantively met the EUR-ACE outcome criteria, thereby ensuring an adequate overall level of quality, the evaluation is deemed to be positive. The decision to make a positive evaluation under conditions is only declared when deficiencies exist which most likely can be resolved within one year. The AAQ checks if these conditions are fulfilled within the set period of time.

AAQ informs ENAEE about the positive evaluation and proceeds according to the valid rules for granting the EUR-ACE label to the engineering programme. A fee will be charged by ENAEE to the programme.

The final expert report and the decision approved by the Scientific Advisory Board are brought to the attention of those responsible for the engineering programme.

If the experts have issued recommendations for improvements to quality, the engineering programme is encouraged to follow these recommendations with the aim of improving the overall quality of the training provided and reinforcing its national and international positioning.

Negative evaluation and period prior to the submission of another request

A period of at least two years from the date of the evaluation decision must elapse before a further application may be made. The same period is applicable where a programme withdraws its evaluation request after being informed about the report of the expert panel. In that case, the period commences from the withdrawal of the application.

The evaluated unit is strongly advised to follow the recommendations issued by the experts with the aim of improving the overall quality of the training provided and subsequently being able to meet the EUR-ACE outcome criteria.
Publication

AAQ applies the valid rules set by ENAEE on the publication of evaluation decisions and reports, in conformity with Swiss legislation.

Appendix A: EUR-ACE Programme Outcomes for Accreditation, including detailed EUR-ACE outcome criteria for first cycle and second cycle graduates

(see EUR-ACE Framework Standards, 05 November 2008, pages 4-7, hereafter)

Appendix B: Example of a table showing the modules of the degree programme which contribute to the L.O.

See the template of the complementary report (separate document, not included in this guide)
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.

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;
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- 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.
Appendix C: Code of conduct to be observed during the evaluation

AAQ and the engineering programme accept joint responsibility for establishing an atmosphere of trust during the preparation, execution and processing of the evaluation. They are to jointly ensure that members of the expert panel can work in complete independence.

Against this background, experts and representatives of the AAQ undertake to abide by the following code of conduct:

Experts

Experts are to behave in an ethical manner, displaying qualities such as trust, integrity, confidentiality and discretion. They are to confine themselves to giving a factual account, meaning that they accurately report matters in accordance with the reality. Their conclusions are to be based on evidence.

The experts are to:

- be aware of the central principle of independence and raise any outstanding conflicts of interest, if applicable;
- make impartial judgments and show respect for the organisation and status of the HEI;
- be critical and constructive;
- be well prepared;
- handle all information and documents presented to them during the procedure in a confidential manner;
- abide by the schedule.

No provision is made for direct contact between experts and those responsible for the engineering programme. All communication is to be through AAQ.

AAQ

AAQ representatives contribute to the success of the evaluation by supporting the engineering programme during self-evaluation and by lending their assistance to the experts. They coordinate the drafting of the expert report and prepare the final AAQ decision.

AAQ representatives are to:

- ensure the integrity of the procedure by protecting the evaluation against any external influences;
- ensure that all important information is gathered and that all aspects of the evaluation are taken into account;
- provide information, if required, about procedural requirements;
- refrain from contributing to the formation of the opinion of the expert panel.