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Award of the EUR-ACE label

BSc HES-SO in Systems Engineering | 16.12.2022

Content

1. Introduction

This document presents the proposal for the award of the EUR-ACE label on the basis of the self-evaluation with external expertise (AEE) of the Bachelor's degree in Systems Engineering of the University of Applied Sciences and Arts Western Switzerland (HES-SO). The AEE is part of the HES-SO's quality assurance process, and the Swiss Agency of Accreditation and Quality Assurance (AAQ) has been asked to accompany this procedure with a view to awarding the EUR-ACE label to the programme.

The proposal for the award of the label is made in accordance with the EUR-ACE® Framework Standards and Guidelines of 4th November 2021 (EAFSG).

2. Presentation of the BSc HES-SO in Systems Engineering

The HES-SO offers a Bachelor's degree programme (BSc) in Systems Engineering at the Haute Ecole d'ingénierie et de Gestion du Canton de Vaud (HEIG-VD) and the Haute Ecole d'ingénierie du Canton de Valais (HEI-VS). The first cohort began their studies in September 2005. It is possible to obtain the Bachelor's degree in 3 years full-time or in 4 years in employment or part-time. A new framework curriculum (PEC2022) will be introduced between 2022 and 2025. This document is written according to the model set by the Engineering and Architecture domain of the HES-SO (E&A domain). In particular, it makes it possible to establish the 10 teaching axes, based on the professions targeted by the graduates and the positioning of the programme in the academic world.

3. Self-evaluation with external expertise (AEE)

The evaluation procedure for the programme applying for the EUR-ACE label was carried out as part of a self-evaluation with external expertise (AEE) as provided for in the HES-SO's own quality assurance system. Such an evaluation takes place every 7 years.

The expert group consisted of :

- Mr Noah Stegmüller, student in the Master en Génie mécanique programme, EPFL (student profile)
- Mr Hung Quok Tran, Chief Technology Officer, ASA Action Super Abrasive SA, Cornaux (professional profile)
- Mr Claude Wolf, Directeur d'études, Filière en Génie mécanique, Université du Luxembourg (disciplinairy profile)
- Prof. Martin Kucera, School of Engineering and Computer Science, Berner Fachhochschule (quality profile).

This composition is in line with the recommendations of Annex 2, paragraph 2, of the EAFSG.

The self-evaluation report was provided to the experts in July 2022, i.e. more than one month before the on-site visit. It was organised according to the 19 evaluation criteria of the HES-SO quality assurance system. These criteria are largely consistent with the EUR-ACE criteria.

The on-site visit took place from 7 September 2022 afternoon to 9 September morning:

- First afternoon: information on the context, the HES-SO's quality assurance procedures; preliminary meeting of the experts

- Second day: interviews with managers, students, lecturers, administrative and technical staff, professionals, visit of the facilities
- Last morning: additional interview with the head of the programme and preparation of the preliminary conclusions of the evaluation which were presented at the end of the morning.

The on-site visit was organised in accordance with the EAFSG (Annex 2, paragraphs 3 and 4). The various interviews and the examination of the programme made it possible to assess the level of competence of the graduates. The external expert's report dated 4 October 2022 (see appendix) allows an assessment of the conformity of the programme with the EUR-ACE Standards.

4. Compliance with EUR-ACE Standards

4.1 Student Workload Requirements

According to the Standards, Chapter 2.2: ENAEE describes the Programme Outcomes for Bachelor Degree programmes of a minimum of 180 ECTS credits.

Conclusion related to AEE Data Sheet

The programme has 180 ECTS credits (corresponding to three years of higher education).

Compliance with the standard: achieved

4.2 Outcomes Framework for Bachelor of Engineering programmes

Programme Outcomes describe the knowledge, understanding, skills and abilities which an accredited engineering degree programme must enable a graduate to demonstrate. The learning process should enable Bachelor Degree graduates to demonstrate capacities in the following eight learning areas, according to chapter 2.3 of the EAFSG.

Knowledge and Understanding

Knowledge and understanding of the mathematics, computing and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes;

knowledge and understanding of engineering fundamentals underlying their specialisation, at a level necessary to achieve the other programme outcomes, including some awareness at their forefront;

awareness of the wider multidisciplinary context of engineering.

Engineering Analysis

Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods om established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses;

ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to

recognise the importance of non-technical – societal, health and safety, environmental, economic and industrial – constraints.

Engineering Design

Ability to develop and design complex products (devices, artefacts, etc.), processes and systems in their field of study to meet established requirements, that can include an awareness of non-technical societal, health and safety, environmental, economic and industrial considerations; to select and apply relevant design methodologies;

ability to design using an awareness of the forefront of their engineering specialisation.

Investigations

Ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study;

ability to consult and apply codes of practice and safety regulations in their field of study;

laboratory/workshop skills and ability to design and conduct experimental investigations, interpret data and draw conclusions in their field of study.

Engineering Practice

Understanding of applicable techniques and methods of analysis, design and investigation and of their limitations in their field of study;

practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study;

equipment and tools, engineering technologies and processes, and of their limitations in their field of study;

ability to apply norms of engineering practice in their field of study;

awareness of non-technical – societal, health and safety, environmental, economic and industrial – implications of engineering practice;

awareness of economic, organisational and managerial issues (such as project management, risk and change management) in the industrial and business context.

Making Judgements, Communication and Team-working

Ability to gather and interpret relevant data and handle complexity within their field of study, to inform judgements that include reflection on relevant social and ethical issues;

ability to manage complex technical or professional activities or projects in their field of study, taking responsibility for decision making.

Lifelong Learning

Ability to recognise the need for and to engage in independent life-long learning;

ability to follow developments in science and technology.

Conclusion related to AEE criteria 5 and 18

According to the analysis of the expert group, the competence profile seems to be coherent. The programme allows the graduates to demonstrate capacities in the described learning areas. The expert group confirms the self-assessment of criterion 18 demonstrating the compliance of the programme with the EUR-ACE® requirements in terms of programme outcomes. This demonstration is based on a table provided by the programme. In this table, the actual modules and learning units are mapped against the programme outcomes defined in chapter 2.3 of the EAFSG. The teaching axes of the new PEC, to be introduced between 2022 and 2025, are also included in this mapping.

The Framework curriculum (PEC) presents the way how the programme has defined the 10 teaching axes and the expected outcomes to be achieved. The PEC starts from the general competences chosen for all the HES-SO engineering degrees, then presents seven professional competences of the engineer in Systems Engineering and finally details the specific competences expected together with the level of qualification to be achieved.

Compliance with the standard: achieved.

4.3 Programme Management

The five Standards concerning the programme management have been assessed in the framework of the AEE. The expert report allows the following conclusions to be drawn regarding compliance with the EAFSG, Chapter 2.4.

Programme Aims

The aims of accredited programmes must reflect the needs of employers and other stakeholders. The programme outcomes must be demonstrably consistent with the aims.

Conclusion related to AEE criterion 1

The expert group notes in its analysis that the positioning of the programme is made with regard to the new framework curriculum. According to their analysis the competence profile seems to be coherent. But the objectives are not systematically validated by the professionals.

Formal, regular and systematic consultation with the professional sector seems necessary. No industry-specific employability study is conducted in relation to the challenges and demands of the labour market.

Compliance with the standard: achieved

Recommendation concerning the criterion 1

- Conduct a specific employability study for the programme.

Teaching and Learning Process

The teaching and learning process must enable engineering graduates to demonstrate the knowledge, understanding, skills and abilities specified in the Programme Outcomes. The programme curriculum must specify how this is to be achieved.

Conclusion related to AEE criteria 5, 6 and 7

According to the experts, the programme enables the development of the targeted competences. The pedagogy is essentially based on projects, a method appreciated by students and professionals. However, the experts advocate the development of other pedagogical approaches. In addition, a proposal for the provision of technical English courses and practice should be considered, based on a specific request from students and the industry.

Compliance with the standard: achieved

Resources

The resources to deliver the programme must be sufficient to enable the students to demonstrate the knowledge, understanding, skills and abilities specified in the Programme Outcomes.

Conclusion related to AEE criteria 5, 10, 11 and 12

An important and essential strength is the small class size, as well as the proximity and availability of the teachers, and also of the administrative staff. Students feel that they are listened to and taken into account. The expert group points out that the possibility of pedagogical support for teachers to improve pedagogical quality or introduce new methods is not requested. The possibility of a (half) year's sabbatical leave also seems to have little resonance. The experts advocate encouraging academics to take advantage of these opportunities to develop teaching and find openings for applied research.

The technical facilities of the programme are fully aligned with the training offer. However, some of the laboratories do not seem to be accessible to students outside of standard hours

Compliance with the standard: achieved

Student admission, transfer, progression and graduation

The criteria for student admission, transfer, progression and graduation must be clearly specified and published, and the results monitored.

Conclusion related to AEE criteria 7 and 19

Admission and academic regulations are published and available to students and teachers. The experts suggest harmonising the rules valid in the two training sites in order to avoid problems and ensure consistency in training.

Compliance with the standard: achieved

Internal Quality Assurance

Accredited engineering degree programmes must be supported by effective quality assurance policies and procedures.

Conclusion related to AEE criteria 16, 14 and 17

The student evaluations of courses are a major asset of the programme. Their use could be optimised, according to the experts, in particular by a more judicious choice of assessment dates and feedback by teachers. The students' request to offer more modules or electives could be studied by the programme in view to improve the educational offer, and develop exposure to research, but also to increase motivation by making students actors of their training.

Compliance with the standard: achieved

Recommendation concerning the criterion 16

- Create the context and encourage teachers to offer new industry and research related electives.

4.4 Statement of the programme's position on the expert report

In the position statement dated 25 October 2022 (see appendix), the directors of the involved universities of applied sciences and the heads of the programme concerned welcome the positive points raised in the report. The comments on each of the recommendations show that measures can be taken to follow up each recommendation.

5. Proposal for the award of the EUR-ACE label

The responsible AAQ Project Manager considers that the procedure complies with the EUR-ACE® Framework Standards and Guidelines of 4th November 2021 (EAFSG) and that the award of the EUR-ACE label can be envisaged.

On the basis of the self-assessment report, the on-site visit and the expert report, the project coordinator proposes to the AAQ that the BSc HES-SO in Systems Engineering be awarded the EUR-ACE label for a period of 6 years.

The proposal to award this label is accompanied by the following two recommendations :

1. Recommendation concerning the criterion 1
   - Conduct a specific employability study for the programme.
2. Recommendation concerning the criterion 16
   - Create the context and encourage teachers to offer new industry and research related electives.

6. Decision to award the EUR-ACE label

The AAQ follows the proposal of the project coordinator and will award the EUR-ACE label to the Bachelor of Science in Systems Engineering of the University of Applied Sciences and Arts Western Switzerland (HES-SO). After having examined the decision of the HES-SO's Engineering and Architecture domain (included in the decision of the HES-SO Rectorate, see appendix), the AAQ invites the programme to implement the domain's three recommendations.

- Conduct a specific employability study for the programme with a view to better communicating the interest of the programme and the relevance of the educational offer (replaces recommendation 1 in Chapter 5, above);
- Make a proposal for the integration of project-based learning into training programmes in line with the current needs of the industry (replaces recommendation 2). This proposal should encourage teachers to offer new industry and research related electives (complement by the AAQ);
- Identify the opportunity for the use of English in relevant courses (new recommendation).

The AAQ expects a follow-up report at the latest 2 years after the award of the EUR-ACE label. This report can be the copy of the report to be provided to the domain, which includes the complement to the 2nd recommendation.

7. Appendix

- Decision of the Rectorate of the HES-SO of 31 January 2023 (4 pages)
- Statement of the programme's position, 25 October 2022 (5 pages)
- Expert report, 4 October 2022 (14 pages)

The appendices are available on the HES-SO website at the following address: https://www.hes-so.ch/la-hes-so/a-propos/amelioration-continue/evaluation-des-enseignements/resultats-des-evaluations.

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