Accreditation Report

Concerning the Application for Reaccreditation by

South Westphalia University of Applied Sciences

Department of Electrical Engineering, Soest

167-xx-3

73. Meeting of the Standing Accreditation Committee 06.10.2015
TOP 6.06

Title of the programme	Degree awarded	ECTS	Duration of Programme	Type of Programme	Yearly Capacity	Master	
						Consecutive/ Further Ed.	Profile
Systems Engineering and Engineering Management	M.Sc.	90	3 Sem.	full time	40	consecutive	research oriented

Date of Contract: 07.01.2015

Date of Peer-Review: 29./30.06.2015

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Referee responsible: Henning Schäfer

Expert panel:

- Prof. Dr.-Ing. Bernd Kuhfuß, Bremen Institute for Mechanical Engineering, University of Bremen
- Prof. Dr. Herbert Palm, Systems Engineering, University of Applied Sciences Munich
- Dipl.-Wirt.-Ing. Gerald Pörschmann, General Manager, Zukunftsallianz Maschinenbau e.V.
- Richard Rietzel, Student of Microsystems Engineering, Albert-Ludwigs-University Freiburg

Hanover, July, 31st, 2015

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I. Final Vote of the Expert Panel and SAK-Decision

1. SAK-Decision

The SAK agrees with the experts' report for the most part. However, the SAK does not adopt the second condition proposed by the experts, since it has no basis in the accreditation rules. Furthermore, the SAK sees the last two conditions as fulfilled, since the institution has provided a revised Diploma Supplement and a current version of the Memorandum of Agreement. Since the institution waived its right for a formal response, the fulfilment of the other proposed conditions has yet to be demonstrated.

The SAK accredits the study programme Systems Engineering and Engineering Management with the degree Master of Science with the following conditions for the duration of seven years.

1. *The institution has to align the contents and objectives of the programme with its title. (Criterion 2.1, 2.3, Drs. AR 20/2013)*
2. *The institution has to provide an amended and corrected version of the Exam Regulations that incorporates the following changes, and show proof of implementation and publication:*
    a) *The regulations for the recognition of qualifications acquired at other institutes of higher education have to be amended according to the requirements of the federal law regarding the Convention on the recognition of qualifications concerning higher education in the European region ("Lisbon Convention"). The exam regulations have to state clearly that recognition will be granted provided there are no substantial differences between the competences acquired, and that the responsibility to demonstrate that an application does not fulfil the relevant requirements lies with the body undertaking the assessment.*
    b) *The exam regulations have to include rules assuring that proven qualifications acquired outside higher education institutions can be credited to provide up to half of the credits of the programme.*
    c) *The allocated hours of student workload per ECTS credit have to be clearly defined in the exam regulations, and the workload hours provided in the modules have to match this definition.*
    d) *The examination system has to be amended so that as a rule no more than one examination is required in each module. In case a minority of the modules still includes more than one examination, these exceptions have to be justified didactically.*

    (Criterion 2.2, 2.3, 2.5, Drs. AR 20/2013)

The conditions have to be fulfilled within 9 months. Lack of evidence of fulfilment of such conditions may lead to the revocation of the accreditation.

This decision is based on item 3.1.2 of the Accreditation Council's resolution "Rules of the Accreditation Council for the Accreditation of Study Programmes and for System Accreditation" (Drs. AR 20/2013)

2. Final Vote of the Expert Panel

2.1 Systems Engineering and Engineering Management (M.Sc.)

2.1.1 Recommendations:

- The expert panel recommends including oral exams other than presentations.

2.1.2 Accreditation recommendation for the Standing Accreditation Commission (SAK)

The expert panel recommends accrediting the study programme Systems Engineering and Engineering Management with the degree Master of Science with the following conditions for the duration of seven years.

- The institution has to align the contents and objectives of the programme with its title. (Criterion 2.1, 2.3, Drs. AR 20/2013)
- For the objective of furthering the students' independency and to give them opportunity for the development of an individual profile, the institution has to make room for electives in the programme. (Criterion 2.3, Drs. AR 20/2013)
- The institution has to provide an amended and corrected version of the Exam Regulations that incorporates the following changes, and show proof of implementation and publication:
    - The regulations for the recognition of qualifications acquired at other institutes of higher education have to be amended according to the requirements of the federal law regarding the Convention on the recognition of qualifications concerning higher education in the European region ("Lisbon Convention"). The exam regulations have to state clearly that recognition will be granted provided there are no substantial differences between the competences acquired, and that the responsibility to demonstrate that an application does not fulfil the relevant requirements lies with the body undertaking the assessment.
    - The exam regulations have to include rules assuring that proven qualifications acquired outside higher education institutions can be credited to provide up to half of the credits of the programme.
    - The allocated hours of workload per ECTS credit have to be clearly defined in the exam regulations, and the workload hours provided in the modules have to match this definition.
    - The examination system has to be amended so that as a rule no more than

one examination is required in each module. In case a minority of the modules still includes more than one examination, these exceptions have to be justified didactically.

(Criterion 2.2, 2.3, 2.5, Drs. AR 20/2013)

- The institution has to provide a current Diploma Supplement that includes the new pathway Renewable Systems. (Criterion 2.2, Drs. AR 20/2013)
- The institution has to provide a current version of the Memorandum of Agreement with the University of Bolton that covers at least the entire accreditation period. (Criterion 2.6, Drs. AR 20/2013)

This recommendation is based on item 3.1.2 of the Accreditation Council's resolution "Rules of the Accreditation Council for the Accreditation of Study Programmes and for System Accreditation" (Drs. AR 20/2013)

II. Expert report

Introduction

The South Westphalia University of Applied Sciences (FH SWF) consists of eight departments, spread out over campuses in Hagen, Iserlohn, Meschede, Soest and Lüdenscheid. At the moment, roughly 12,000 students are registered in 51 Bachelor's and Master's courses.

The Master's programme Systems Engineering and Engineering Management is offered by the Department of Electrical Engineering in Soest. It has been developed in cooperation with the University of Bolton in the United Kingdom. Both institutions offer the same course and the students have the opportunity to spend one semester abroad at the other institution, which then offers a double degree. The programme is not a joint programme in the sense of the regulations of the German Accreditation Council, as it is not held in conjunction by the two institutions, but is offered in parallel by both. The double degree is only an additional option for students who want to spend a semester abroad, and the credits earned in Bolton are being recognised by the South Westphalia University of Applied Sciences.

The Master's programme has been initiated in 1997 and has been accredited twice before. The initial accreditation has been issued in 2003 and the first reaccreditation in 2008. Both accreditation procedures have been conducted by ZEvA in conjunction with a validation by the University of Bolton, with a joint expert panel. In this current accreditation procedure, the validation procedure is not included but will be conducted separately.

This report is based on the experts' assessment of the institution's self-report and their findings during the site-visit. During the site visit, the expert panel conducted interviews with the institution's management, teaching staff and students. Representatives from the University of Bolton were also present during the site-visit.

The assessment is based on the regulations by the German Accreditation Council (GAC) and Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK) in the current version at the time of the signing of the contract. Central documents are the "Rules for the Accreditation of Study Programmes and for System Accreditation" (Drs. AR 20/2013), the „Common structural guidelines of the Länder for the accreditation of Bachelor's and Master's study courses" (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany of 10 October 2003 as amended on 4 February 2010) and the „Qualifications Framework for German Higher Education Qualifications " (Produced by the German Rectors' Conference, the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany and the Federal Ministry of Education and Research, and adopted by the Standing Conference on 21 April 2005).[1]

[1] These and other relevant documents and regulations can be found on the web-site of the German

1. Systems Engineering and Engineering Management (M.Sc.)

1.1 Qualification Objectives/Intended Learning Outcomes

The Objectives of the study programme are laid out on the programme's web-site:

> The programme aims to deepen and broaden the research potential and the knowledge base of graduate engineers. The programme builds on the well-established first-degree (Dipl. Ing.) courses especially in Electrical, Mechanical and Manufacturing Engineering. These courses in Engineering are regarded as a foundation and the Masters Programme will provide advanced and special education extending from this base.
>
> The course aims to provide research education in electronic systems and engineering management for graduates from backgrounds in mechanical, electrical and manufacturing engineering. The course will incorporate modern electronic technology and a major non-technological element (management science) because it is highly relevant to use of both strands in the new M.Sc., as they are important aspects of modern industrial and engineering practice and research.
>
> This programme will provide advanced specialist education equipping graduates with the skills to integrate electronic technology, control systems design and digital signal processing in a wide variety of industrial applications and research topics.[2]

Additionally, the following aims have been formulated in the programme's exam regulations:

> (1) The objective of the Master Course is to deepen and expand the skills acquired in engineering courses. The graduates of the Master Course Electronic Systems and Engineering Management should be able to analyze independently problems of electrical, mechanical and mechatronics engineering and to work out scientific methods to their description and solution. The research oriented course has its priorities in theory-based seminars and deepening classes, which procure the ability to independent scientific work based on the previous contents.
>
> (2) Besides the technical knowledge the course should bring forward social competence, willingness of cooperation, communication and team skills as well as entrepreneurial thinking and preparation for working in international fields. The master examination is both a scientific and professional qualifying graduation. With the master examination should be determined whether the student has acquired the necessary solid knowledge for a scientific activity and is able to work independently and successfully on a technical problem on the basis of scientific knowledge and methods. It includes the qualification for doctoral programmes.

The expert panel concludes that the formulated qualification objectives are fitting for a Master's programme and include scientific qualifications, the competence to take up a qualified employment, the competence for involvement in society, the students' personality development. However, the experts see a discrepancy between the objectives and the title of the programme. For this, see 1.2

Accreditation Council: http://www.akkreditierungsrat.de/

[2] http://www4.fh-swf.de/de/home/studieninteressierte/studienangebote/stg_so/esem_master/index.php

1.2 Concept and Contents of the Study Programme

The consecutive, research oriented Master's programme has a duration of 3 semesters, after which time 90 ECTS-Credits are awarded. The students have to conclude 8 modules of either 7 or 8 ECTS-credits in one of four different pathways. For the Master's thesis, 30 ECTS-credits are awarded. The programme concludes with the degree "Master of Science". The programme is exclusively offered in English.

The entry qualifications and admission procedures for the programme are laid out in the exam regulations and on the programme's web-site. Applicants are required to have completed a programme on the Bachelor level in Electrical, Mechanical or Mechatronics Engineering with a duration of at least 7 semesters (210 ECTS Credits). If the applicants have only completed a 6-semester-course (180 ECTS credits), the examination board will specify further qualifications studies like e.g. further modules or homework amounting to 30 ECTS credits. Furthermore, the students need to show their aptitude for the course by having concluded their prior degree with at least a grade average equalling "Good", and by demonstrating their proficiency in English, e.g. through reaching at least 550 points in a TOEFL test. If the applicants cannot prove their aptitude in this manner, they can be invited for an oral examination for verification.

In the programme, the students have a choice between four pathways, a) Mechatronic Systems, b) Mechanical Systems, c) Electronic Systems, and d) Renewable Systems. Renewable Systems as a pathway is a new introduction of the course. The choice for a pathway is made at enrolment but can be changed during the first semester after approval of the examination board.

The programme has been designed in cooperation with the University of Bolton and is offered at both institutions in parallel. The students have the opportunity, but not the obligation, to spend a semester in Bolton and receive a double degree. Likewise, the students from Bolton can spend a semester at the FH SWF in Soest and also receive a double degree.

The experts see a discrepancy between the title of the programme on the one hand and its qualification objectives and contents on the other. Systems Engineering, as e.g. defined by the "International Council on Systems Engineering" (INCOSE) and its German chapter, the "Gesellschaft für Systems Engineering" (GfSE), is usually seen as an interdisciplinary approach that integrates all engineering disciplines:

> Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem:

Operations	Cost & Schedule
Performance	Training & Support
Test	Disposal
Manufacturing	

> Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.[3]

While the expert group recognizes that different approaches that vary from the INCOSE definition are possible, the understanding of Systems Engineering in the industry is very much in line with this definition, and thus a degree in Systems Engineering would raise certain expectations that the experts do not see fulfilled by the programme. The four pathways, representing four disciplines within engineering, stand rather isolated next to each other, and an integration of the disciplines is not visible in the programme. The applicants for the most part stay in the disciplines which they have studied in their Bachelor's programme without contact to the other engineering disciplines, and thus, the programme rather serves as a furthering of existing engineering skills than as a broadening of knowledge and integration of different engineering disciplines. The programme does not seem to further a deeper understanding of systems and systems engineering and does not give the theoretical background necessary for working as a systems engineer. Qualifications for Systems Engineering specific roles such as "system architect", "requirements engineer", "integration engineer", "system tester" etc. are not integral parts of the master course.

The programme representatives at the FH SWF, when asked about their definition of systems engineering, stressed the importance of the combination of engineering disciplines with management skills. However, this would rather be an argument for a programme in industrial engineering or engineering management ("Wirtschaftsingenieur") than systems engineering. In other terms, the students are being educated in engineering systems rather than systems engineering, which is a subtle but important distinction.

The experts concede that the programme was designed at a time when Systems Engineering was not as clearly defined and thus has already been accredited twice under that title, but nevertheless at this moment they see the need to align the contents and objectives of the programme with its title, either by changing the title or by adjusting the programme to suit common definitions of systems engineering.

Furthermore, the expert panel sees it as a deficiency of the programme that no electives are included. For the objective of furthering the students' independency and to give them opportunity for the development of an individual profile, the institution has to make room for electives in the programme.

Barring the discrepancy between title and contents and the missing electives, the programme nevertheless seems well designed and has been very successful so far. The experts are especially impressed by the high level of internationalisation. It meets the common criteria for a Master's degree as laid out in the Qualifications Framework for German Higher Education. Building on the Bachelor's level, the students' knowledge and understanding is significantly

[3] http://www.incose.org/AboutSE/WhatIsSE

extended and consolidated and, especially through the close connection to professional practice, they gain a sufficient level of instrumental, systemic and communicative competences.

1.3 Academic Feasibility

The expert panel takes it as a given that the programme is feasible and can be finished within the allotted time even though several students so far have exceeded the regular length of study. The programme representatives explained that the students usually lose time after completion of the second semester searching for a suitable Master's project and thus start their thesis work later than scheduled. A few of the students also choose to study part time in order to maintain their employment alongside their studies. The expert panel agrees that this should not be seen as a deficiency of the programme and does not impair its feasibility.

The expected entry qualifications, as laid out in the entry requirements in the exam regulations (see 1.2), are amply considered in the design of the programme. The curriculum is designed in a way that all modules can be taken in the appropriate semester without overlap. The modules of semester 1 and 2 are interchangeable so the students can start in the summer as well as the winter term.

The students' workload seems to be well feasible. The FH SWF has provided an analysis of students' actual workload that shows little variation from the allocated hours and in total lies a little below the expected average.

The examination system also does not seem to impair the programme's feasibility considerably. However, the students have to complete two or three exams in every module, consisting of homework, written examinations and a combination of homework and presentation. This system does not conform to the regulations of the GAC and the KMK and has to be adjusted so that, as a rule, the modules conclude with only one overall examination. Exceptions from this rule have to be justified didactically. See also 2.5.

Student support and guidance can overall be considered to be very good, as also the students reported during the site visit. The teaching staff seems to be very accessible and the overall atmosphere appears to be constructive and friendly. The interests of handicapped student are also being taken into consideration.

1.4 Staff and Facilities

The expert panel concludes that the adequate implementation of the programme is ensured in terms of staff, material and space.

The members of the teaching staff seem very dedicated and well qualified for the subjects they are representing and also sufficiently proficient in English. The Department of Electrical Engineering employs 19 professors, 26 research assistants and 13 lecturers, and the De-

partment of Mechanical Engineering employs 16 professors, 26 research assistants and 2 lecturers. Of these, 12 professors, 10 research assistants and 4 lecturers are currently involved with the programme, with a total of 98 teaching hours.

The expert panel had the opportunity to inspect the campus in Soest during the site-visit and was impressed by the facilities. The lecture halls and laboratories all seemed in very good condition and well suited for the programme. The budget of the two departments is adequate, and the library is well stocked with literature for the subjects involved. The IT services are also adequate for the needs of the students.

The cooperation with Bolton University is laid out in a Memorandum of Agreement which settles the responsibilities of each party. However, the Memorandum provided has expired in 2008. Thus, the expert panel sees the need for a renewed Memorandum that covers at least the entire accreditation period. The FH SWF also has close ties with the Fraunhofer Institute, which is located on-campus. The head of the institute is also responsible for the pathway Renewable Systems.

1.5 Quality Assurance

A functional quality assurance system is in place at the institution, which includes regular evaluations of students and graduates, and surveys of the students' workload, their academic accomplishments, and the graduates' work placement.

The lectures and seminars are evaluated regularly, including questions regarding workload, and furthermore the FH SWF evaluates the whole of the course, e.g. during the second semester. There is also a separate evaluation involving the teaching staff. Former students and graduates are also evaluated regularly, once directly after graduation and then again after 1-1.5 years. The experts also had the impression that the results of these evaluations are being used to improve and develop the programmes. Results are regularly being discussed with the students.

The FH SWF has provided results of the workload survey and the evaluation of graduates, which show very positive results, and also examples of improvements made as a direct result of the evaluation results.

Quality assurance at the institution is coordinated by the internal Institute for Quality Development and Management (IQEM). For the evaluations, the software EvaSys is employed.

2. Criteria of the German Accreditation Council

2.1 Qualification Objectives of the Study Programme Concept
(Criterion 2.1)

The criterion 2.1 is partly fulfilled.

See 1.1

2.2 Conceptional Integration of the Study Programme in the System of Studies
(Criterion 2.2)

The criterion 2.2 is partly fulfilled.

For the most part, the programme fulfils the formal requirements of the Common Structural Guidelines of the Länder and the Qualifications Framework for German Higher Education Qualifications. For the requirements regarding content, see 1.2.

The programme has a duration of 3 semesters and awards a total of 90 ECTS Credits, which is within the range of the Structural Guidelines. With 30 ECTS credits, the Master's thesis is also within the permitted range.

The entrance requirements assure that the students reach 300 ECTS credits after graduation, and the consecutive programme does not exceed 300 ECTS credits in conjunction with the relevant Bachelor's programmes at the FH SWF. The entry requirements also ensure the Master's programme's character as a further degree qualifying for employment.

The two study systems (Diplom/Magister and Bachelor/Master) are not intermingled. Only one degree is awarded. The title Master of Science fits the profile of the programme. The programme is characterized correctly as consecutive and research oriented.

A Diploma Supplement is issued providing detailed information about the studies underlying the qualification. However, the example Diploma Supplement provided did not yet include the new pathway Renewable Systems. The institution has to provide a current version of the Diploma Supplement containing the new pathway.

In addition to the final grades, the university also issues ECTS grades according to the ECTS User's Guide from 2005. The Structural Guidelines recommend to use relative grades according to the current version of the ECTS User's Guide, i.e. the grading tables as included in the 2015 version.

The programme has been modularised and provided with a credit point system. As a rule, in the programme 30 hours of workload comprise 1 ECTS credit, however, this is not included in the study regulations, and the given hours in the modules do not always match the credits exactly. This has to be remedied.

The modules can all be concluded within one semester and account for more than 5 ECTS

credits (7 or 8 throughout). For the number of exams per module, see 2.5.

The module descriptions meet the requirements by the Structural Guidelines. All the necessary information is provided, and intended learning outcomes are formulated in terms of competences.

The programme is designed in a way to provide opportunity for periods of study at other institutes of higher education, especially, but not exclusively, at the University of Bolton.

The regulations for the recognition of qualifications acquired at other institutes of higher education do not meet the requirements of the federal law regarding the Convention on the recognition of qualifications concerning higher education in the European region ("Lisbon Convention"). The exam regulations have to state clearly that recognition will be granted provided there are no substantial differences between the competences acquired, and that the responsibility to demonstrate that an application does not fulfil the relevant requirements lies with the body undertaking the assessment.

Furthermore, no provisions are included in the exam regulations for the recognition of qualifications and competences acquired outside higher education. The exam regulations have to include rules assuring that proven qualifications acquired outside higher education institutions can be credited to provide up to half of the credits of the programme.

There are no specific structural guidelines for North Rhine-Westphalia.

2.3 Study Programme Concept

(Criterion 2.3)

The criterion 2.3 is partly fulfilled.

For recognition, see 2.2

For the compensation of disadvantages of handicapped students see 2.5

Otherwise, see 1.2

2.4 Academic Feasibility

(Criterion 2.4)

The criterion 2.4 is partly fulfilled.

See 1.3

2.5 Examination System

(Criterion 2.5)

The criterion 2.5 is partly fulfilled.

The expert panel sees it as a given that, in the programme, examinations are competence- and knowledge-oriented and that they serve the purpose of determining whether the formulated qualification objectives of the module have been accomplished. However, in all of the modules, more than one examination is required, which violates the rule that modules should conclude with one overall examination. It also raises doubts whether the examinations are entirely module-related. Thus, the examination system has to be amended so that as a rule no more than one examination is required in each module. In case a minority of the modules still include more than one examination, these exceptions have to be justified didactically. As for the types of examinations, the experts would like to recommend including oral exams other than presentations.

The exam regulations include rules for the compensation of the disadvantages of handicapped students under section 6 (6).

The examination regulations have been subject to legal verification and are implemented and published. However, the Exam Regulations have to be amended in several points (see also 2.2), and contain some minor errors (e.g. sec. 11 (2) refers to the non-existent sec. 9 (6)). Thus, the institution has to provide an amended version of the Exam Regulations that incorporates the necessary changes, and show proof of implementation and publication.

2.6 Cooperation within the Study Programme

(Criterion 2.6)

The criterion 2.6 is not fulfilled.

See 1.4

2.7 Facilities

(Criterion 2.7)

The criterion 2.7 is fulfilled.

See 1.4

2.8 Transparency and Documentation

(Criterion 2.8)

The criterion 2.8 is partly fulfilled.

All relevant documents regarding the course of study, examination requirements and prereq-uisites for admittance are provided on the programme's web-site.

2.9 Quality Assurance and Further Development

(Criterion 2.9)

The criterion 2.9 is fulfilled.

See 1.5

2.10 Study Programmes with a Special Profile Demand

(Criterion 2.10)

not relevant

2.11 Gender Justice and Equal Opportunities

(Criterion 2.11)

The criterion 2.11 is fulfilled.

The FH SWF has provided ample documentation of concepts for the promotion of gender equality and equal opportunities that are also executed at the programme level.

III. Appendix

1. Response of the Institution

The institution did not issue a formal response.