

Accreditation Report

Reaccreditation at the

University of Applied Sciences Lübeck

and the

East China University of Science and Technology (ECUST)

“Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.)

“Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.)

I Procedure

“Environmental Engineering” (B.Eng./B.Sc.) first accreditation on: September 23rd, 2010 through: ACQUIN, until: September 30th, 2015

“Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): first accreditation on: September 23rd, 2010 through: ACQUIN, until: September 30th, 2015

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Standing Expert Committee: “Engineering Sciences”

Attendance by ACQUIN office: Marion Moser

Accreditation decision: September 29th, 2015

Members of the peer group:

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- **Dr. Frank Haupt**, GfE Freemat GmbH, Freiberg
- **Prof. Dr. Vesselin Iossifov** (already a member of the peer group in the previous accreditation), Technical Computer Science and Computer Engineering, University of Applied Sciences of Technology and Economics Berlin
- **Prof. Dr. Gerhard Lindner** (already a member of the peer group in the previous accreditation), Institute for Sensor und Actuator Technology ISAT, University of Applied Sciences Coburg

- **Prof. Dr. Wolfgang Ruck**, Environmental Chemistry, Leuphana University Lüneburg
- **Prof. Dr. Ing. Matthias Schirmer**, Energy and Environment, University of Applied Sciences Jena
- **Philipp Schulz**, student in the study program Business Administration and Engineering (major electrical engineering) at Aachen University

The evaluation report of the peer group is based on the self-evaluation report of the higher education institutions and extensive discussions with the head of the study programs, staff representatives and students.

The evaluation criteria are based on the "Rules for the Accreditation of Study Programs and for System Accreditation" (resolution of the Accreditation Council of December 8th, 2009, last amended on February 20th, 2013).

The applicant will initially receive the report in parts I-III to comment on it. Part IV entitled "Recommendations for the Accreditation Commission" will be received by the relevant and responsible Standing Expert Committee and Accreditation Commission only.

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II Introduction

1 **Short Profile of University of Applied Sciences Lübeck (FHL) and East China University of Science and Technology (ECUST)**

The University of Applied Sciences Lübeck was founded in 1969 and is a higher education institution specialized in technology, the natural sciences and economics. FHL consists of the following four departments:

- Department of Applied Natural Sciences
- Department of Architecture, Civil Engineering and Urban Design
- Department of Electrical Engineering and Computer Science and
- Department of Mechanical Engineering and Business Administration

Currently, 4,200 students are enrolled at FHL in 16 Bachelor's and 11 Master's programs. 125 professors are involved in teaching and research. The university's credo can be described as follows: "Innovative qualification and applied research for economy on an international level". The focus of FHL is on international programs, e-learning and technology transfer.

FHL offers in total three double degree programs in China, two with the East China University of Science and Technology and one with the Zhejiang University of Applied Sciences and Technology. Another double degree program is offered with Milwaukee School of Engineering. International students at FHL can choose between the Master's programs "Mechanical Engineering", "Biomedical Engineering" and "Environmental Engineering".

Students interested in e-learning programs have the possibility to enroll in the following study courses: "Computer Science and Media Applications" (B.Sc./M.Sc.) and "Business Administration and Engineering" (B.Sc.).

ECUST resulted from the merger in 1952 of five Chinese universities formerly referred to as the East China Institute of Chemical Technology. Then in 1993, it was renamed as the East China University of Science and Technology. ECUST is considered one of the best universities in China as highlighted by a ranking of number 17 among all Chinese universities. It is divided into 15 academic schools, two colleges and two departments. Instruction takes place on three campuses: the Xuhui Campus, the Jinshan Campus and the Fengxian Campus.

At ECUST a wide range of programs is offered to cater to the demands of society and to prepare the students for an ever-changing global context. There are a total of 26,800 students studying at ECUST, of whom 24,800 are in Bachelor's programs and 8,500 are in Master's programs. The number of faculty and staff members has reached 3,700, among whom there are about 1,000 professors and associate professors.

2 The Programs and their Faculty Framework

The study programs “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.) and “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.) are offered at FHL within the Department of Applied Natural Sciences (degree program “Chemical Engineering and Technology/Environmental Engineering”) and the Department of Electrical Engineering and Computer Science (degree program “Electrical Engineering and Automation/Information Technology”). Besides the ECUST study courses, the Department of Electrical Engineering and Computer Science offers five Bachelor’s and two Master’s programs, the Department of Applied Natural Sciences seven Bachelor’s and three Master’s study programs.

At ECUST, the Sino-German College of Technology, which was founded in 2003, is responsible for the coordination and organization of the two programs.

The first students started to enroll in the programs for the academic year 2004/2005 and the first group of students started their second phase of study in Lübeck in March 2007 and graduated in July 2008. At the same time, students were also receiving a Bachelor’s degree in Engineering (B.Eng.) at ECUST. Meanwhile, the ninth cohort is studying in Lübeck. Each year, 40 students will be admitted in each program. Enrollment takes place annually during the winter semester.

3 Results of the first Accreditation

Both Bachelor’s programs were accredited on March 23rd, 2010 until September 30th, 2015.

The following recommendations were given for the program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.):

- “Inorganic Laboratory Course”: Instead of including the experiment in “Preparation and Characterization of Aspirin”, an inorganic analysis (e.g. separation procedure) or an inorganic synthesis (e.g. Cu-I-Chloride) should be integrated.
- “Advanced Mathematics 1” and „Advanced Mathematics 2“: The curricula of both courses should be designed progressively.
- “Organic Chemistry Laboratory Course”: In this course more synthesis experiments should be integrated.
- “Inorganic Chemistry Laboratory Course”, “Organic Chemistry Laboratory Course”, “Analytical Chemistry Laboratory Course”: The niveau of the laboratory tasks should increase along with the growing qualifications of the students (c.f. expert report page 13.)
- “Basics of Electrical Engineering Laboratory Course”: In the module’s description the experiments involving a transistor should also be included.

For the Bachelor's program "Electrical Engineering and Automation/Information Technology" (B.Eng./B.Sc.), the following recommendations were given:

- "Advanced Mathematics 1" and "Advanced Mathematics 2": The curricula of both courses should be designed progressively.
- In order to offer students more possibilities to strengthen their individual profiles, the variety of potential electives at the University of Applied Sciences Lübeck should be increased.

The following recommendations were made for both degree programs:

- The independent work of students should be strengthened at the ECUST by e.g. carrying out small projects independently, drafting small scientific papers (student research project, seminar paper). All these works should be finished by a presentation of the results. For further information see the expert report on pages 7-8.
- At ECUST, more opportunities should be available for students to be integrated in research projects.
- In order to support the lecturers at ECUST in the preparation of lectures which have to be held in English, English language courses should be offered.

III Evaluation

1 Targets of the Higher Education Institutions and Overall Objectives of the Study Programs

One of the objectives of both higher education institutions is strengthening their internationalization by increasing the number of incoming and outgoing students, international projects and international study programs. The establishment of the two double degree Bachelor's programs "Chemical Engineering and Technology/Environmental Engineering" and "Electrical Engineering and Automation/Information Technology" is therefore fully in line with the internationalization strategy of the two universities. The study courses are well integrated into the existing education system of both higher education institutions and complement their portfolio in a meaningful manner.

The overall objective of both programs is to train students for the international job market (with special attention on the German-Chinese labor market) and is positively evaluated by the peer group. Students should combine a sound specialized knowledge of engineering, enabling them to enter into skilled employment, with good cross-cultural competencies. Besides engineering knowledge and competencies, students should also acquire generic competencies and methodological skills as well as soft skills. After graduating, all students should understand the various ways of working in Germany and China, and should be able to work and carry out research equally in both cultures. These are important competencies in international projects and cooperation projects. Potential fields of work for graduates are in particular in German companies in China or in Chinese companies in Germany, but also within world-scale companies.

According to the peer review panel, the combination of a sound specialized knowledge and generic competencies with international experience and cross-cultural competencies will provide students with positive opportunities in the labor market. Graduates are furthermore qualified to continue their education with a Master's program in China or abroad.

Both study programs are in line with the binding regulations (the rules of the German Accreditation Council and the Qualifications Framework for German Higher Education Qualifications).

1.1 Admission Criteria and Recognition of Competencies

The responsibility for the selection of students lies in the hands of ECUST. A prerequisite for admission to the programs is a successful national university entrance exam (Gaokao exam). Students are selected according to their Gaokao grade and only the best qualified students will be admitted into the two study programs. This is proved by the fact that the Gaokao results of

selected students are significantly above the average of all ECUST's applicants. Both programs have a strong reputation and attractiveness – this can also be seen in the number of applications, which far exceeds the number of university places available.

According to the peer group, the admission regulations and criteria are well defined and adequate. Students are carefully selected and past experiences show clearly that selected applicants are very successful and are among the best students at ECUST. So far there is no drop-out rate in both programs, which proves that the admission criteria are reasonable.

The recognition of competencies according to the Lisbon Convention as well as the recognition of externally achieved credits (competencies achieved outside the higher education area) are defined in the examination regulations of FHL.

1.2 Students' Personal Development and Engagement in Society

Besides knowledge and competencies linked to Chemical Engineering/Environmental Engineering and Electrical Engineering/Information Technology, respectively, students also acquire competencies which are summarized as soft skills and personal competencies. They gain knowledge and skills which pave the way for the development of their own ideas, the integration of ethical and social issues into their judgments, communication of thoughts and the ability to solve engineering-related problems. Furthermore, their personal development is fostered in regard to self-discipline and time management, because the students have to combine their studies with everyday life in a foreign culture. The social modules "Social Sciences" and "Law and Moral Education" are an integral part at the first study phase at ECUST and should promote the ability for social responsibility in a diverse modern world. Furthermore, the academic environment and approach fundamentally form the students' personal points of view and specific attitudes. In general, the students' personal development is enhanced considerably by both programs and the students acquire abilities for further engagement in society.

2 Overall Structure of the Study Programs

Both study programs have a regular study period of eight semesters in which 210 ECTS credits are achieved. The first five semesters are dedicated to the modules at ECUST. All modules at ECUST are compulsory so that students have acquired a sound basic knowledge of engineering when they start the German part of the study program at FHL after the fifth semester. In the sixth and seventh semesters, students complete their compulsory and elective modules at FHL. The electives (in total 10 credits) provide students with the opportunity to create their own individual qualification profile according to their personal interests. The Bachelor thesis is written in the

eighth semester (12 credits plus 3 credits colloquium), preferably within industry. FHL helps students to find industry placements for their theses in cooperation with Wirtschaftsförderung und Technologietransfer Schleswig-Holstein GmbH (WTSH) [Business Development and Technology Transfer Cooperation Schleswig-Holstein (WTSH)]. Students also have the possibility of writing the Bachelor thesis at the respective department at FHL.

In both study programs, internships are included during the first stage of study at ECUST. Besides short practical training in “Engineering Training”, “Cognition Practice”, “Social Training” and “Scientific Training” organized by ECUST, an industry internship lasting ten weeks (10 credits) within a company has to be completed during the fifth semester.

To prepare students for their studies in Germany, English language modules (24 credits) are integrated into both programs. Students need to pass a standardized English language exam (TOEFL or IELTS) before the transfer to FHL. In addition, during the fifth semester, the first German language module (3 credits) and “Intercultural and Preparation Training” is offered to prepare students for the transfer to Germany. In the sixth and seventh semesters, two more successive German language modules are offered to improve the students’ German language proficiency to facilitate everyday life.

The program duration of eight semesters, which is one semester more than German study programs with 210 credits, is positively assessed by the peers. This is a proper extension of the program length considering that students have to face more demanding challenges in the double degree programs than in a “normal” study course. In addition to the subject-related technical content, they also have to learn two languages (English and German), prepare for their stay abroad and cope with intercultural challenges. Extra time is also included to compensate for a delay in the preparation of the thesis at FHL (one extension in possible) and to accommodate the requirements of the residence permit.

The languages of instruction in both programs at ECUST are Chinese and English. In the first semesters, more Chinese is used, but with an increasing language proficiency in English, the language of instruction switches more and more to English in the later ECUST semesters. At FHL, modules are only taught in English. In order to familiarize students with the German education system and its different teaching methods early on, lecturers from FHL also teach some modules at ECUST during the first five semesters so that students can transition more easily to their studies at FHL.

The peer group evaluates the overall structure of both programs positively. Students acquire specialized knowledge and interdisciplinary knowledge as well as technical procedural and generic competencies. Soft skills are considered adequately in both curricula.

In both study programs, reasonable modifications were implemented according to the results of the internal quality management since the previous accreditation.

At ECUST, the “Scientific Literature Research” module was moved from the fourth to the third semester, which now has a positive impact on the “Scientific Training Course” at the end of the third semester by providing students with basic knowledge about scientific literature research, which has to be applied in the “Scientific Training Course”. Also, the lecture “Principles of Marxist Philosophy” was moved from the first to the second semester to spread the social sciences courses more evenly over the semesters.

To strengthen independent working, students have the possibility to take part in the two-week course “Speciality Practice”, where they work on a short paper about a defined topic. This gives students the possibility to discuss and exchange their ideas about professional issues and their solutions. At FHL, the module “Scientific Writing” was integrated in the curriculum to prepare students better for their Bachelor thesis. The German language is now taught and assessed at two language levels. Depending on their abilities, students can reach level A2 of the Common European Framework of References for Languages. Also, the examination format of the language modules changed from written exam to portfolio. This new format allows a better evaluation of students’ language proficiency and the assessment of all four language skills (listening, reading, speaking and writing).

Due to the careful selection of students for both programs and the intensive student support provided, there is no drop-out rate and more than 92% of the students complete their study program in the defined period of study.

A variety of legal regulations, guidelines and recommendations have been considered in the design of the study programs, such as the Qualifications Framework for German Higher Education Qualifications, the ECTS Users’ Guide, the rules of the German Accreditation Council and 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).

2.1 ECTS and Modularization

Both programs are completely modularized. The workload is in general spread evenly between the academic years, presenting a workload of 61.5 credits (Chemical Engineering/Environmental Engineering) and 61 credits (Electrical Engineering and Automation/Information Technology) in the first academic year, which is then reduced in the following academic years to 46 and to 54.5 credits per year. The reduced workload should give the students the possibility to prepare themselves for their transfer to FHL, especially in the fifth semester, where the workload is 21.5 and 19.5 credits respectively. In total, students achieve 210 credits within eight semesters. The modules are offered in an annual interval.

One credit is equivalent to 30 hours of workload of the students. The size of the modules at ECUST and FHL is in general 5 credits and above and is in accordance with the regulations of the Common Structural Guidelines of the Länder for the Accreditation of Bachelor's and Master's Study Courses. At both higher education institutions, only a few modules comprise less than 5 credits (e.g. Basic German module at ECUST and Scientific Writing module at FHL with 3 credits each), reflecting their workload and content. To the peers, creating bigger units seems in these cases not appropriate according to the content of the modules and would lead to unreasonable combinations. The smaller modules have no negative effect on the study programs and the peer group evaluates the workload as adequate, which is proved by the number of students graduating in the defined period of study.

For each study program, a module handbook is available which provides students with valuable information about, for example, workload, course outcomes, course topics, kind of exams, required materials and prerequisites. In the module catalog, the modules "Advanced Mathematics I" and "Advanced Mathematics II" seem to be identical to the content and course outcomes, therefore the description of module II should express that it intensifies and deepens the knowledge of module I.

2.2 Teaching Methods

Students in both programs experience several teaching methods. At ECUST, the prevailing teaching methods are lectures which are supported by labs, group work and homework. Similar teaching methods are used at FHL. In addition to lectures, seminars, exercises and labs, in some modules project work with presentations is used at FHL. In general, at FHL students have to work more independently, which is a challenge for students at the beginning.

Through the combination of lectures with labs, exercises and practical training, students in the first semesters already have the possibility to apply and deepen theoretical acquired knowledge in lab experiments and practical training courses.

At FHL, the teaching formats with the combination of more independent learning, practical elements and a strong application orientation are appreciated by the students. There is also strong interest in writing the Bachelor thesis in industry, but in some cases the parents of the students urge for a final thesis in an academic environment and some students are reluctant to change their accommodation and therefore write their thesis within FH Lübeck. Insufficient German language proficiency of the Chinese students is another obstacle for finding a final thesis task in a company exclusively using the German language for everyday communication.

The teaching methods are in general appropriate for the defined learning outcomes, and the percentage of practical training and labs in both curricula is adequate. Nevertheless, the variety of

teaching and learning methods could be increased. With respect to the defined soft skills, it is desirable to strengthen more interactive teaching and learning formats like project work in small groups already in the first study phase at ECUST. This would further promote application of knowledge, teamwork, problem solving and independent working. Both universities should also develop a common concept to strengthen project work in the curricula, which could be done, for example, through project weeks.

3 Study Program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.)

3.1 Qualification Objectives

The study program has well-defined objectives. Students should acquire a sound knowledge of environmental technology in areas like environmental protection technology, environmental consultancy, environmental analytics and planning and conceptual environmental protection, which enables them to identify and evaluate problems in the areas of air, water and waste and to elaborate and implement appropriate solutions independently. Students should also have the capability to present engineering issues and topics effectively in English and Chinese.

Graduates of the study program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.) should find work in leading positions for example in the areas of air pollution, waste management, environmental chemistry, wastewater technology in engineering companies, plant and apparatus engineering and public authorities.

The peers evaluate the objectives of the study program positively. The objectives are clearly described and consider the requirements and opportunities of the job market. The objectives of the study course have been proven valid, therefore no significant changes have been made since the last accreditation. According to the peers, due to the rising importance of environmental protection and an increasing demand worldwide for environmental friendly techniques and sustainability of products and processes, graduates have good career opportunities.

3.2 Concept of the Study Program

The focus of the study program at ECUST lies on basic chemical and engineering knowledge.

In the first five semesters at ECUST, students are provided with a sound basic knowledge of mathematics with 14 credits, natural sciences (physics, chemistry) with 21 credits as well as IT and engineering sciences (basics of electrical engineering, unit operations, thermodynamics, chemical and environmental engineering) with 27 credits. This provides a good basis for the further

specialization in environmental engineering at FHL. Students also have to complete the module “Environmental Engineering Skills” with the lectures “Basic Occupational Safety and Health Technology” (2 credits) and “Environmental Engineering Skills (3 credits).

According to the peers, the field of Chinese environmental law (with just one credit) seems to be underrepresented in the curriculum. Environmental law is always part of the context of the work of an environmental engineer. At the same time, environmental law is the overlap between the spheres of environmental engineering and administration. Therefore the peers suggest strengthening the area of environmental law in the curriculum.

Lectures are complemented by labs, in which students acquire practical experimental skills. The ten-week internship in industry in the fifth semester gives the students the possibility to apply theoretical knowledge directly into practice.

At FHL, students deepen and extend their knowledge of environmental engineering in the following areas:

- Waste and Wastewater Management
- Recycling
- Air Pollution Control
- Renewable Energies
- Environmental Process Engineering
- Environmental Chemistry
- Environmental Microbiology/Biochemistry/Biotechnology

Through integrated practical training and experiments, project management skills as well as problem-solving competencies are imparted in the program. Besides theoretical knowledge, students also acquire application-oriented engineering competencies and skills for solving environmental problems.

The following suggestions are made for the further development of the modules:

College Physics Laboratory Course

- “Closed book exam” as an assessment method is unusual and should be reassessed. For example, this could be replaced by a successful experiment as assessment type.

Analytical Chemistry with Analytical Chemistry Laboratory Course

- Recent developments should be considered in a stronger way. The analysis of organic substances as well as the use of rapid tests and sensors are underrepresented and should be strengthened in the lecture and the laboratory work.

Unit Operations of Chemical Engineering Laboratory Course

- One credit for a laboratory course with 24 hours of lab work seems to be rather low. The assessment type “closed book exam” is unusual and should be reassessed. A more suitable type of assessment would be for example a successful lab experiment.

Environmental Engineering Skills

- In the field “solid waste”, the topics “recycling” and “toxic waste” are missing and should be integrated.

Waste Management

- The fields “recycling and reutilization”, “toxic waste” and “waste separation” are missing and should be integrated.

Water Chemistry and Analysis – Laboratory Course

- Recent developments should be considered in a stronger way. Experiments on nitrification and denitrification, phosphate precipitation and biochemical degradability should be integrated into the laboratory course.

X-Ray Technology

- This module is rather specific and does not seem to be aligned with the objectives of the study program.

Ecology

- The mentioned prerequisite “basic knowledge of biology” should be checked. These prerequisites are not taught in the program.

Considering the above remarks, the study program “Chemical Engineering and Technology/Environmental Engineering” is positively assessed by the peers. It has valid and reasonable objectives, which are reflected appropriately in the curriculum. Current research topics are also integrated into the study program. According to the peers, students acquire adequate subject-related competencies as well as methodological competencies with a sound knowledge of the identification, analysis and evaluation of environmental problems in the environmental compartments of air, water and waste. Appropriate problem-solving competencies enable them to implement solutions with relevant engineering techniques. The defined content and competencies are adequate for a Bachelor’s degree.

The module sequence is logical and the credits allocated to the modules adequate. At the beginning, the basics in natural sciences and engineering are taught, followed in the later semesters by application-oriented specialized modules.

The organization and structure of the study program is well-thought-out; almost all students complete the study program in the defined period of study. On the basis of the results of the internal quality management of both universities and the recommendations of the first accreditation, some well-documented changes were made in the study program which led to an improvement of the curriculum. Modules were renamed to better reflect their (updated/new) content (e.g. "Chinese Environmental Protection Law" was renamed as "Introduction to Sustainable Development of Environmental Science") or replaced ("Measurement Techniques" was replaced by "Process Instruments and Automation"). In the „Organic Chemistry Laboratory Course" more synthesis experiments have been included. Also, the syllabi of the courses „Inorganic Chemistry Laboratory Course", „Organic Chemistry Laboratory Course", and "Analytical Chemistry Laboratory Course" have been updated.

4 Study Program "Electrical Engineering and Automation/Information Technology" (B.Eng./B.Sc.)

4.1 Qualification Objectives

In the Bachelor's program "Electrical Engineering and Automation/Information Technology", students should acquire a good knowledge of electrical engineering, automation and the major information technology fields:

- Methods of software technology, software architecture, design patterns, distributed systems
- Information systems, organization and analysis of large amounts of data, security in information systems
- Operation systems, administration of computer systems, operating system and network security, computer networks
- Use of intelligent system processes
- Web technologies, client/server architectures, service-oriented architectures.

Furthermore, students should be able to plan, develop and implement small, mid-sized and large automation systems with distributed data communication infrastructures as well as design and implement small and moderately complex software modules for operating and monitoring energy and automation systems.

Fields of employment for the graduates with a focus on information technology are found in the broad sector of information technology and software development, including complex software

systems. For example, graduates should be able to work in research and development, production, marketing and project management.

Besides the specialization in information technology, the study program also offers a focus on automation technology, which allows graduates through their interdisciplinary knowledge to work also in the field of “industry 4.0” and to operate in the areas of planning, development and implementation of automation systems.

The objectives of the program are still valid and have not been changed since the first accreditation. According to the peers, the curriculum is appropriately designed for the achievement of the objectives and is clearly structured. The study program imparts interdisciplinary expertise and theoretical and conceptual knowledge and its practical implementation as well as generic competencies. The combination of cross-cultural teaching and learning methods provides a targeted education for globalized employment markets and societies.

4.2 Concept of the Study Program

The curriculum of the study program has a clear structure. Students have to complete 18 compulsory modules at ECUST and nine compulsory modules at FHL. In addition, students can choose two electives out of a catalog of seven modules at FHL.

The relationship between foundation modules, electronic engineering modules and information technology modules is balanced while the modules are aligned to the Information Technology focus in the first place. Basic competencies in computer science are complemented by two modules in mathematics and two in electronic engineering. The knowledge acquired in the ECUST modules “Automation” and “Principles and Applications of Microcontrollers” is extended adequately by the module “Power Electronics” at FHL. Taking into account the defined objectives of the first year module “Basic Engineering” with the courses “Engineering Drawing” and “Engineering Training”, it would be desirable to include also electrical engineering topics in this module (e.g. CAD focusing on “electrical schematic drawings”), since the modules emphasize mechanical construction and manufacturing technology so far. In addition to that, the information technology modules could be oriented to a greater extent towards the requirements of the automation technology modules. (For example part of automation technology is Boolean algebra as well as the design of finite automation; automatic control is already integrated in the curriculum.) Furthermore, the peers suggest to update the software tools and operating systems in the computer science modules and to apply this as a standard tool chain (which should be based on Microsoft Windows or Unix/Linux) in all computer science modules. This application should also take into account the typical tools of automation technology.

The offered electives at FHL are adequate with respect to the defined objectives. In particular the modules “Artificial Intelligent Systems” and “Automation Systems” complete the module catalog

adequately. For the peers, the module “Principles of Compiler Design” seems to be rather specific and not to be aligned totally with the objectives of the study program. Also, the English titles of the modules should be checked once more; references can be found under <http://www.computer.org/portal/web/education>.

Taking into account the above remarks, the study program is positively evaluated by the peers. It has a logical structure and well-defined learning outcomes with a focus on information technology and automation. The modules are designed adequately and have a clear progression, and the module sequence follows a logical structure. Subjects and modules cover the relevant content and competencies to meet the program’s objectives. Complex interrelationships of automation technology are also effectively taught in the program by means of simulations and simulation software (e.g. Matlab) in combination with computer-aided control of external modules. In particular, the concepts of simulation (e.g. hardware-in-the-loop) and their practical application are positively evaluated. Students obtain a solid scientific application-oriented education with profound competencies in information technology and automation.

Based on the results of the internal quality management, the recommendation of the first accreditation and recent developments, some reasonable changes were implemented in the program. At FHL, the elective catalog was supplemented by the modules “Power Electronics”, “Screen Design Basic” and “Human Machine Interaction”. The additional modules offer students the possibility to strengthen their competencies in Automation and Cyber-Physical Systems.

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5 Implementation

5.1 Resources

Human Resources

The personnel resources provided by ECUST and FH Lübeck for the running of the two Bachelor's programs are adequate and secured. At FHL, the instruction is provided by the appointed professors and lecturers of the departments, whereas at the Sino-German College, the required teaching staff is annually defined and selected from the different schools of ECUST. The selection criteria for the lecturers correspond with the particular requirements of the programs (e.g. language proficiency in English). The qualifications and competence of the teaching staff encompass a wide range of competencies and are on a very high level so that the study programs' objectives can be reached. In the discussions with lecturers from both universities (via video conference also with lecturers from ECUST), it became obvious that there is a strong identification with the objectives of these two study programs and a corresponding engagement and quality awareness among the teaching staff. Also, the number of technical and administrative staff is adequate in both institutions.

Important for the success of both study courses is also the China Coordination Office which has three employees for the support of Chinese students.

Both universities provide their staff with opportunities for personal development and further qualification. FHL, for example, offers the possibility of research and teaching-free sabbaticals; didactic skills can be improved by attending didactic seminars which are offered at FHL or at the University of Lübeck's lecturers' service center. In addition, at FHL intercultural training is offered for all persons involved in the programs. Academic staff of both higher education institutions also have the opportunity to participate in conferences. In addition, for further support of the lecturers, an "Exchanging Seminar to Promote Cooperative Education" was offered. Lecturers of both universities exchanged their ideas for the design of courses, and gained the opportunity to discuss other forms of teaching instead of the ones already used. One result of the increasing exchange was the establishment of the two bilingual courses "College Physics" and "College Physics Laboratory Course" at ECUST.

According to the peers, the communication between the lecturers of FHL and ECUST could be strengthened. Both universities should therefore develop a concept for a more systematic exchange about content and objectives of both programs between the German and Chinese teaching staff (this could be arranged, for example, through video conferences).

Financial Resources

According to the peers, both programs have a comfortable financial situation. The Sino-German College at ECUST is one of the regular schools of ECUST and is therefore financed by the university. For both study programs, students have to pay tuition fees of EUR 1,600 per year. Since the study programs are approved by the Ministry of Education of the People's Republic of China in terms of international study programs, ECUST can charge higher tuition fees compared to Chinese study programs (EUR1,600 per year instead of EUR 500 per year).

At FHL, the resources needed for the running of the study programs are mainly provided by an affiliated company, to which Chinese students pay a mentoring contribution of EUR 5,500 for their stay in Germany. This allowance covers about 70% of the financial needs with the remainder allocated by FHL.

Of particular importance is the Study Center of FH Lübeck, which was established two years ago. This is a permanent institution concentrating all language training modules of FHL and which has also been offering the German language modules for students in the two study programs since the previous cooperation with the Goethe Institute ended. With the shift of the language modules to FHL, the format of the German language modules also changed (with two language levels and a new examination format), which has had a positive impact on the language proficiency of students.

The Study Center is equipped with 1.5 staff positions and is being subsidized for four years by the Ministry of Science of the State of Schleswig-Holstein with EUR 50,000 per year. Since the Study Center offers not only German language modules for the Chinese students, but also foreign language modules for German students, the departments of FHL assume part of the costs as well.

The peer group considers the funding of the study programs to be secured. They explicitly appreciate the establishment of the Study Center offering German language training modules for the Chinese students at FHL as well as the intercultural training offered to the students. The peers recommend to the president's office of FHL to make an effort with respect to sustainable financing of this institution beyond the temporary allowance from the Ministry of Science of the State of Schleswig-Holstein.

Infrastructure

For both programs, there is an appropriate infrastructure with respect to seminar rooms, laboratories and technical as well as IT equipment needed for the successful implementation of the study courses at both universities. Necessary investments are made and the technical and IT equipment is in general state-of-the-art. Students are provided with very good studying conditions.

According to the peer group, both study programs are implemented on a sound organizational, financial and academic basis. Both universities have defined adequate measures and processes for successful implementation and further development of both study programs.

5.2 Organization and Cooperation

Decision-making processes and cooperation

Both Chinese-German study programs are important elements of the internationalization strategies of FHL and ECUST and are strongly supported by the respective president's offices. The up-to-now successful implementation of both study courses is essentially based on the establishment of very effective organizational structures and decision-making processes at both higher education institutions. The long-standing cooperation (since 2004) between ECUST and FHL is based on contractual agreements between both universities, sustainable organizational structures and effective decision-making processes.

An essential committee for ensuring trouble-free cooperation and quality management is the Joint Management Committee (JMC) composed of high-rank representatives of both universities with comprehensive competencies. The JMC consists of eight representatives, four from each university. It discusses matters like enrollment planning, course setting, teaching processes, students' transition, quality of teaching and quality management measures. The corresponding president's offices are integrated into the cooperation via the membership of vice presidents of both universities in the JMC. The JMC meets twice a year and each committee meeting is reported to the presidents of both universities.

At ECUST, the Sino-German College of Technology is responsible for the running of the study programs. At FHL, study program committees are established in both involved departments to ensure the coordination and implementation of the study programs and quality management.

The peer group considers these organizational arrangements and the close contact and regular communication between the decision makers to be crucial success factors. The peer group recommends to strengthen these structures and procedures and to stabilize them independently of the individuals involved.

To provide students with the opportunity to write their Bachelor thesis in industry, FHL cooperates with Wirtschaftsförderung und Technologietransfer Schleswig-Holstein GmbH (WTSH) [Business Development and Technology Transfer Schleswig Holstein]. WTSH helps to arrange positions for students to work on their theses and builds up a network of companies interested in assigning a thesis project. An increasing number of Chinese students have a chance to prepare their final thesis on a practical topic in an enterprise. In the meantime, between 25 and 50 percent of the students make use of this opportunity.

The peer group acknowledges the efforts of FHL with respect to an employability-focused education of the Chinese students and the considerably increasing participation of companies in Bachelor theses. Against this background, the peers appreciate the intended strengthening of German language teaching, the already-in-place intercultural training and the job application training support for students. They encourage the study program directors and the president's office members to maintain the contacts with the enterprises and to inform the students about the special competencies which they can acquire by preparing a final thesis within an enterprise.

5.3 Examination System

The examination system is well organized and the examination procedures are clearly defined in the universities' examination regulations, which were subjected to legal verification and comply with the respective legal requirements. The disadvantage compensation for students with disabilities is clearly defined in the examination regulation.

Student performance is assessed mainly by written exams, quizzes, homework, project work and reports, which are sometimes complemented by oral presentations. For each module, there is one final exam at the end of the module – in the first semesters mainly a “closed book exam”. Failed exams can be repeated twice at FHL, while at ECUST there is no restriction on the number of makeup exams. Re-examinations are offered at ECUST at the beginning of the following semester, at FHL at the beginning and at the end of the following semester.

During the on-site visit, students alluded to the different examination requirements in China and in Germany. Whereas in China, the lecturers distribute homework assignments regularly, in Germany more independent and application-oriented learning is requested. Correspondingly, the examination requirements are easier to assess in China since the examination questions are close to the homework assignments, whereas in Germany they are less evident and more preparation efforts are needed.

Taking into account the different educational and didactic concepts in China and Germany, the peer group evaluates the examination system of both study courses in general as appropriate for the defined objectives and learning outcomes. This is corroborated by the high success rate and the fact that over 90% of the students graduate within the regular period of study. All examinations are module-related as well as knowledge- and competence-oriented. Nevertheless, the peer group recommends to increase the variety of examination formats for better compatibility between learning objectives and examination types. This concerns in particular practical courses and laboratory exercises, which should not be assessed by written examinations but by more practice-oriented types of assessment.

5.4 Documentation and Transparency, Student Support

General information on the programs and requirements for the admission and application procedures is provided by brochures, the internet and telephone consultations at ECUST and is easily accessible to students. Examination regulations, module catalogs, diploma supplements and transcripts of records are all available in English.

Comprehensive support is provided for students. To prepare students for their second study phase in Germany, intercultural and preparation training is offered at ECUST in the fifth semester together with a first German language course. Important for both study courses and the support of students is the China Coordination Office of FHL. After their arrival at FHL, the office supports students in relation to their visits to the authorities and also in finding accommodation after the second semester. (In the first two semesters, students have a guaranteed place in the halls of residence.) To help students during their first months in Germany, FHL has established the Chinabuddies program. German students help their Chinese academic peers settle in to a different culture and help to promote an intercultural dialog. The Chinabuddies program is regularly evaluated with positive results.

Also, the lecturers in the programs are highly engaged in student support and counselling at departmental level (mostly) for study-related questions and problems. They also organize the first contact between students and companies for a placement for the Bachelor thesis. To prepare students for finding companies for the Bachelor thesis, job application training is also offered.

According to the peer group, students receive very good assistance and all staff members show a high level of engagement in terms of student support and counselling. This has a positive impact on students' success.

5.5 Gender Justice and Compensation Opportunities for Disabled People

FHL and ECUST have a no-discrimination policy and stick to the equality of opportunity principle. Both universities strive for equal participation from men and women both in their studies and work. An equal opportunities officer supports FHL in the implementation of the Equality Plan. There is for example gender training for new professors, a separate funding pool for equality and gender measures, and on-campus childcare. To increase the proportion of female students in fields of study where women are underrepresented, there is for example a "Girls Day", promotion of female students by the Career Development Center and mentoring.

At FHL, a disability officer supports students with disabilities in the organization of their studies. Lecturers also find individual solutions for specific problems. Compensation regulations are defined in the examination regulation and special examination arrangements are made in individual cases.

There was no indication of a lack of gender equality and the concept of gender justice is fully implemented in both programs.

6 Quality Management

Several quality management measures are applied for both study programs. An important element is the course evaluations which are carried out online and in paper format. At FHL, course evaluations take place in the last third of the semester. The results are received by the lecturer and the dean and afterwards discussed with the students. When poor results emerge, a discussion takes place between the lecturer and the dean about possible solutions. At ECUST, the evaluation of courses is carried out in the middle of each term. Participation in the evaluation is a prerequisite for getting access to the examination results. The evaluation results are discussed in the Joint Management Committee.

The workload is also regularly assessed and the results prove that the calculated workload is appropriate.

In addition, a graduate survey was conducted to get information about the careers of the graduates. Most of the students followed their graduation with a Master's program in China or abroad. To evaluate the individual career paths of graduates as well as the objectives of the programs with respect to job opportunities and careers, the peer group recommends developing a common concept for alumni tracer studies which integrates the position of alumni not only shortly after graduation but also over a long-term period.

Another important quality management tool at ECUST is the careful selection of lecturers. While at FHL, the lecturers are assigned within a particular department, the Sino-German College does not have its own permanent teaching staff. After the syllabus planning, the lecturers are selected from the different schools of ECUST and the list of lecturers has to be approved afterwards by the Sino-German College. For the study programs, only the best instructors and professors are selected. Selection criteria include teaching experience, professional knowledge, international experience and English language proficiency. As a general rule, the Sino-German College tries to select lecturers who have already been involved in the programs and are therefore familiar with the specifics and peculiarities of the study courses so that there is continuity among the lecturers.

Furthermore, at FHL lecturers and supervising representatives from companies are trained regularly in intercultural skills to sensitize them to any cultural misunderstandings which may emerge during the supervision of Chinese students.

The Joint Management Committee has central responsibility for the quality of the study programs. It discusses all matters relating to the programs like course setting, teaching processes, students' transition, evaluation procedures and results, feedback from companies about the performance

of students as well as necessary amendments and adjustments. The meetings of the JMC take place alternately in Shanghai and Lübeck.

In summary, the peer group assesses the quality management positively. Both universities have implemented a comprehensive quality management system for the study courses which secures targeted further development of the study programs.

7 Summary

The Bachelor's programs "Chemical Engineering and Technology/Environmental Engineering" (B.Eng./B.Sc.) and "Electrical Engineering and Automation/Information Technology" (B.Eng./B.Sc.) at the University of Applied Sciences Lübeck and the East China University of Science and Technology are consistent and well structured. They offer both a solid foundation for direct entry into the labor market and adequate preparation for future Master's programs. Overall, the peer review group received a very good impression of both study courses. The objectives of the study programs are valid and conclusive and the curricula are appropriately designed for the achievement of the given objectives. The organizational and personnel resources are adequately geared toward the goals of the programs. The study programs meet the relevant German requirements and are in accordance with the Qualifications Framework for German Higher Education Qualifications. The review group had the opportunity to take a comprehensive look at the study programs, and would like to point out the very strong commitment of all persons involved in the programs, which significantly contributes to the success of both study courses. Both programs are a model of success for double degree study courses.

8 Evaluation according to the “Criteria for the Accreditation of Study Programs” (Resolution of the Accreditation Council of December 8th, 2008, last amended on February 20th, 2013)

Criterion 1: Qualification Objectives of the Study Program Concept:

- Bachelor’s program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): criterion fulfilled
- Bachelor’s program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.): criterion fulfilled

Criterion 2: Conceptual Integration of the Study Program in the System of Studies

- Bachelor’s program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): criterion fulfilled
- Bachelor’s program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.): criterion fulfilled

Criterion 3: Study Program Concept

- Bachelor’s program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): criterion fulfilled
- Bachelor’s program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.): criterion fulfilled

Criterion 4: Academic Feasibility

- Bachelor’s program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): criterion fulfilled
- Bachelor’s program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.): criterion fulfilled

Criterion 5: Examination System

- Bachelor’s program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.): criterion fulfilled

- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering"
(B.Eng./B.Sc.): criterion fulfilled

Criterion 6: Program-related Cooperation

- Bachelor's program "Electrical Engineering and Automation/Information Technology"
(B.Eng./B.Sc.): criterion fulfilled
- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering"
(B.Eng./B.Sc.): criterion fulfilled

Criterion 7: Facilities

- Bachelor's program "Electrical Engineering and Automation/Information Technology"
(B.Eng./B.Sc.): criterion fulfilled
- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering"
(B.Eng./B.Sc.): criterion fulfilled

Criterion 8: Transparency and Documentation

- Bachelor's program "Electrical Engineering and Automation/Information Technology"
(B.Eng./B.Sc.): criterion fulfilled
- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering"
(B.Eng./B.Sc.): criterion fulfilled

Criterion 9: Quality Assurance and Further Development

- Bachelor's program "Electrical Engineering and Automation/Information Technology"
(B.Eng./B.Sc.): criterion fulfilled
- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering"
(B.Eng./B.Sc.): criterion fulfilled

Criterion 10: Study Programs with a Special Profile Demand

- Not applicable

Criterion 11: Gender Justice and Equal Opportunities

- Bachelor's program "Electrical Engineering and Automation/Information Technology" (B.Eng./B.Sc.): criterion fulfilled
- Bachelor's program "Chemical Engineering and Technology/Environmental Engineering" (B.Eng./B.Sc.): criterion fulfilled

9 Recommendation of the Peer Group to the Accreditation Commission of ACQUIN

The peer group recommends the accreditation of the Bachelor programs "Chemical Engineering and Technology/Environmental Engineering" (B.Eng./B.Sc.) and "Electrical Engineering and Automation/Information Technology" (B.Eng./B.Sc.) at the University of Applied Sciences Lübeck and the East China University of Science and Technology (ECUST) **without conditions**.

IV Decisions of the Accreditation Commission of ACQUIN¹

Based on the peer report, the statement of the universities and the statement of the standing expert committee the accreditation commission took on September 29th, 2015 the following decisions:

Chemical Engineering and Technology/Environmental Engineering (B.Eng./B.Sc.)

The double degree Bachelor program “Chemical Engineering and Technology/Environmental Engineering” (B.Eng./B.Sc.) is accredited without conditions.

The accreditation is valid until September 30th, 2022.

For the further development of the program the following recommendations are given:

- The field of Chinese environmental law should be strengthened in the program.
- Recommendations for the modules:
 - Analytical Chemistry with Analytical Chemistry Laboratory: Current developments should be considered in a stronger way. The analysis of organic substances as well as the use of rapid tests and sensors are underrepresented and should be strengthened in the lecture and the laboratory work.
 - Unit Operations of Chemical Engineering Laboratory: One credit for a laboratory module with 24 hours of lab work seems to be rather low.
 - Environmental Engineering Skills: the topics “Recycling” and “Toxic Waste” should be more visible in the module description.
 - Water Chemistry and Analysis – Laboratory: Recent developments should be considered in a stronger way. Experiments on nitrification and denitrification, phosphate precipitation and biochemical degradability should be integrated into the laboratory module.

¹ According to cl. 1.1.3 and cl. 1.1.6 of the “Rules for the Accreditation of Study Programms and for System Accreditation” of the Accreditation Council only the peer group evaluates the compliance of the study program with the criteria of the Accreditation Council. However, certain defects and critical remarks addressed by the peer group can be revised by the statement of the HEI to the evaluation report. On the other side, the Accreditation Commission can decide on new conditions based on their general perspective and/or reasons of consistency with previous accreditation decisions. Insofar, the decision of the Accreditation Commission can deviate from the accreditation recommendation made by the peer group

Electrical Engineering and Automation/Information Technology (B.Eng./B.Sc.)

The double degree Bachelor program “Electrical Engineering and Automation/Information Technology” (B.Eng./B.Sc.) is accredited without conditions.

The accreditation is valid until September 30th, 2022.

For the further development of the program the following recommendations are given:

- In the computer science modules the tool chain should be harmonized and updated to state-of-the-art software.
- Electrical engineering topics (e.g. CAD focusing on “electrical schematic drawings”) should be included in the module “Basic Engineering”, taking into account the courses “Engineering Drawing” and “Engineering Training”.

For both study programs the overall recommendations are given:

- Both universities should develop a common concept for alumni tracer studies which integrates the position of alumni not only shortly after graduation but also over a long-term period.
- More interactive teaching methods should be implemented, in particular in the first study phase at ECUST. In this regard, both universities should also develop a common concept to strengthen project work in the curricula. Project work should also be implemented in the first phase of the study programs. This could be done through project weeks, for example.
- The variety of examination forms should be increased, in particular in the first semesters. Labs should not be assessed by written exams but by more practice-oriented types of assessment.
- Both universities should develop a concept for a more systematic exchange about content and objectives of both programs between the German and Chinese teaching staff (this could be arranged, for example, through video conferences).
- The organizational and communication structures and procedures should be strengthened in order to stabilize them independently of the individuals involved.