ASIIN Seal & Euro-Inf® Label

Accreditation Report

Bachelor's Degree Programmes
Industrial Engineering and Management
Computer Science

Master's Degree Programmes
Operations Management
Global Management of Innovation and Technology
Computer Science

Provided by
Lappeenranta University of Technology, Finland

Version: June 30th 2017

Table of Content

A About the Accreditation Process 3

B Characteristics of the Degree Programmes 5

C Peer Report for the ASIIN Seal 10

1. The Degree Programme: Concept, content & implementation 10
2. The degree programme: structures, methods and implementation 25
3. Exams: System, concept and organisation 31
4. Resources 35
5. Transparency and documentation 37
6. Quality management: quality assessment and development 43

D Additional Documents 45

E Comment of the Higher Education Institution (26.05.2017) ..... Fehler! Textmarke nicht definiert.

F Summary: Peer recommendations (01.06.2017) 47

G Comment of the Technical Committees 50

Technical Committee 04- Computer Science (21.06.2017) 50
Technical Committee 06- Industrial Engineering (13.06.2017) 50

H Decision of the Accreditation Commission (30.06.2017) 52

Appendix: Programme Learning Outcomes and Curricula 57

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for[1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Tekniikan kandidaatin tutkinto-ohjelma tuotanttalus	Bachelor Industrial Engineering and Management	ASIIN	ASIIN 2011-2016/17	06
Tutannon johtamisen Di-ohjelma	Master Operations Management	ASIIN	ASIIN 2011-2016/17	06
Master Global Management of Innovation and Technology	--	ASIIN	--	06
Bachelor Computer Science	--	ASIIN, Euro-Inf®	ASIIN 2012-2018	04
Master Computer Science	--	ASIIN, Euro-Inf®	ASIIN 2012-2018	04
Date of the contract: August 18th 2016 **Submission of the final version of the self-assessment report:** February 23rd 2017 **Date of the onsite visit:** April 04th/05th 2017 **at:** Lappeenranta				
Peer panel: Prof. Dr. Petra Maria Asprion, University of Applied Sciences Bern/Asprion & Partner Prof. Dr. Dieter Beschorner, Emeritus University of Ulm; Prof. Dr. Rüdiger Reischuk, University of Lübeck;				

[1] ASIIN Seal for degree programmes; Euro-Inf®: Label European Label for Informatics.
[2] TC: Technical Committee for the following subject areas: TC 04 – Informatics/Computer Science); TC 06 – Industrial Engineering.

Prof. Dr. Martin Wölker, University of Applied Sciences Kaiserslautern	
Representative of the ASIIN headquarter: Dr. Alexander Weber	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of 10.05.2015 ASIIN General Criteria, as of 04.12.2014 Subject-Specific Criteria of Technical Committee 04 – Informatics as of 09.12.2011 Subject-Specific Criteria of Technical Committee 06 – Industrial Engineering as of 09.12.2011	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Industrial Engineering and Management	Tekniikan kandidaatti / Bachelor of Science (Technology)	--	6	Full time	-	6 Semester	180 ECTS	Autumn semester
Operations Management	Diplomi-insinööri / Master of Science (Technology)	--	7	Full time	-	4 Semester	120 ECTS	Autumn semester
Global Management of Innovation and Technology	Diplomi-insinööri / Master of Science (Technology)	--	7	Full time	-	4 Semester	120 ECTS	Autumn semester
Computer Science	Tekniikan kandidaatti / Bachelor of Science (Technology)	--	6	Full time	-	6 Semester	180 ECTS	Autumn semester
Computer Science	Diplomi-insinööri / Master of Science (Technology)	--	7	Full time	-	4 Semester	120 ECTS	Autumn semester

[3] EQF = The European Qualifications Framework for lifelong learning

For the Bachelor's degree programme Industrial Engineering and Management the institution has presented the following profile in the self-assessment report:

"The Bachelor's Programme in Industrial Engineering and Management combines business, technology and management. A person who has completed the degree of Bachelor of Science in Industrial Engineering and Management has fundamental knowledge and skills in the fields of mathematics and natural sciences, business and engineering sciences. The BSc programme divides the most important learning concepts into six different entities or modules in which graduates have fundamental skills. The modules, consisting of several courses, are the following:

1. The core of managing a business, organisations, processes and projects
2. The fundamentals of mathematics and physics
3. The basics of information systems and software engineering
4. Communication and foreign languages
5. The basics of one field of engineering (software engineering, computer science, mechanical engineering, energy and environmental technology, or chemical engineering)
6. Experience in research (Bachelor's Thesis) and practical work (internship)

In Finland's educational system and among Finnish employers, the university level Bachelor's degree in technology is generally considered as an intermediate phase in the progress towards a Master's degree. Therefore, the competency profile of Bachelor's degree graduates of Industrial Management focuses mainly on giving a strong basis for Master's level studies. Graduates with the Bachelor's degree in Industrial Management are not meant to be placed in the labor market, as the degree is an intermediate phase towards the Master's degree in Finnish technology education.

After completing the Bachelor's degree, graduates will

- know the basic concepts and the key theories of their own field
- be able to utilise their knowledge of mathematics, natural sciences and information technology for problem-solving
- be able to think scientifically and master scientific working practices
- be able to work in projects and teams
- be able to communicate in writing and orally in both national languages and in English
- be capable of working independently and continue learning. In addition, they will be able to
- choose the appropriate methods and practices of industrial engineering and management for different situations
- analyse the processes and development opportunities of different business areas

- understand and evaluate the production processes and practices of their own field of technology.

These learning outcomes are covered during the studies by a selection of compulsory, alternative and elective courses."

For the Master's degree programme Operations Management the institution has presented the following profile in the self-assessment report:

"Graduates from the Master's Programme in Operations Management are technical and business experts able to operate in industrial, commercial, and public sector organisations. Graduates have good knowledge of and expertise in technology, cost management, supply chain management and systems engineering, providing strong capabilities in business process development and management. They have the ability and desire to work in an international environment, to act responsibly and ethically, and to develop and update their skills further (e.g. doctoral studies and academic research). Graduates are able to

- evaluate the interconnections between an organisation's activities and stakeholders, as well as evaluate their impact on the success of the organisation in an international business environment
- analyse the processes of organisations, determine their development needs and innovate solutions
- specify, produce and acquire relevant information for decision-making as well as draw conclusions and offer reasoned recommendations for the strategic decision-making situation
- analyse the impacts of different organisational solutions and decisions
- select and apply appropriate management policies and methods for different organisational situation
- analyse development needs and plan development programmes, projects and activities
- evaluate technical applications from the business point of view
- apply new scientific knowledge and develop skills further.

These learning outcomes are covered during studies by a selection of compulsory, alternative and elective studies/courses."

For the Master's degree programme Global Management of Innovation and Technology the institution has presented the following profile in the self-assessment report:

"Graduates from the Master's Programme in Global Management of Innovation and Technology will possess a wide variety of perspectives on the management of innovations and technology based on the combination of business, engineering and management. They will be able to cooperate and solve complex situations in today's networked business world due to diverse study methods and working in teams.

The programme is international. Students from all continents and BSc graduates from the LUT's own IEM degree programme are now able to attend. The studies in the programme promote the abilities necessary for business decision-making in innovation and technology management: critical and innovative thinking, a global business perspective, an entrepreneurial mindset, enhanced communication skills and the up-to-date knowledge of relevant technical tools and development methods. Already during the studies and the thesis projects, close collaboration with industry ensures the practical real-world application of new knowledge and theories. Additionally, the studies on research methods and scientific writing also construct a firm basis for graduates to continue in postgraduate studies in this field.

The graduates will

- be able to create and analyse strategies within an international context relating to products, services and technologies
- be able to implement and manage decision-making strategies, frameworks and tools in global networks and markets
- be able to analyse processes and structures of organisations and their development issues
- be able to implement, plan and manage the building of product families, product systems, and product platforms for tangible and intangible goods using widely different management methods in companies and networks
- be able to plan and manage international businesses from start-ups to multinational enterprises
- be able to apply innovation and technology management theories, methods and tools of decision-making and analysis to practical management activities."

For the Bachelor's degree programme Computer Science the institution has presented the following profile in the self-assessment report:

"The Bachelor's Programme in Computer Science combines technology, science and management skills. A person who has completed the degree of Bachelor of Science inComputer Science has fundamental knowledge and skills in the fields of information technology, computer science and software engineering. Graduates from the programme will

- know how to think and work following scientific principles
- be able to utilise their skills in mathematics and natural sciences in problem solving
- be familiar with the basic concepts and theories in computer science
- be able to work in projects and in different groups
- be able to describe and solve problems using software engineering techniques and methods as well as self-made programmes
- be capable of independent study and ready for life-long learning

- be able to participate in software development projects using the acquired knowledge and technical skills
- be able to apply their technical skills in different domains, taking into account technical, social, and economic constraints
- be able to communicate both verbally and in writing and work as a part of a project team using both the domestic languages and English."

For the Master's degree programme Computer Science the institution has presented the following profile in the self-assessment report:

"The professional scope of the Master's Degree Programme is diverse and rapidly developing. Students of Software Engineering will acquire expertise in software development and its processes, methods and tools. Typical roles for the graduates of this specialisation field include software architect, programming expert, software product manager, and systems analyst. Furthermore, graduates may also work in research, consulting, sales, education, or their own business.

The graduates

- will be able to apply scientific knowledge and methods to practice
- will be able to apply modern design techniques and methods in daily software engineering
- will be able to participate in software projects as an expert or project manager
- will be able to recognise problems in software development and improve processes from the technical, project management, and organisational viewpoints
- will be able to communicate in English both orally and in writing
- will have good skills in presenting results, conducting project work, leading teams, and working in multicultural environments
- will be ready for scientific graduate studies and lifelong learning at work."

C Peer Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- LUT- Self Assessment Report
- LUT - University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- LUT – Study Guide 2015-2016. Study programs and courses in English (https://uni.lut.fi/en/c/document_library/get_file?uuid=262cffb3-fe5a-44ea-8408-d4a6e89757fa&groupId=10304 (11.04.2017))
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:
Lappeenranta University of Technology (LUT) has defined three levels of overall objectives and learning outcomes:

a.) General aims of educational programs both on Bachelor and Master level are set according to Finnish legislation and laid down in "LUT University Regulations on Education and Completion of Studies";

b.) General aims of the superior disciplines Industrial and Engineering and Management and Computer Science are presented in the applicants self-assessment report (SAR);

c.) Programme specific aims and objectives. Partly translated from Finnish these objectives are presented in the applicants´ SAR. Based on the example of the two

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

Master Programs Global Management of Innovation and Technology and Computer Science taught in English, the peers understand that these objectives are (in a rather shortened version, though) part of the so called "Study-Guides" and thus publically available. The publication status of the objectives of the remaining degree programmes that are taught in Finnish (Bachelor´s programmes Industrial Management and Engineering and Computer Science, Master´s programme Operations Management) cannot be comprehended offhand. However, the auditors assume that there are publically available Finnish study guides that contain this central information for these programs as well (cf. as well chapter 5.3).

The following assessment is based on an integrated view of these three levels as presented in the SAR:

The three programs in the area of Industrial Engineering and Management (Bachelor Industrial Engineering and Management, Master Operations Management, Master Global Management of Innovation and Technology) raise the very general claim "to equip students for organisational development and business process management by merging technology and management skills". Thereby, graduates should be prepared for an employment in the "wide spectrum of industries, research institution and public administrations".

Looking at the learning objectives on programme level the auditors first of all take note that specific career paths the programs should prepare for are lacking. Thus, a differentiation between Bachelor and Master level is impossible. Moreover the peers determine that matrices that set the programme specific learning objectives in relation to the ASIIN subject – specific – criteria 06 – Industrial Engineering (SSC 06) are missing as well.

In accordance with the SSC 06 the Bachelor Industrial Engineering and Management claims to educate students in the "fundamentals of mathematics and physics" as well as in the "basics of one field of engineering". Moreover, the learning objectives of the Bachelor encompasses "the core of managing a business, organisations, processes and projects" what is seen as coherent with some very general provisions of the SSC 06 as well. As all Bachelor programs at LUT strive to "provide students with a capacity for scientific thinking and the application of scientific working methods", competences in "academic research and writing" as mandatory prescribed by the SSC 06 are covered as well. Even if central parts of "knowledge" as required by the SSC 06 are covered, the peers underline that any reference to "integrate knowledge" and thus the main feature of the overall discipline "Industrial Engineering" is missing. In particular, the overall objectives don´t encompass a "set of interrelated and integrated subjects, which bring together economic, technical and social aspects and processes". Coming to the specific learning

outcomes and thereby the level of “skills” and “competences” as laid down in the SSC 06, the auditors are able to attest an only partially fulfilment of this framework either: While the economic-related parts of the SSC are largely covered, skills and competences that are linked to the engineering related parts of the education are not pronounced properly: LUT aims to enable students “to understand and evaluate the production processes and practices of their own field of technology”, what in particular falls behind the central objective of the SSC 06 to “indentify, abstract, structure and solve complex technical tasks and problems (...)”. The non subject-specific parts of this framework are finally at least largely covered: The Bachelor aims at enabling students to “work in projects and teams” and thus considers the competence area “cooperation and teamwork” according to the SSC 06 adequately. By fostering the ability “to communicate in writing and orally in both national languages and in English” the objectives cover “communication-“ and “cross-cultural” competences properly. The capacity of “working independently and continue learning” finally matches with the SSC competence for “life-long-learning”.

The shortcomings regarding the Bachelor´s profile can be found within the one of the Master Operations Management as well: While the deepening and widening of economic related knowledge is clearly outlined, the technical parts of the education are only captured with the generic expression “graduates have good knowledge of and expertise in technology”. By referring to typically integration-subjects such as “Supply Chain Management” or “Systems Engineering” integrative knowledge and competences are covered implicitly at best. The learning objectives for the Master Global Management of Innovation and Technology are finally more convincing: The framework topic “technology management” is elaborated clearly and thus adequately grasps the interdisciplinary approach at the interface of management and technology.

According to the overall objectives the Master Computer Science sets a focus on aspects of software development and software engineering. Even if the Higher Education Institution (HEI) demands for the Bachelor-programme a broader approach (“built on general computer science to provide students with a solid and broad basis in the discipline”) the auditors see this restriction, as will be further discussed below, for the undergraduate programme either. Without criticising the content-related approach of the programs, the peers firstly determine that the names of the degree programs do not reflect the actual learning objectives properly (cf. chapter 1.2, 1.3). On this account it is comprehensible that the learning objectives of both programs only partly match with the provisions of the ASIIN subject specific criteria 04 – Informatics (SSC 04):

It is the central aim of the Bachelor Computer Science to convey “fundamental knowledge and skills in the fields of information technology, computer science and software engineering". As a result, graduates should be prepared to “work in software projects as de-

velopers or testers". The learning objectives derived from this very general aim are rather generic: Indications such as students are able "to utilise their skills in mathematics and natural science in problem solving", are "familiar with the basic concepts and theories in computer science" or are "able to describe and solve problems using software engineering techniques" cover in their sweeping generality the whole discipline of Computer Science, but do not give conclusive indications on concrete competences. Moreover, the fact that the curriculum of the Bachelor programme not even covers the discipline "Computer Science" in its contextual broadness will be extensively discussed in chapter 1.3. The non-subject-specific competences as provided by SSC 04 are however considered to be largely fulfilled: Envisaged skills and competences such as "work in projects and in different groups", "be capable of independent study and ready for life-long learning" or "be able to communicate both verbally and in writing and work as a part of a project team using both the domestic languages and English" are covering the respective areas within the SSC 04 sufficiently.

By consequently referring to "Students of Software Engineering" and not "Computer Science" the qualification profile of the Master captures the actual approach of the programme much better than the Bachelors profile does. This self chosen wording underlines, however, the mismatch between the name of the degree programme and the learning objectives. As key objective the Master Computer Science imparts "expertise in software development and its processes, methods and tools". As a result, graduates should be prepared to work as "software architect, programming expert, software product manager, systems analyst" or in "research, consulting, sales, education or their own business". The competences derived from these general aims are, like in case of the Bachelor, rather generic. Statements such as students "will be able to apply scientific knowledge and methods of practice" or "will be able to apply modern design techniques and methods in daily software engineering" are not only less meaningful but do moreover not reflect the intended master level of the programme properly. The auditors certainly believe that the master conveys in a limited part of Computer Science, namely Software Engineering, competences that are in line with the SSCs 04 master level. However, this conclusion is drawn from the study plan and has up to now no equivalent in the self defined learning objectives (cf. chapter 1.3).

In case of all five degree programs under review the assessment of the self defined learning objectives, is closely linked to the curricula concept that will be discussed in chapter 1.3. In summary the auditors determine the following:

a.) It is necessary to prepare qualification profiles for all programmes that integrate the general objectives as laid down in the University regulations, the general ob-

jectives of the respective superior discipline and the programme specific objectives;

b.) The qualification profiles of the three programs in the area of Industrial Engineering and Management (Bachelor Industrial Engineering and Management, Master Operations Management and Master Global Management of Innovation and Technology) should outline which specific career paths/professional profiles the graduates are prepared for;

c.) The qualification profiles of the Bachelor Industrial Engineering and Management and the Master Operations Management should thoroughly reflect the integrative competences on the interface of business and technology and, in case of the latter, the engineering related competences on an adequate level. A curricula implementation of these areas of competences should be proven as well (cf. chapter 1.3);

d.) First of all, the qualification profiles of the Bachelor and Master Computer Science should be, as will be discussed in the following chapters, in accordance with the name of the programme and the curricula content. Moreover, the auditors judge it necessary to further elaborate the competences aimed at on an adequate level.

Criterion 1.2 Name of the degree programme

Evidence:

- LUT, Self Assessment Report
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:

The peers take note that the names of the degree programs under review have been changed since the first accreditation 2011/12:

a.) To better emphasize the technical paths of the educational programme, the Bachelor "Industrial Management" is now called "Industrial Engineering and Management";

b.) The former Master "Industrial Management" has been thoroughly restructured and subdivided in two independent Master-Programs:

- The curricula core subjects of the "old" Master Industrial Management, Cost Management and Supply Management, are now operated as Master "Operations Management";
- In the framework of a pronounced international strategy of LUT the perspective on global issues has been further developed into a second Master "Global Management of Innovation and Technology";

c.) The Bachelor and Master Computer Science have been accredited in 2011 as "Information Technology"

In case of the three degree programs in the area of Industrial Engineering and Management the peers consider the restructure and accompanying renaming to be plausible oriented on the intended aims and learning outcomes. As already has been mentioned above the auditors determine that the Bachelor and Master Computer Science set an obvious focus on "Software Engineering". As fundamental aspects of "Computer Science" (such as theoretical and technical informatics) are not part of the curricula the peers see the need to better harmonize the name of the degree programs with the learning objectives and respective curricula (cf. Chapter 1.3).

The English terms "Industrial Engineering and Management", "Operations Management" and "Computer Science" (in case of the Bachelor) are translations from the language of instruction Finnish. As the master programs Global Management of Innovation and Technology and Computer Science are entirely run in this language, the English naming is justified.

Criterion 1.3 Curriculum

Evidence:

- LUT, Self-Assessment Report
- Curricular Overviews cf. Appendix
- Curriculum-Tool B.Sc. Industrial Engineering and Management, including a Module-Objective-Matrix (as provided with the SAR)
- Curriculum-Tool M.Sc. Operations Management, including a Module-Objective-Matrix (as provided with the SAR)
- Curriculum-Tool M.Sc. Global Management of Innovation and Technology, including a Module-Objective-Matrix (as provided with the SAR)
- Curriculum-Tool B.Sc. Computer Science, including a Module-Objective-Matrix (as provided with the SAR)
- Curriculum-Tool M.Sc. Computer Science, including a Module-Objective-Matrix (as provided with the SAR)
- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- Audit discussions April 4th – 5th 2017

Preliminary assessment and analysis of the peers:

The peers learn that the distinction between bachelor and master programs at Finnish universities is much less pronounced than in other states of the Bologna-Area. They understand that this can be lead back partially to a lack of acceptance of the universities bachelor in industry. As a result, hardly any student leaves the HEI with only the Bachelor degree. This peculiarity affects the study structure as well: Even if the formal subdivision between Bachelor and Master-Programs has been slightly sharpened since the first accreditation 2011/12, the Bachelors are still designed as “lower degrees” that almost seamlessly merge into the respective Masters. As will be discussed in chapter 3 this issue becomes also apparent in the design of the bachelor theses.

All five programs under review are located at LUT´s School of Business and Management. As a result the curricular structure especially of the Bachelor Programs is characterized by some synergies: Students of both programs are attending basic courses in the amount of

12 ECTS points of the respective other discipline. The peers consider this approach comprehensible.

The overall structure of the Bachelor-Programmes on the one and the Master-Programmes on the other hand is very similar. Both Bachelor Programmes encompass "general studies" (industrial engineering and management, software and information technology, mathematics, language and communication) in the amount of 64 ECTS, "intermediate specialisation studies" (the own discipline) in the amount of 84 ECTS resp. 81 ECTS, "minor studies in technology" (different technical areas except the respective major-subject) in the amount of 24 ECTS and "elective studies" in the amount of 8 ECTS resp. 11 ECTS points. This approach is continued in the Master programs on a higher and specialised level. With regard to the "minor studies in technology", master students can choose either to keep up the area of technology they studied in their B.Sc. on an advanced level or change the subject. The peers learn that the students must not choose the minor courses randomly, but according to fixed packages. By this pre-structuring and an in-depth guidance in the preparation of the individual study plans the HEI ensures that the minor studies correspond with the overall objectives as well as the intended level of qualification.

Regarding the curricula implementation of the overall objectives, the peers determine that conclusive module-objective-matrices are missing. Moreover, a matching of the overall learning objectives and curricula content with the respective ASIIN subject-specific-criteria (SSC) is lacking as well.

Based on the information at hand, the peers gain the impression that the overall objectives of Bachelor Industrial Engineering and Management and the two related Master programs Operations Management and Global Management of Innovation and Technology are at least widely implemented within the curricula.

The compliance with the SSC 06 is assessed as follows:

All students of the Bachelor Industrial Engineering and Management obtain a sound knowledge in the relevant mathematical and statistical topics. Moreover, the auditors do see that all graduates have achieved basic knowledge in the relevant natural science ("BM30A2700 Basics of Thermal Physics") and fundamental engineering disciplines ("BM30A260 Basic of Mechanics", "BM30A2900 Wave Motion and Wave Phenomena", "BM30A3000 Electricity and Magnetism"). By attending minor studies either in Software Engineering, Mechanical Engineering, Energy and Environmental Technology, Chemical Engineering or Computer Science the respective competences are deepened exemplarily, whereby the auditors do not consider "Computer Science" as an engineering discipline in the strict sense. According to the specific approach of the programme the dissemination

of business-related competences is somewhat stronger pronounced: Students get an overview over all significant areas of economics (e.g. “CS90A0012 Basic course in Business and Management”, “CS20A0002 Basic course in Innovation and Technology Management”, “CS20A0002 Basic course in Supply Chain and Operations Management”, “A250A0250 Basic Course in Financial Accounting”, “LM10A1000 Project Management”). In addition, soft-skills and foreign languages are as well part of the curriculum as a short practical placement. As has already been discussed in chapter 1.1 the overall objectives do not consider integrated competences at the interface of engineering and economic sufficiently. Looking at the study plan, the programme managers refer in general to the case studies that should consider this main feature of the discipline Industrial Engineering and Management, which should be in the peers´ point of view further substantiated in an exemplary way. The programme ends up with a Bachelor thesis that should make students familiar with academic research and writing. That the implementation of the Bachelor Theses is, however, only partly convincing will be discussed in Chapter 3. The peers see that “Skills” and “Competences” as required by the SSC are considered largely adequate as well. Just to name a few examples: Subject related problem-solving competences are part of modules like “A250A0250 Basic Course in Financial Accounting”. The collection and interpretation of technical and economic data is for example subject to the statistical teaching units. Methodical competences, such as modelling, simulation, design and implementation are imparted for example in teaching units like “CS30A0961 Creating and Managing Business Networks” or “BK10A4200 Product Design and Modeling“. Problem solving competences in a technical and economical context are for example part of modules like “CS30A1612 Strategic Planning and Management” or in practical application in several case studies. The abilities to communicate, cooperate and work effectively in teams are fostered for example in group works. For example in the Bachelor Thesis students should learn critical thinking.

As students in the two Master Programs Operations Management and Global Management of Innovation and Technology are required to pass minor studies in Modern Manufacturing, Technical Solutions in Energy Technology or Chemical Process Engineering they obtain in-depth knowledge in selected fields of engineering. The further alternative “Computer Science” is, however, not seen as a genuine engineering-discipline, as has already been discussed above. In their respective area of specialization both programs convey in-depth knowledge of essential micro- and macro-economic contexts and an understanding for the relevant economic- and management-related processes. Within the Master Global Management of Innovation and Technology relevant knowledge is for example imparted in courses such as “CS34A0401 Strategic Entrepreneurship in an Age of Uncertainty” or “CS30A1341 Strategic Technology and Innovation Management”; within the

Master Operations Management such skills are for example part of “CS20A6072 Sustainable Business Models” or “LM10A4000 Strategic Management of Accounting and Cost”. Both Master programs encompass a set of interrelated and integrated subjects at the interface of business and engineering, such as “Product Development” or “Industrial Project Management” in the Master Global Management of Innovation and Technology and courses in “Supply Chain Management” or “Systems Engineering” in the Master Operations Management as well. Thereby both programs encompass a sufficient amount of case-studies and project-works and thus guarantee an adequate link to practical work. The master thesis and, in the Master Global Management of Innovation and Technology in addition the module “Research Methods of Master Students”, are meant to familiarize students with academic research and writing. Looking at skills and competences as required by the ASIIN SSC, the auditors see that graduates of both programs are, just to name one example, enabled to chose and apply adequate methods of modeling, simulation, design and implementation. Such competences are for example subject to courses like “CS30A1372 Creative Thinking and Problem Solving” or “CS30A1391 Systems Engineering” in the Master Global Management of Innovation and Technology or to the specialization area “Systems Engineering” in the Master Operations Management. The peers finally attest both programs a sound enhancement of methodological and analytical skills based on a previous degree. In-depth methodological competences are imparted in modules like “CS34A0401 Strategic Entrepreneurship in an Age of Uncertainty” or “CS30A1372 Creative Thinking and Problem Solving” in the Master Global Management of Innovation and Technology or “CS30A7370 Simulation Modeling in Industrial Management” in the Operations Management programme.

Concerning the three programs in the field of Industrial Engineering and Management the peers sum up the following issues:

a.) As “Computer Science” is no engineering discipline in the strict sense, the peers think that this “minor” does not fit with the overall approach of Industrial Management programmes properly. Thus, the HEI should reflect on replacing this “minor” by a more engineering-specific subject;

b.) The HEI should verify that students of the Bachelor Industrial Engineering and Management obtain a set of integrated competences on the interface of engineering and management.

As mentioned above the Bachelor and Master Computer Science do not cover the field of “Computer Science” in its total range, but set a strong focus on the sub-discipline “Software Engineering”. As a result, the naming of the degree programme is, as discussed in

chapter 1.2, to certain extend misleading. The very specific approach of the programs leads, moreover, to an at best partially compliance with the ASIIN SSC 04 – Computer Science:

First of all, the peers notice that in the Bachelor programme Computer Science basic skills in mathematics and statistics are considered adequately within the curriculum. A thorough education in mathematics (BM20A5800 Functions, Linear Algebra and Vectors, BA20A5810 Differential calculus and applications) is flanked reasonably by two teaching units in statistics (BM20A1401 Statics 1, BM20A410 Statistics Assignment). Even if the HEI raises, in accordance with ASIIN SSC, the claim, to convey "fundamental knowledge and skills in the field of (...) Computer Science (...)" and to familiarize students with "the basic concepts and theories in Computer Science", the core subjects that, according to ASIIN SSC, are to be considered in the study plan are only covered partially. In particular, key aspects such as theoretical informatics, communication systems and computer architecture are missing. In the peers point of view the implementation of LUTs objective to enable students "to participate in software development projects using the acquired knowledge and technical skills" is not fully convincing. Students get in touch with basic principles of Project Management (LM10A1000) and complete an indeed very limited internship; an independent industry project as recommended by ASIIN SSC is, however, lacking. In turn, social competences as required by ASIIN SSC are adequately considered. The curriculum familiarizes students for example with ethical questions related to data security (e.g. BM40A0201 Foundations of Computer Science, LM10A2000 Introduction to Information Systems). Moreover, key skills such as techniques of learning and working, problem solving skills or the capacity for teamwork are promoted thoroughly by an elaborated didactical approach (cf. Chapter 2).

As the qualification profile of the Master Computer Science focuses on the field of Software Engineering consequently, it captures the contend-related approach of the programme adequately. Thus, the peers come to the conclusion that the self-defined goals of the programme are implemented appropriately. In turn, a thorough compliance with the subject-related parts of the ASIIN SSC 04 can´t be attested either. In particular, the curriculum imparts inevitably "comprehensive and detailed knowledge in a specialist field of computer science" but does not encompass a "*general* computer science expertise independent of current technology and applicable in the long term" as intended by the SSC.

In sum, the peers assess the content related approach of the degree programs even in their present state to be plausible. Moreover, they gain the impression that the given focus on problems of Software Engineering is closely oriented on the needs of the Finnish labour market. Such strategic positioning within the wider field of informatics justifies in the auditors' point of view the award of the ASIIN-seal even if the ASIIN SSC 04 are un-

avoidable not fulfilled entirely. In turn, the peers underline that the programs at hand are at present no degree programs in *Computer Science* and thus do not justify the award of the Euro-Inf®-Label.

First of all the auditors see the need to better harmonize the name of the degree programs, the overall learning objectives and the curricular content. In particular, the HEI should decide either

a.) to keep up the current focus on "Software Engineering". If doing so this focus needs to be reflected in the name of the degree programs as well.

or

b.) to keep up the current name "Computer Science". If doing so, both degree programs need a broader curriculum. In particular, it needs to be ensured, that all students obtain at least basic competences in the area of theoretical and technical informatics.

From the peers point of view the award of the Euro-Inf®Label should made dependent on this strategic decision.

Notwithstanding the above, the peers underline finally

a.) that informatics-related problem solving competences (modelling) on Bachelor level are only partly reflected in the curriculum ("CT60A4302 Databases" "CT60A2411 Object-Oriented Programming"). As a safe handling of modeling and related tools is a core competence for every software-related work and appears moreover at an exposed position within the self defined goals, the auditors see the need to better pronounce this competence area within the Bachelor curriculum;

b.) that even if some relevant elements are in place, the practical parts of the Bachelor curriculum should preferably be strengthened. In particular, the peers deem it reasonable to include an longer industry project with a strong relation to the field of the aspired profession;

c.) that aspects of software and systems security are currently considered only subordinately (e.g. as a part of "LM10A2000 Introduction to Information Systems" in the Bachelor) and thus should be better pronounced;

d.) that Master students legitimately claim to have too little opportunities for a content-related priority-setting, which should be considered on occasion of the further-development of the programme in a medium or long term.

Criterion 1.4 Admission requirements

Evidence:

- LUT, Self-Assessment-Report
- Website „Studyinfo.fi“ (https://studyinfo.fi/wp2/en/ (11.04.2017))
- LUT/Admission (http://www.lut.fi/web/en/admissions (11.04.2017))
- LUT - University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- LUT – Study Guide 2015-2016. Study programs and courses in English (https://uni.lut.fi/en/c/document_library/get_file?uuid=262cffb3-fe5a-44ea-8408-d4a6e89757fa&groupId=10304 (11.04.2017))
- Audit Discussions April 4th - 5th 2017

Preliminary assessment and analysis of the peers:
The admission procedure for both Bachelor and Master Programs at Finnish HEIs is largely governed by legal regulation. Student admission and selection is carried out by a joint universities application system (“Studyinfo”). All relevant information is publically available on the respective website as well as on the web presences of the university.

On Bachelor level applicants are allowed to apply for at maximum six degree programs at one or different universities or universities of applied sciences. The distribution of study-places is finally based on a centralized entrance examination. Applicants are offered the study place highest in their order of preference, for which they have reached a threshold score, determined by the particular university. The peers learn that in Finland the admission procedure is still hardly aligned to the two-cycle structure of the Bologna process. Even if in recent years Bachelor and Master-Programs became more separated, students apply for the Bachelor and the related Master at the same time. Hence, the transition from the Bachelor in the Master is an automatism.

The auditors appreciate that nevertheless a change of university and subject for the Master degree is possible. Bachelor graduates from other universities and/or related subjects may apply for all three Master programs under review. Those candidates are subject to an

individual assessment of the respective “Selection Committee”. An admission under the requirement to catch up certain competencies is thereby in principle possible. Even if the duality between universities and universities of applied sciences in Finland is more pronounced than for example in Germany, the permeability between both paths of tertiary education meanwhile is high. While in former times candidates from the respective other institution were required to pass so called “complementary studies” they are meanwhile subject to the regular admission procedure.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

Criterion 1.1 Objectives and learning outcomes of the degree programme

The auditors take note that the HEI plans to revise the competence profiles of all degree programs under review. In particular, the peers appreciate that the programme specific objectives should be matched in more detail with the course specific level as well as with the relevant ASIIN subject specific criteria. Concerning the insufficiently pronounced professional profile of the Bachelor Industrial Engineering and Management the peers are aware that Bachelor programmes at Finish Universities are mainly designed as a preparation for a corresponding Masters programme. However, as Finland is part of the European Higher Education Area, the undergraduate programme should not only prepare for further studies but also allow a first professional activity. Even though nearly 100% of the Bachelor graduates continue their education, the peers deem it still necessary to anchor such a claim already in the qualification profiles. Thus, the auditors see the need that the qualification profile of the Bachelor Industrial Engineering (like the one of the Bachelor Computer Science already does) reveals specific career paths graduates would be prepared for. In sum, the auditors keep up their preliminary assessment. They recommend checking the announced revision and publication of the qualification profiles in a medium term and therefore support a respective requirement.

Criterion 1.2 Name of the degree programme

~ Bachelor / Master Computer Science

As already mentioned, the auditors deem the present focus of the Bachelor and Master Computer Science on Software Engineering in principle justified. However, they again emphasize that programmes that pursue such an approach, are no “full” Computer Science Degrees. In this respect the peers appreciate that the HEI obviously plans to change the name of the Masters´ Programme in “Software Engineering”. If the name “Computer Science” should be kept up for the Bachelors´ Programme, the HEI, however, has to substantiate that this degree covers the discipline in an adequate broadness. If this is indeed,

as mentioned in LUTs statement on the preliminary report, just a matter of a shortened presentation of the module descriptions, such evidence should be made easily. In sum the peers see still the need that LUT proofs that the name, learning objectives and curricula content of the Computer Science programmes have been harmonized and recommend a respective requirement.

Criterion 1.3 Curriculum

~ Integrative Competences on the interface of Business and Technology in the curricula of the Bachelor Industrial Engineering and Management and the Master Operations Management

As already discussed above, the HEI plans to strengthen the interdisciplinary approach of the Bachelor Industrial Engineering and Management and the Master Operations Management. A revision of the qualification profiles should be compiled within the curricula by a deeper interdisciplinary connection between the programs in the field of Industrial Management and genuine engineering disciplines and the implementation of corresponding courses such as "Venture Management". The auditors deem the announced measures reasonable to better pronounce the integrative competences on the interface of business and technology. As this area of competences is a main feature of the overall discipline Industrial Engineering, that auditors think the implementation of such measures should be checked in a medium term and recommend a respective requirement.

~ Computer Science as a minor in the Industrial Engineering and Management programmes

According to LUTs statement on the draft report, the minor "Computer Science" should be replaced by "Software Engineering", even in both Masters Programs. All in all the auditors keep up their preliminary assessment. They think the content alignment of the minor subjects in the three Industrial Engineering and Management programs should be checked thoroughly on occasion of the re-accreditation and thus support a respective recommendation.

~ Overall curricular approach of the Bachelor / Master Computer Science

As already has been discussed above, that auditors appreciate that the name of the Master Computer Science should be changed to "Software Engineering". In the auditors point of view this term grasps the actual approach of the programme thoroughly. Concerning the Bachelor Computer Science the HEI indicates that a condensed presentation of the module descriptions currently obscures an indeed broader approach of the programme what, finally, justifies the name "Computer Science". The auditors take note of these; but state that both aspects need to be verified in the course of the current proceedings. Thus,

they keep up their preliminary assessment. They deem it necessary to check this issue in a medium term and support a respective requirement. As the award of the EUR-INF-Label is limited to programs that cover the discipline “Computer Science” in an adequate broadness they recommend postponing a decision about the subject-specific seal to a later stage of the procedure.

~ Consideration of aspects of software and systems security and software verification in the Bachelor / Master Computer Science

The auditors take note that the HEI will check the possibilities whether aspects of software and systems security and software verification can be integrated into the curricula of the Bachelor and Master Computer Science. The peers appreciate this notification. They think the corresponding further-development of the curricula should be discussed on occasion of a re-accreditation and support a respective recommendation.

~Practical parts of the Bachelor Computer Science

The auditors do not doubt that in particular the Master Computer Science is closely linked to the needs of a national labour market. The peers are also convinced that even Bachelor students are prepared for a practical application of their knowledge and get in touch with case studies that are aligned on “real” industry problems. However, a period of practical training (as highly recommended by subject specific qualification frameworks like the ASIIN SSC) is still missing. Against the background of a sharpening of the professional profile of the Bachelors degree they encourage the HEI to think about a respective further development of the curriculum. The auditors think this issue should be revived on occasion of a re-accreditation and support a respective requirement.

~Possibilities of content-related priority setting in the Master Computer Science

The auditors take note that the HEI plans to provide more opportunities for individual study paths in the Master Computer Science. They think the corresponding further-development of the curriculum should be discussed on occasion of the re-accreditation and support a respective recommendation.

Taking the statement of the HEI into account, the peers assess criterion 1 for all degree programs under review to be partly fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- LUT, Self-Assessment-Report
- Curriculum-Tool B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Curriculum-Tool M.Sc. Operations Management (as provided with the SAR)
- Curriculum-Tool M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Curriculum-Tool B.Sc. Computer Science (as provided with the SAR)
- Curriculum-Tool M.Sc. Computer Science (as provided with the SAR)
- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- Recognition of Prior Learning and Credit Transfer (Lappeenranta University of Technology 2011, updated on 1 September 2014)
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:

Modularization:

All study programs under review are modularized. The peers determine that each module is a sum of teaching and learning whose contents are concerted.

Feasibility of the Study Structure:

The auditors take note that statistical data on the average length of studies and drop-out rates are obviously not collected at LUT. However, everyone involved assesses the estimated regular duration of six semesters in the Bachelor- and four in the Master-programs to be realistic. By limiting the opportunities to attend Master courses before finishing the

Bachelor-programme exceedances of the regular study durations have been reduced on this level as well. The auditors learn that an efficient and target-oriented course of studies is highly supported by governmental funding. As all students receive state subsidies for at maximum seven years there is no pressure for additional work. Thus, students are able to totally focus on their education. According to the students roughly 20% of Computer-Science-Students leave the university without any degree. The reasons for that are seen in false expectations about the degree programme or a lucrative job offer; structural issues are strictly negated. In the Industrial Management Programmes drop-outs are hardly known. Although there is no hint for a serious problem, the auditors advise the HEI to collect study progress data (in particular average study durations and drop-out rates). Statistical conspicuities should be followed up and be used for a further improvement of the feasibility of the course of studies.

Practical Approach/Internships

Internships are compulsory parts of both Bachelor-Programmes. In both degrees students are required to pass at the very end of their education the so called “Work internship”. Within the limited scope of two ECTS points (or 52 hours) students should get insights in the working-world. Thereby *every* kind of job is acknowledged. In case of an optional prolongation by up to six credits in the Bachelor Industrial Management and a two to ten credits valued “follow-up-internship” in the Master Computer Science a certain link of the assignment to the overall objectives of the respective degree programme is necessary. The peers notice that a structured supervision of these internships is not provided by the university:

a.) The students seek the internships independently and start their assignments without any consultation of a university supervisor. Instead, the respective assignments are approved afterwards;

b.) Even though the award of the credits happens on basis of a report, type and scope of this report is obviously not fixed.

As their precursors did on occasion of the first accreditation in 2011/12, the peers seriously doubt that at present state the HEI is actually able to vouch for the quality of this part of the education in terms of relevance, content and structure. This is all the more problematic as the industry representatives complain a certain lack of practical experience of LUT graduates. In the first place, the peers see the need to establish a structured support and supervision of the internship by LUT. Furthermore, the university needs to ensure that the internship is aligned with the overall objectives of the respective degree

programme consistently. That the practical parts of the Bachelor Computer Science should be strengthened anyway has been already discussed in chapter 1.3.

Recognition of achievements and competences / "Window of Mobility"

The recognition of achievements and competences obtained at another university or outside the tertiary education sector is governed by the "University Regulations". While these specifications are kept rather general, the respective implementation rules ("recognition of prior learning and credit transfer") are fixing a process that is in line with the Lisbon-Convention. In particular, it is laid down that recognition is based on learning outcomes and a rejected recognition has to be justified by the university ("reverse onus-clause"). According to the students, these regulations are put into practice adequately; specific problems in this respect can´t be named either.

The specific structure of the degree programmes under review gives the impression that study periods abroad are basically possible without exceeding the regular study period. Especially for the Industrial Engineering programmes LUT maintains co-operations with a series of European universities ("IE-Cluster"). Course packages harmonized between the partner institutions allow a structured student-exchange and facilitate the recognition of achievements. In view of these framework conditions the outgoing mobility in the Industrial Engineering programmes is rather high. According to the universities management approximately 35% of the students (Bachelor and both Master programmes together) spend at least a three month period at a foreign university. Structured programme-specific exchange co-operations for the Computer Science programmes are nonexistent. Based on ERASMUS+-partnerships or individual contacts of the teaching staff, study visits abroad are nevertheless possible even in these programs. Statistical data on outgoing mobility in the Computer Science programs are not available.

Criterion 2.2 Work load and credits

Evidence:

- LUT, Self-Assessment-Report
- Curriculum-Tool B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Curriculum-Tool M.Sc. Operations Management (as provided with the SAR)
- Curriculum-Tool M.Sc. Global Management of Innovation and Technology (as provided with the SAR)

- Curriculum-Tool B.Sc. Computer Science (as provided with the SAR)
- Curriculum-Tool M.Sc. Computer Science (as provided with the SAR)
- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- LUT Course-Feedback Questionnaire
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:
To measure the amount of work required by students LUT uses the ECT-System. In section 15 of the "University regulations" it is laid down, that one ECTS-point equals to 26 hours of students' workload. Within the course-evaluation the allocation of credits to specific modules is checked on a regular basis. The auditors understand that in case of a mismatch not the content or the number of credits but the didactical approach is adapted. That means, the workload is reduced by better assisting students in solving tasks. In general the interviewed students consider the awarded credits to adequately reflect the actual workload.

Criterion 2.3 Teaching methodology

Evidence:

- LUT, Self-Assessment-Report
- Audit discussions April 4th – 5th 2017

Preliminary assessment and analysis of the peers:
LUT uses different forms of teaching: Lectures with large student groups are mainly located in the Bachelors and are meant for the impartment of key concepts, methods and theories of the respective field of study. The main focus especially in the master programmes lies on small and medium-sized groups with interactive and collaborative teaching and learning. The auditors learn that the teaching methodology is based on a so called "student-oriented approach" and, as a rule, is closely aligned with the intended learning

outcomes: A focus on real-life problems from the world of work and tasks that require practical problem solving, decision making, development of activities and interactive teamwork help to illustrate the actual relevance of the topic dealt with. Different approaches, such as learning by doing, problem-based or model-based learning further promote the students ability to retrieve theoretical information for a practical application. The auditors highly appreciate the differentiated portfolio of teaching methods. That the universities management offers courses to familiarize the teaching staff with different didactical approaches is considered to be laudable as well. However, the peers regret that development and adaption of teaching methodologies and didactical methods mostly happens on the level of individual courses in a rather "organic" way. Concerning this matter an overall framework with binding standards is not existent but would, at least from the auditors' point of view, better establish and support the didactical approach.

Criterion 2.4 Support and assistance

Evidence:

- LUT, Self-Assessment-Report
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:
Everybody involved assess the working environment and, in particular, the relationship between students and teaching staff as very good. The students highlight a familiar and open atmosphere and an individual guidance in small learning groups as a distinctive advantage of LUT.

The peers take note that LUT maintains a well structured system of support and assistance. Students especially appreciate the tutorship-system that is considered to be on a higher level than at other Finnish universities. Specially educated students act as "peer-tutors" and help freshmen throughout the acclimatization period at LUT. Even for the further study progress the peer-to-peer principle plays an important role in LUTs support system: For example, advanced Students provide as so called "Study-Advisors" fellow students with guidance even in later stages of their education. These low-threshold offers are reasonably flanked by specific contact-partners within the academic personnel: So called "Study counsellors" are providing in-depth guidance in preparing the personal study plans. "Teacher Tutors" help students for example in the selection of elective course and minor subjects form the viewpoint of career guidance. Problems related to specific courses/modules can be addressed to the competent teacher/professor at any time. That, however, despite the positive overall impression a specific supervision of the internships has to be established has been already discussed in chapter 2.1.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

Criterion 2.1 Structure and Modules

~ Feasibility of the study structure

The auditors do not doubt that LUT maintains effective processes to support and even monitor the educational progress of their students. They deem it also convincing that due to this the ratio of drop-outs and overruns of the standard study period are rather low. However, to effectively identify and solve potential deviances in the future, the auditors assess it still reasonable to reliably quantify both phenomena. In so far they keep up their preliminary assessment. They think the corresponding further development of the quality management system should be discussed on occasion of a re-accreditation and support a respective recommendation.

~ Practical approach / internships

For the above mentioned reasons, the auditors assess the current approach of the internships in both Bachelor programmes still critically. On the other hand they acknowledge that even in the present state the internships ensure that Bachelor students get acquainted with some basic rules of working life. They also deem it credible that in practice most students work in the relevant industry. In sum they appreciate, that in an educational system where the Bachelor still is exclusively seen as a preparation for masters' studies, such an internship ensures at least a certain orientation on professional fields. In so far the auditors welcome that in its statement on the draft report LUT announces the implementation of a new Bachelors course on employability skills. Taking the LUTs statement into account the auditors at this point see no need for urgent action. Nevertheless they strongly encourage the HEI to go on sharpening the profile of the Bachelor as a first professional and therefore Bologna-compliant degree. Therefore the HEI should establish the mentioned "job-market-module" as planned. Moreover, a stronger university-sided quality assurance of the internship as discussed in the preliminary assessment should be taken into account. The peer panel thinks this issued should revived on occasion of a re-accreditation and thus support a respective recommendation.

Taking the statement of the University into account the peers assess criterion 2 for all degree programs to be generally fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- LUT, Self-Assessment-Report
- University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- Written examinations and/or if applicable Information on case-/project-/study-works in "Moodle" for
    - "BM40A0101 Foundation of Information Processing" (in Finnish),
    - "BM40A0201 Foundation of Computer Science" (in Finnish)
    - "BM40A0301 Data Structures and Algorithms" (in Finnish)
    - "CT30A8904 Software Systems as a Service"
    - "CT60A5102 Models and Methods of Software Engineering"
    - "CS10A0261 Manageing International Business"
    - "CS30A1691 Social Sustainability"
    - "CS10A0863 Research Methods for Master Students"
    - "CS30A1372 Creative Design and Problem Solving",
- Inspection of Bachelor- and Master-Theses on April 5th 2017
- LUT "General Instructions On Writing A Bachelor´s Thesis/Computer Science"
- LUT "Degree Program in Industrial Engineering and Management. Bachelor Thesis and Seminar" (in Finnish only)
- Audit discussions April 4th – 5th 2017

Preliminary assessment and analysis of the peers:

Examination system

The auditors consider LUTs examination system to be well organized. For each academic year the examination periods are scheduled in advance. By offering three temporally dis-

tributed examination sessions for each module structural pressure can be avoided. The students confirm that the examination schedule is usually well balanced and allows enough time for preparation.

Examination methods

In all programmes under review LUT uses different forms of examination. Various methods, such as written and oral examination, project/seminar works, presentations or moodle-based electronic examinations are occasionally used in parallel and thus principally ensure a competence-based assessment.

Subsequent to the on-site-visit the HEI presents for all programmes under review a selection of written examination:
The peers understand that in the Industrial Engineering and Management programmes written examinations are usually not the only assessment method, but used in combination with project-/research reports. Thus, the presented examples should be seen in this broader context. Looking for example at the module "CS10A0261 Managing International Business" from the Bachelor Industrial Engineering and Management the written examination is mainly targeted on the inquiry of basic knowledge. In combination with a likewise required research report on a business case in an international context this approach appears to be reasonable. Also the topics of the case studies required for "CS30A1691 Social Sustainability" are characterized by a high level of reflection. Examples such as "CS10A0863 Research Methods for Master Students" indicate that in the Master programmes this approach is continued on a higher level.

The available written examinations in the Bachelor Computer Science are not fully aligned with level and intended learning outcomes as laid down in the related module descriptions. The description of the teaching unit "Data Structures and Algorithms", for example, comprises complex topics such as "complexity categories", "NP-completeness" or "random algorithms" that are not covered by the written examination. As a result, the auditors deem it necessary to better tailor the written examinations with qualification level and intended learning outcomes of the respective module. Compared with this, the written examinations in the Master Computer Science reflect the intended learning outcomes on an adequate level. The peers take note and appreciate that here again the assessment is often based on a combination of written exams and practical assignments or research reports.

During the on-site-visit the auditors get insights into a representative selection of final theses of all programmes under review. First of all, the peers determine that topics and implementation of the master theses adequately reflect the respective overall objectives as well as the intended qualification level. Compared with this, type and nature of the

final works of both bachelor programmes even look more like intermediate seminar papers than the final theses for a scientific degree. The inspected Bachelor´s theses in particular reveal the following shortcomings:

a.) Scientific methodology:
- Most samples do not discuss or contextualize specific questions and/or findings adequately
- The samples frequently refer only or mainly to online sources with no suitable scientific standard (such as Wikipedia);

b.) Scientific claim of the topics dealt with:
The topics dealt with often do not reflect the intended qualification profile. Just to name one example: A 20-sided literature review that is done by two candidates as conducted in the Bachelor Industrial Engineering and Management does not reach a level that is expected from a bachelor thesis.

These findings are all the more surprising as there are obviously guidelines in place that the set reasonable standards for the degree theses: For the Bachelor Computer Science the "General Instructions On Writing A Bachelor´s Thesis" for example declare a problem definition and delimitation within the current state of research, a methodological/empirical part and a discussion and further contextualization of the findings as fixed parts of the assignments. Relevant directives for the Bachelor Industrial Engineering and Management are existent as well but unfortunately only available in Finnish. Moreover, LUT presents an "Assessment Matrix" that should allow a thoroughly and, above all, scientific-standard-based valuation of the degree theses.

The auditors assume that the detected deficits can be led back to the fact that even in practice the Bachelor still isn´t seen as an independent scientific degree. In this matter it would be less remarkable that the Bachelor theses are designed as kind of "in-between-seminar-paper" and not as first manageable but individual scientific work. Even if the auditors are not eager to turn this "Finnish path" upside down, they emphasize that Finland is part of the Bologna Process and thus has to ensure that the Bachelor degrees are comparable with related programmes in the European Higher Education Area. In this respect they see the need to sharpen the profile of the Bachelor as a first independent scientific degree. In particular, the Bachelor thesis needs to be considered as an independent scientific work on an adequate level. As reasonable standards and guidelines already have been fixed anyway, the HEI should develop a resilient and binding concept on how the prospective quality of the degree theses in terms of methodology and scientific claim can be reliable assured.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

Examination methods

~ Written examinations in the Bachelor Computer Science

The auditors consider a shrewd combination of different examination methods as a fundamental strength of LUTs examination systems. However, especially in those courses where the written exam is used as single assessment method, it has to be ensured that such an exam is closely linked to the intended learning outcomes on an adequate level. In case of the Bachelor Computer Science a comparison of both sample exams with the corresponding module descriptions revealed that even major topics / complex competences were not covered by the examination. All in all the auditors keep up their preliminary assessment. They think LUT should urgently take care that the written examinations are thoroughly aligned on the qualification level and intended learning outcomes as laid down in the corresponding module description. The auditors deem it necessary to fix this issue in a short term and support a respective requirement.

~ Final Theses in the Bachelor Programmes

The auditors take note that the HEI strives to sharpen the scientific claim of the Bachelor theses. Raising the awareness of all supervisors for a consequent implementation of the respective standards and guidelines seems to be a first step in the right direction. However, the peers still see the need to develop a concrete concept on how the quality of prospective Bachelor theses can be reliable assured. The auditors think this concept should be developed in a short or even medium term and support a respective requirement.

The peers assess criterion 3 for the Masters Programmes Computer Science, Operations Management and Global Management of Innovation and Technology to be completely and for the Bachelors Programmes Industrial Engineering and Management and Computer Science to be partly fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- LUT, Self-Assessment-Report

- LUT, Staff-Handbook School of Business and Management
- Audit discussion April 4th-5th 2017

Preliminary assessment and analysis of the peers:
The five study programmes under review are run by LUT school of Business and Management. In total 21 professors and associate professors are involved the Industrial Engineering and Management- and six in the Computer Science-programmes. Moreover a considerable number of post-doctoral researchers and doctoral students participate in the teaching. The auditors assess the staffing level in principal to be sufficient. However, looking at the scientific orientation of the staff, they take note that the basic disciplines in the area of Computer Science are underrepresented. Thus, the specific courses are imported from the School of Engineering Science. The auditors learn that the universities management plans for the next years to implement a significant personnel growth of in total 40 professors / associate professors. As the teaching staff currently mainly consists of LUT graduates and persons from the wider Helsinki-Area, the peers strongly support the aim of the university management to internationalize the teaching staff. As a first step a recently launched four-level tenure track system and an international open search should better attract candidates from abroad.

Criterion 4.2 Staff development

Evidence:

- LUT Self-Assessment-Report
- Audit Discussions April 4th – 5th

Preliminary assessment and analysis of the peers:
The auditors learn that LUT offers differentiated possibilities for staff development. In the field of higher education didactics the HEI maintains a course portfolio directed to specific problems from the daily teaching practice, such as online learning, problem based learning or digitalization. Herby it is possible to offer individual tailored course packages. The participation on such offers is highly recommended by the university´s management and is demanded especially by the younger generation of teachers.

Criterion 4.3 Funds and equipment

- LUT, Self-Assessment-Report

- Audit discussion April 4th-5th 2017

Preliminary assessment and analysis of the peers:
The degree programmes under review are financed by budgetary resources of the university, founds of the Finnish Ministry of Education and third parties such as the Finnish Agency for Innovation (TEKES), private companies, the Academy of Finland and the European Union. According to the university´s management TEKES plays a major role amongst the external donors: TEKES, a network of companies, fosters in the area of industrial engineering research topics with relevance for the industry and thus indirectly influences the curricula.

Besides two computer rooms and the library the auditors get only little insights in the infrastructure relevant for the degree programmes under review: In particular, it remains to certain extend unclear where and how the engineering related parts of the Industrial Management-Programmes are conducted. Thus, the peers ask for more information about the laboratory equipment. The short descriptions of the relevant laboratory-units in particular should contain a specification of the students' working-places and existent devices.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

~ *Funds and equipment*

Together with its statement on the draft report the HEI presents an overview of the laboratory equipment that is used in the Industrial Engineering and Management Programmes. The auditors assess nature and extend of the laboratories to be suitable for an education on the intended qualification level. Insofar they see no need for further action.

Taking the statement of the HEI into account the auditors assess criterion 4 for all programmes to be completely fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- LUT, Self-Assessment-Report

- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- LUT UNI-Portal: Study Programs and Courses in English. Study Guide 2015-2016 (https://uni.lut.fi/en/c/document_library/get_file?uuid=262cffb3-fe5a-44ea-8408-d4a6e89757fa&groupId=10304 (11.04.2017))
- LUT UNI-Portal: School of Business and Management / Computer Science / Courses (https://uni.lut.fi/en/c/document_library/get_file?uuid=78fa17cd-7ec0-4916-b77a-75e69dc462c2&groupId=10304 (11.04.2017))
- LUT UNI-Portal: School of Business and Management / Industrial Engineering and Management / Courses (https://uni.lut.fi/en/c/document_library/get_file?uuid=f009be2e-b0f8-4400-875d-1748f5f26d85&groupId=10304 (11.04.2017))
- LUT UNI-Portal: Opinto-Oppaat (https://uni.lut.fi/opinto-oppaat1 (15.04.2017))
- Audit discussions April 4th – 5th 2017

Preliminary assessment and analysis of the peers:
Together with the SAR the HEI documents for each programme under review detailed module descriptions ("Study Guides"). The peers cannot comprehend whether these descriptions are actually published in the existing forms:

a.) Module descriptions at least of the English taught Master-Programmes Global Management of Innovation and Technology (headed as "Industrial Engineering and Management", though) and Computer Science are apparently part of the so called "Study-Guide" that is published online at "UNI-Portal" for the academic year 2015/16.

b.) On the "UNI-Portal" the auditors moreover find under the heading "Undergraduate Courses" for both areas Industrial Management and Engineering and Computer Science a clutter of descriptions where Bachelor and Master Courses are intermixed. Furthermore, it cannot immediately determined whether these texts depict the current status;

c.) Due to a respective hint on LUT´s English Webpage the auditors assume that the module descriptions of both Bachelor-Programmes and the Master Operations Management are published separately in a non English-part of the "UNI-Portal".

As shall be seen below in Chapter 5.3 the Auditors determine this presentation mode even for external parties and in particular those who are familiar with the Finnish language slightly difficult to comprehend.

Due to these uncertainties the following assessment of the peer panel is based on the module descriptions as presented together with the SAR:

To begin with, the Auditors determine that the data sheets principally contain all necessary information. However, the information value of the texts themselves widely varies and should be specified as follows:

a.) Although the descriptions differentiate between content and learning objectives, the latter are often hardly phrased as competences. This applies primary for the Master-Programmes were often used keywords such as "can", "learn" or "understand" do not reflect the intended qualification level properly;

b.) Especially in case of the Bachelor Computer Science it is striking that nature and extent of the specific learning content is often difficult to understand. The teaching units "Data Structures and Algorithms" or "Foundations of Information processes" for example encompass a wide range of topics that with a scope of only six credits most likely are only touched lightly;

c.) The description of the degree theses are in their present state rather generic and thus hardly meaningful. Precisely because the level of the Bachelor theses needs to be strengthen, the competences that should be obtained with this assessment form should be further worked out (cf. also chapter 3).

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- LUT, Self-Assessment-Report
- Section 23 University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- Sample Copy Diploma Supplement B.Sc. Industrial Engineering and Management

- Sample Copy Diploma Supplement M.Sc. Operations Management
- Sample Copy Diploma Supplement M.Sc. Global Management of Innovation and Technology
- Sample Copy Diploma Supplement B.Sc. Computer Science
- Sample Cops Diploma Supplement M.Sc. Computer Science
- Audit Discussions April 4th – 5th 2017

Preliminary assessment and analysis of the peers:
According to section 23 of the "University regulations" LUT includes an english Diploma Supplement in its undergraduate and postgraduate degree certificates. The Diploma Supplement should contain information on the university, individual results and how they compare to other studies within the educational system. The provision of statistical data according to ECTS Users Guide in addition to the final grade is not explicitly intended.

Sample Copies of the Degree Certificates are not available and should be handed in later for each degree programmes under review.

Together with the SAR the HEI provides for each programme under review specific example copies of the Diploma Supplement. The peers take note that the documents neither contain any information about the overall objectives of the respective degree programmes nor the courses completed or the individual results. Statistical data for a categorization of individual results aren't shown either. Insofar the auditors point out that the Diploma Supplement needs to contain detailed information about the educational objectives, intended learning outcomes and the individual performance of the student. Moreover, it has to be ensured that statistical data according to ECTS-Users guide in addition to the final grade are shown as well.

Criterion 5.3 Relevant rules

Evidence:

- LUT, Self-Assessment-Report
- University Regulations on Education and the Completion of Studies. Approved on 22 June 2016
- LUT UNI-Portal: Instructions and Regulations (https://uni.lut.fi/en/web/lut.fi-eng/instructions-and-regulations (12.04.2017))
- LUT UNI-Portal: Study-Guides (https://uni.lut.fi/en/web/lut.fi-eng/study-guides9 (12.04.2017))

- LUT UNI-Portal: Opinto-Oppaat (https://uni.lut.fi/opinto-oppaat1 (15.04.2017))
- Study-Guide B.Sc. Industrial Engineering and Management (as provided with the SAR)
- Study-Guide M.Sc. Operations Management (as provided with the SAR)
- Study-Guide M.Sc. Global Management of Innovation and Technology (as provided with the SAR)
- Study-Guide B.Sc. Computer Science (as provided with the SAR)
- Study-Guide M.Sc. Computer Science (as provided with the SAR)
- Audit Discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:
The auditors learn that the overall structure of degree programmes at LUT is governed by the "University Regulations". This document contains very general framework-conditions on admission procedures, aims and structure of Bachelor- and Master-Programmes, the organisation of examination and so on. These regulations are operationalised by the "schools", that decide about the implementation of specific degree programmes largely independently. The "University Regulations" are publically available on LUTs website.

The peers understand that study regulations on programme-level, are unknown in Finland. Instead, the academic board fixes every year "study guides" that contain information about learning objectives and the courses offered. Also because individual study plans are prepared for the entire education in advanced, the auditors wonder whether this system guarantees a certain liability of the study structure. The peers learn that the course portfolio isn´t subject to major changes normally. Furthermore, LUT guarantees all students that he/she can award the desired degree. If a specific course is cancelled by the academic board, it is ensured that adequate alternatives are offered. The students confirm the functionality of this approach. As significant uncertainties regarding the course portfolio are obviously unknown, the auditors see no need for further action.

The "study guides" provided together with the SAR have been obviously worked up for the purpose of the accreditation procedure. Information about the overall objectives of the degree programmes are missing, but are laid down in the "study guides" presented at the Universities website, at least for the English taught master programmes.

As already has been noted above it is nevertheless striking that the English parts of LUTs Website exclusively refer to the English taught Master programmes. Even if the auditors assume that the Finnish taught programmes are presented separately, they assess this presentation mode to a certain extend opaque. For external parties and in particular

those who are not familiar with either the English or the Finnish language, it needs considerable efforts to get a complete overview about LUTs teaching offers. Precisely because LUT aims at a further internationalization the peers strongly recommend preparing a joint online-presence for both English and Finnish taught degree programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

Criterion 5.1 Module descriptions

The auditors take note that LUT plans to revise the module descriptions according to the shortcomings mentioned in their preliminary assessment. They think the result should be checked in a short term and support a respective requirement.

Criterion 5.2 Diploma Supplements

The Auditors take note that the diploma supplements will be updated on the university level. As the diploma supplement according to European Standards is meant to support international mobility of students they underline the necessity that such documents not only reveal the learning objectives (what is obviously planed anyway), but also the individual performance (i.e. the final grade) and in addition statistical data according to ECTS Users Guide. The Auditors think the revision of the diploma supplement should be checked in a medium term and support a respective requirement.

Together with LUTs statement the peers receive for all study programs under review sample copies of the degree certificates and transcripts of records. As all documents contain the necessary information the auditors see no need for further action.

Criterion 5.3 Relevant Rules

The auditors totally agree with LUT that the public presentation of degree programs should be in the language of instruction. However, in the present case the presentation of the English and Finnish programs are totally separated. Insofar they think a reference on the English Webpage to the Finish programs and vice versa would facilitate the orientation on and, as a result, the transparency of LUTs Website. The auditors suggest revising the website in this respect and support a respective recommendation.

The auditors assess criterion 5 for all degree programs to be partly fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- LUT, Self-Assessment-Report
- LUT, Quality Manual Version 5.0
- LUT Course-Feedback Questionnaire
- LUT „Performances of Programs indicators 2014-2016“ Computer Science/Industrial Engineering and Management
- LUT “Alumni Career Survey”/further information on Chart 2 “Unemployment after graduation”
- Audit discussions April 4th-5th 2017

Preliminary assessment and analysis of the peers:
LUT maintains a structured quality management system (QMS). Processes and responsibilities are laid down in the “LUT Quality Manual”. The QMS has passed an external audit of the Finnish Education Evaluation council.

The auditors see that at LUT several quality assurance tools are in use:

Every teaching unit is evaluated by the students periodically. The survey is based on ten overall questions that are individually supplemented by course-specific issues. The results are provided to the affective teacher, the programme-manager and, in aggregated form, to the dean. In case of a repeated negative assessment of a teacher the programme-manager informs the dean, who seeks the personal dialogue with the person concerned. In the worst case a continuous negative assessment may affect payment and resources of the teacher affected. The results of the course evaluation are internally considered for the further development of the programmes. Moreover, the teachers are required to discuss the findings with their students.

For the Master programmes alumni surveys are conducted on a regular basis. Besides data on graduates’ career during the first five years after leaving the universities, these surveys primary collect a retrospective assessment of the teaching conditions.

LUT finally collects so called “performance of programs indicators” (such as applicants/acceptance rate, satisfactory level of students (aggregated), employment rates etc.). That data on average study durations and drop-out rates should be (as far as possible) considered as well has been discusses in chapter 2.1.

The auditors gain the impression that the QMS is largely suitable for a continuous development of teaching and learning. The students confirm this assessment. They underline that their feedback provided not only in the course evaluation and other discussion rounds but also in all relevant committees is highly appreciated and taken seriously into account.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

Statistical Data on study durations and drop-out-rates

Cf. Final Assessment regarding criterion 2.1

The auditors assess criterion 6 for all degree programs to be principally fulfilled.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

D 1. Short descriptions of the laboratories used in the Bachelor Industrial Engineering and Management and the Masters Operations Management and Global Management of Innovation and Technology. These descriptions should include information on working-places and devices;

D 2. Programme Specific samples of the degree certificates

E Comment of the Higher Education Institution (26.05.2017)

The institution provided a detailed statement as well as the following additional documents:

- For all degree programmes: Programme-Specific examples of degree certificates and transcript of records
- Short descriptions of the laboratories used in the Bachelor Industrial Engineering and Management and the Masters Operations Management and Global Management of Innovation and Technology

The peers refer to the institutions statement in their final assessment.

F Summary: Peer recommendations (01.06.2017)

Taking into account the additional information and the comments given by Lappeenranta University of Technology the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific Label	Maximum duration of accreditation
Ba Industrial Management and Engineering	With requirements	n/a	30.09.2023
Ma Operations Management	With requirements	n/a	30.09.2023
Ma Global Management of Innovation and Technology	With requirements	n/a	30.09.2021
Ba Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024
Ma Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024

Requirements

For all study programs

A 1. (ASIIN 5.1.) Revise the module descriptions according to the comments made in the report (distinction between content and learning objectives, realistic description of the respective level of competences, further elaboration of the descriptions of the final theses).

A 2. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the educational objectives, intended learning outcomes, the structure and the academic level of the degree programme as well as about the individual performance (final grade) of the student. Moreover, provide statistical data according to the ECTS Users‘ guide in addition to the final grade.

For the Bachelor`s degree programmes

A 3. (ASIIN 3) Sharpen the profile of the Bachelor`s degree as a first scientific degree. In particular, the Bachelor thesis needs to be designed as a first independent scientific work on an adequate level. Therefore develop and execute a resilient and binding concept on how the quality of the final theses in terms of methodology and scientific claim can be assured.

For the Bachelor Industrial Engineering and Management, Master Operations Management, Master Global Management of Innovation and Technology

A 4. (ASIIN 1.1) Revise the educational objectives and learning outcomes so that they describe the academic, subject-specific and professional classification of the qualifications gained in the degree programme. In particular, include engineering related competences (Master Operations Management) and integrative competences at the interface of business and management on an adequate level (Bachelor Industrial Engineering and Management, Master Operations Management). Verify that the latter is implemented within the curricula properly. Make these educational objectives and learning outcomes available to all relevant stakeholders.

For the Bachelor and Master Computer Science

A 5. (ASIIN 1.1) Revise the educational objectives and learning outcomes so that they describe the academic, subject-specific and professional classification of the qualifications gained in the degree programme. Make these educational objectives and learning outcomes available to all relevant stakeholders.

A 6. (ASIIN 1.1; 1.2; 1.3) Harmonize the name of the degree programmes, the learning objectives and the curricula:

a) If the present focus on “software engineering” is kept up, reflect this focus in the name of the degree programme as well. In accordance with the overall objectives, deepen the knowledge in the field of modeling tools on the Bachelor´s level;

b) If the present name “Compute Science” is kept up, ensure that the programmes impart competences in the field of theoretical and technical in-

formatics and deepen the knowledge in the field of modeling tools on the Bachelor´s level.

For the Bachelor Computer Science

A 7. (ASIIN 3) Better tailor the written examinations with qualification level and intended learning outcomes of the respective module.

Recommendations

For all study programs

E 1. (ASIIN 2; 6) It is recommended to collect statistical data on the average length of studies and drop-out rates. Statistical conspicuities should be followed up and be used for a further improvement of the feasibility of the course of studies.

E 2. (ASIIN 5.3) It is recommended to improve the transparency of LUTs online-appearance.

For the Bachelor programmes

E 3. (ASIIN 2.1) In order to sharpen the profile of the Bachelor as a first professional degree it is recommended to improve the university-sided quality assurance of the internships. Moreover, the course on employability skills should be established as planned.

For the Bachelor Industrial Engineering and Management, Master Operations Management and Master Global Management of Innovation and Technology

E 4. (AR 2.3) It is recommended to replace the minor “computer science” by a more engineering-specific subject.

For the Bachelor/Master Computer Science

E 5. (ASIIN 1.3) It is recommended to integrate aspects of software and systems security and software verification (e.g. model checking and testing) into the curricula.

For the Bachelor Computer Science

E 6. (ASIIN 1.3) It is recommended to strengthen the practical parts of the curriculum. In particular, a longer industry project with a strong relation to the field of the aspired profession should be included.

For the Master Computer Science

E 7. (ASIIN 1.3) It is recommended to allow the students setting contend related priorities.

G Comment of the Technical Committees

Technical Committee 04- Computer Science (21.06.2017)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure controversially, eventually agreeing in majority to follow the peer's recommendations. Concerning the requirements three and seven as well recommendation three the TC decides to follow the alternative formulation.

Analysis and Assessment concerning the award of the Euro-Inf® Label:

The Technical Committee is of the opinion that the learning outcomes aimed for do not (yet) correspond with the Subject Specific Criteria of the Technical Committee 04 – Informatics. Following the peer's advice it will be decided on the award of the Euro-Inf® Label after the fulfilment of the requirements.

The 04 – Computer Science recommends the award of the seals as follows:

Degree Programme	**ASIIN seal**	**Subject-specific Label**	**Maximum duration of accreditation**
Ba Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024
Ma Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024

A 3. (ASIIN 3) The Bachelor Thesis needs to be designed as an independent scientific work on an adequate level. Therefore a resilient and binding process on how the quality if the final thesis in terms of methodology and scientific standard can be assured, needs to be developed and executed.

A 7. (ASIIN 3) Make sure that the level of the written examinations is properly aligned with the intended learning outcomes.

E 3. (ASIIN 2.1) It is recommended to strengthen the quality of the internship by extending its length and connecting it to the field of studies.

Technical Committee 06- Industrial Engineering (13.06.2017)

Assessment and analysis for the award of the ASIIN seal:

The technical committee discusses the procedure. It follows the proposal of decision in all aspects concerning the Bachelor Industrial Engineering and the Master Programms Operations Management and Global Management of Innovation and Technology unchanged.

The Technical Committee 06 – Industrial Engineering recommends the award of the seals as follows:

Degree Programme	**ASIIN seal**	**Subject-specific Label**	**Maximum duration of accreditation**
Ba Industrial Management and Engineering	With requirements	n/a	30.09.2023
Ma Operations Management	With requirements	n/a	30.09.2023
Ma Global Management of Innovation and Technology	With requirements	n/a	30.09.2021

A Decision of the Accreditation Commission (30.06.2017)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The Accreditation Commission intensively discusses the at least still unfinished implementation of the Bachelor degree as a first cycle degree on its own. Concerning the scientific claim of the bachelor theses it fully supports the assessment of the peer panel. However, to better stress the issue the commission decides minor editorial changes to the respective requirement 4. As to the status of the Bachelors as first professional degrees the commission determines to focus the respective recommendation 3 on the internship, using the same wording as in the other LUT clusters.

To harmonize the final resolution with the other procedures at LUT, the accreditation commission moreover decides to cover the recommended monitoring of statistical data on study progress by a requirement.

Despite further editorial modifications to requirements 7 and 8 the accreditation commission confirms the proposal for a decision of the peer panel and the technical committees in all other aspects.

Assessment and analysis for the award of the Euro-Inf® Label:

The accreditation commission determines that the learning outcomes and curricula contents of the Bachelor and Master Computer Science do not (yet) correspond with the Subject-Specific Criteria of the technical committee 04 – Informatics. Following the proposal for a decision of the peers and the technical committee it postpones the decision about the award of the Euro-Inf®-Label until the Universities decision about the future direction of the programmes in the course of the fulfilment of requirements.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	**ASIIN seal**	**Subject-specific Label**	**Maximum duration of accreditation**
Ba Industrial Management and Engineering	With requirements	n/a	30.09.2023
Ma Operations Management	With requirements	n/a	30.09.2023

Degree Programme	ASIIN seal	Subject-specific Label	Maximum duration of accreditation
Ma Global Management of Innovation and Technology	With requirements	n/a	30.09.2021
Ba Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024
Ma Computer Science	With requirements	Euro-Inf® (Decision postponed until fulfilment of requirements)	30.09.2024

Requirements

For all study programs

A 1. (ASIIN 5.1.) Revise the module descriptions according to the comments made in the report (distinction between content and learning objectives, realistic description of the respective level of competences, further elaboration of the descriptions of the final theses).

A 2. (ASIIN 5.2) Ensure that the Diploma Supplement contains information about the educational objectives, intended learning outcomes, the structure and the academic level of the degree programme as well as about the individual performance (final grade) of the student. Moreover, provide statistical data according to the ECTS Users‘ guide in addition to the final grade.

A 3. (ASIIN 6) Provide a concept for a systemic monitoring of the study progress and its intended use for the development of the degree programmes. This should include meaningful cohort-wise statistical data concerning the graduation rate, the drop-out rate, the examination failure rate and the duration of study. Prove evidence that first steps of its implementation have been taken.

For the Bachelor`s degree programmes

A 4. (ASIIN 3) The Bachelor Thesis needs to be designed as an independent scientific work on an adequate level. Therefore a resilient and binding process on how the quality if the final thesis in terms of methodology and scientific standard can be assured, needs to be developed and executed.

For the Bachelor Industrial Engineering and Management, Master Operations Management, Master Global Management of Innovation and Technology

A 5. (ASIIN 1.1) Revise the educational objectives and learning outcomes so that they describe the academic, subject-specific and professional classification of the qualifications gained in the degree programme. In particular, include engineering related competences (Master Operations Management) and integrative competences at the interface of business and management on an adequate level (Bachelor Industrial Engineering and Management, Master Operations Management). Verify that the latter is implemented within the curricula properly. Make these educational objectives and learning outcomes available to all relevant stakeholders.

For the Bachelor and Master Computer Science

A 6. (ASIIN 1.1) Revise the educational objectives and learning outcomes so that they describe the academic, subject-specific and professional classification of the qualifications gained in the degree programme. Make these educational objectives and learning outcomes available to all relevant stakeholders.

A 7. (ASIIN 1.1; 1.2; 1.3) Harmonize the name of the degree programme, the learning objectives and the curricula along the indications given in the report.

For the Bachelor Computer Science

A 8. (ASIIN 3) Make sure that the level of the written examinations is properly aligned with the intended learning outcomes.

Recommendations

For all study programs

E 1. (ASIIN 2; 6) It is recommended to collect statistical data on the average length of studies and drop-out rates. Statistical conspicuities should be followed up and be used for a further improvement of the feasibility of the course of studies.

E 2. (ASIIN 5.3) It is recommended to improve the transparency of LUTs online-appearance.

For the Bachelor programmes

E 3. (ASIIN 2.1) It is recommended to strengthen the quality of the internship by extending its length and connecting it to the field of studies in order to strengthen the profile of the Bachelor as a first professional degree.

For the Bachelor Industrial Engineering and Management, Master Operations Management and Master Global Management of Innovation and Technology

E 4. (AR 2.3) It is recommended to replace the minor “computer science” by a more engineering-specific subject.

For the Bachelor/Master Computer Science

E 5. (ASIIN 1.3) It is recommended to integrate aspects of software and systems security and software verification (e.g. model checking and testing) into the curricula.

For the Bachelor Computer Science

E 6. (ASIIN 1.3) It is recommended to strengthen the practical parts of the curriculum. In particular, a longer industry project with a strong relation to the field of the aspired profession should be included.

For the Master Computer Science

E 7. (ASIIN 1.3) It is recommended to allow the students setting content related priorities.

Appendix: Programme Learning Outcomes and Curricula

The publication status of the **objectives** and **learning outcomes (intended qualifications profile)** that shall be achieved shall be achieved by the Bachelor degree programme Industrial Engineering and Management remains unclear.

The following **curriculum** is presented:

1st year Compulsory studies	**1. period**	op	**2. period**	op	**3. period**	op	**4. period**	op	**Workload of studies, 1st academic year**
	CS90A0002 Introduction to Studying Industrial Engineering and Management		CS90A0002 Introduction to Studying Industrial Engineering and Management		CS90A0002 Introduction to Studying Industrial Engineering and Management	2	CS90A0002 Introduction to Studying Industrial Engineering and Management	1	
	CS90A0012 Basic Course in Business and Management	1	CS90A0012 Basic Course in Business and Management	2	CS30A0952 Innovation and Technology Management: a Basic Course	3	CS30A0952 Innovation and Technology Management: a Basic Course	3	
	LM10A3000 Introduction to Office Software	3	LM10A2000 Introduction to Information Systems	3	CS20A0002 Basic Course in Supply Chains and Operations Mgnt	6			
					Swedish for technology/business		Swedish for technology/business	2	
	CT60A0201 Introduction to Programming	3	CT60A0201 Introduction to Programming	3	English Communication for Engineering professionals	2	English Communication for Engineering professionals	2	
	BM20A5800 Functions, Linear Algebra and Vectors	3	BM20A5810 Differential Calculus and Applications	4	Business/technology communication in Finnish		Business/technology communication in Finnish	3	
	BM30A2600 Basics of	4	BM30A2700 Basics of	3	BM30A2900 Wave Motion	3	BM30A3000 Electricity	4	

	Mechanics		Thermal Physics		and Wave Phenomena		and Magnetism		
TOTAL cr	*1 period*	14	*2 period*	15	*3 period*	16	*4 period*	15	60
Elective studies									0
TOTAL cr	*1 period*	14	*2 period*	15	*3 period*	16	*4 period*	15	60
2nd year Compulsory studies	**1. period**	op	**2. period**	op	**3. period**	op	**4. period**	op	**Workload of studies, 2nd academic year**
	CS31A0102 Basic Course in Cost Management	6	A250A0250 Basic Course in Financial Accounting	6	CT60A4002 Software Engineering	3	CT60A4002 Software Engineering	3	
	CS10A0010 Basics of Marketing	3	CS10A0010 Basics of Marketing	3	LM10A1000 Project Management	3	LM10A1000 Project Management	3	
	BM20A1401 Statistics I	1	BM20A1401 Statistics I	2					
	BM20A1410 Statistics		BM20A1410 Statistics	1					

	Assignment		Assignment						
	Minor studies in technology	3			Minor studies in technology	6	Minor studies in technology	2	
TOTAL cr	*1 period*	13	*2 period*	12	*3 period*	12	*4 period*	8	45
Elective studies	A250A0750 Financial Statement Analysis	3	A250A0750 Financial Statement Analysis	6	A250A0160 Introduction to Environmental Economics	3	CS20A0112 Teamwork in Organizational Development	3	15
	A130A0400 Qualitative Research Method				A250A1051 Fundamentals of Corporate Finance		CS30A1461 Risk Management in Industrial Company		
					A130A0650 Basics of Statistical Research		A130A0650 Basics of Statistical Research		
TOTAL cr	*1 period*	16	*2 period*	18	*3 period*	15	*4 period*	11	60

3rd year Compulsory studies	**1. period**	op	**2. period**	op	**3. period**	op	**4. period**	op	**Workload of studies, 3rd academic year**
	CS20A0201 Coordination in Supply Chain	6	CS20A0060 Advanced Course in Supply Chain Management	6	CS31A0051 Management Game	3	CS31A0051 Management Game	3	
	CS30A1612 Strategic Planning and Management	3	CS30A1612 Strategic Planning and Management	3	CS90A0120 Bachelor's Thesis and Seminar	5	CS90A0120 Bachelor's Thesis and Seminar	5	
							CS90A0016 Work Internship in Bachelor's Degree	2	
	Minor studies in technology	3	Minor studies in technology	3	Minor studies in technology	3			
	Elective studies		Elective studies		Elective studies				
TOTAL cr	*1 period*	12	*2 period*	12	*3 period*	11	*4 period*	10	45
Elective studies	CS30A0961 Creating and Managing Business Networks	3	CS30A0961 Creating and Managing Business Networks	3	CS20A0201 Coordination in Supply Chain	6	CS30A1691 Social Sustainability	3	15

			CS10A0261 Managing International Business				CS31A0551 Productivity in Industrial Enterprise		
	A250A0800 Financial Statement Planning		A250A0800 Financial Statement Planning		A250A0800 Financial Statement Planning		CS30A1560 Finnish Labour Market		
TOTAL cr	*1 period*	15	*2 period*	15	*3 period*	17	*4 period*	13	60

The publication status of the **objectives** and **learning outcomes (intended qualifications profile)** that shall be achieved by the Master degree programme Operations Management remains unclear.

The following **curriculum** is presented:

Workload/ MSc in Operations Mgnt/ SCM 1. Academic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the first academic year**
	CS20A0303 Strategic Improvement of Operations	6			CS20A6072 Sustainable Business Models	6			
Compulsory studies, sum	*1 period*	6	*2 period*	0	*3 period*	6	*4 period*	0	12
Elective / optional cours-	Choose minor/optional/elective studies	9	Choose minor/optional/elective studies	15	Choose minor/optional/elective studies	9	Choose minor/optional/elective courses	15	48

es / ex-change studies (ECTS)									
All stu-dies, sum	*1 period*	15	*2 period*	15	*3 period*	15	*4 period*	15	60
Work-load MSc in Opera-tions Mgnt/ SCM 2. Aca-demic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Work-kload of stud-ies in the se-con-d aca-dem-ic year**
	CS20A0400 Supply Chain Improvement Project	4	CS20A0400 Supply Chain Im-provement Project	4	CS90A0060 Master's Thesis	15	CS90A0060 Master's Thesis	15	
			CS20A0251 Decision-Making and Expert Work in Supply Chain De-velopment	6					

Compulsory studies, sum	*1 period*	4	*2 period*	10	*3 period*	15	*4 period*	15	44
Elective / optional courses / exchange studies (ECTS)	Choose minor/optional/elective studies	11	Choose minor/optional/elective studies	5					16
All studies, sum	*1 period*	15	*2 period*	15	*3 period*	15	*4 period*	15	60

Workload/ MSc in Operations Mgnt/ Cost Mgnt 1. Academic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the first academic year**
	LM10A4000 Strategic Management Accounting and Cost Management	3	LM10A4000 Strategic Management Accounting and Cost Management	3		6			
	CS31A0610 Life-Cycle Costing of Investment Projects	3	CS31A0610 Life-Cycle Costing of Investment Projects	3		3			
			CS31A0351 Performance Measurement Systems	6					
Compulsory studies, sum	*1 period*	6	*2 period*	12	*3 period*	9	*4 period*	0	27
Elective /	Choose minor/optional/elective courses	9	Choose minor/optional/elective courses	3	Choose minor/optional/elective	6	Choose minor/optional/elective	15	33

optional courses / exchange studies (ECTS)					courses		courses		
All studies, sum	*1 period*	15	*2 period*	15	*3 period*	15	*4 period*	15	60
Workload/ MSc in Operations Mgnt/ Cost Mgnt 2. Academic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the second academic**
					CS90A0060 Master's Thesis	15	CS90A0060 Master's Thesis	15	
					CS31A0302 Seminar of Cost Management	3	CS31A0302 Seminar of Cost Management	3	

									year
Compulsory studies, sum	*1 period*	0	*2 period*	0	*3 period*	18	*4 period*	18	36
Elective / optional courses / exchange studies (ECTS)	Choose minor/optional/elective courses	12	Choose minor/optional/elective courses	12					24
All studies, sum	*1 period*	12	*2 period*	12	*3 period*	18	*4 period*	18	60

Workload/ MSc in Operations Mgnt/ SYE 1. Academic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the first academic year**
			CS30A1630 System modelling	6	CS30A1391 Systems Engineering	3	CS30A1391 Systems Engineering	3	
							CS30A7370 Simulation Modelling in Industrial Management	3	
Compulsory studies, sum	*1 period*	0	*2 period*	6	*3 period*	3	*4 period*	6	15
Elective / op-	Choose minor/optional/elective courses	15	Choose minor/optional/elective courses	9	Choose minor/optional/elective courses	12	Choose minor/optional/elective courses	9	45

tional courses / ex-change studies (ECTS)									
All stu-dies, sum	*1 period*	15	*2 period*	15	*3 period*	15	*4 period*	15	60
Work-load/ MSc in Opera-tions Mgnt/ SYE 2. Aca-demic year	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Work-load of stud-ies in the se-cond aca-demic year**
			CS90A0060 Master's Thesis	5	CS90A0060 Master's Thesis	15	CS90A0060 Master's Thesis	10	
							CS30A1570 Complex Systems	6	
				3					

Compulsory studies, sum	*1 period*	0	*2 period*	8	*3 period*	15	*4 period*	16	39
Elective / optional courses / exchange studies (ECTS)	Choose minor/optional/elective courses	15	Choose minor/optional/elective courses	6					21
All studies, sum	*1 period*	15	*2 period*	14	*3 period*	15	*4 period*	16	60

According to “Study-Guide 2015-16” the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Global Management of Innovation and Technology:

“LUT Industrial Engineering and Management educates knowledgeable, business oriented students devoted to their own special subjects of technology and management for the service of industrial companies, and commercial and public organisations. The graduates from Industrial Engineering and Management have a good understanding of technology, wide business knowledge, and a strong competence in the management and development tasks of a company. They have an ability to work in an international context, and act in a responsible and ethical way. They can and will further develop and enhance their own competencies.

After completing the degree, the graduate can

- create and analyse strategies within an international context relating to products, services and technologies
- practice and manage strategies of decision making, frameworks and tools in a global networks and markets
- analyse processes and structures of organisations and their development issues
- practice, plan and manage the build-up of product families, product systems, and product platforms for tangible and intangible goods using widely different management methods in companies and networks
- plan and manage international business
- apply theories, methods and tools of decision making and analysis to practical management activities.

Programme-specific Information

International studies combined with engineering and business management skills and a multi-cultural study environment provide graduates with interesting and challenging career prospects. Global customer-supplier relationships and business networks demand talented young professionals in management of innovations and technologies, industrial marketing, management of sales, supply chain management and technology sourcing. Master of Science graduates with an engineering and management background and a strong ability and will to continue learning after graduation will have many career opportunities at the executive level of management as well as in global technology and business. Graduates from the degree programme of Industrial Engineering and Management have been employed e.g. as export managers, key account managers, logistics managers, controllers, analysts, business application specialists, operative purchasers, technology innovation managers etc. The studies also give graduates a firm basis for doctoral studies in the field of industrial engineering and management.”

1. Academic year Compulsory courses in MSc degree	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the first academic year**
	CS10A0120 Introduction to M.Sc. Studies in Industrial Engineering and Management	1			CS30A1341 Strategic Technology and Innovation Management	3	CS30A1341 Strategic Technology and Innovation Management	3	
	CS30A1376 Product Development	3	CS30A1376 Product Development	3	FV11A9800 Academic Writing in English Course 1	2	FV11A9900 Academic Writing in English Course 2	2	
	CS34A0401 Strategic Entrepreneurship in an Age of Uncertainty	6	A330A0251 Internationalisation of the Firm	3	A330A0251 Internationalisation of the Firm	3			
	CS30A1372 Creative Design and Problem Solving	3	CS30A1372 Creative Design and Problem Solving	3					
Compulsory studies, sum	*1 period*	13	*2 period*	9	*3 period*	8	*4 period*	5	35

Elective / optional courses / exchange studies (ECTS)	CS10A0270 Economic Challenges in Russia	3		6	CS10A0152 International Business Networks	6		10	25
	CS30A1601 Case Course in Strategy Consulting		CS30A1601 Case Course in Strategy Consulting		CS10A0760 Business in Russia				
	BK50A4000 Production Processes in Modern Job Shops		BK50A4000 Production Processes in Modern Job Shops		CS30A1655 Advanced Course in Strategic Management		CS30A1655 Advanced Course in Strategic Management		
					CS30A1671 Service Innovation and Management		CS30A1671 Service Innovation and Management		
					BK50A4400 Fabrication Laboratory		BK50A4400 Fabrication Laboratory		
					BK50A4100 Manufacturing Systems and Scheduling		BK50A4100 Manufacturing Systems and Scheduling		
All studies, sum	*1 period*	16	*2 period*	15	*3 period*	14	*4 period*	15	60
2. Academic year Com	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in**
	CS10A0863 Research Methods for Master	3	CS10A0863 Research Methods for Master Stu-	3	CS10A0875 Industrial	3			

pulsory courses in MSc degree	Students		dents		Project Management				**the second academic year**
	CS30A1661 Open Innovation	3	CS30A1661 Open Innovation	3	CS90A0060 Master's Thesis	9	CS90A0060 Master's Thesis	12	
	CS90A0060 Master's Thesis	2	CS90A0060 Master's Thesis	3					
Compulsory studies, sum	*1 period*	8	*2 period*	9	*3 period*	12	*4 period*	12	41
Elective / optional courses /		6	CS30A1552 System Dynamics and Industrial Management	7	CS10A0885 Research Project in Industrial Management	3	CS35A0153 Product Lifecycle Management	3	19
					CS30A1391 Systems Engineering		CS30A1391 Systems Engineering		
	CS30A7402 Software and Application		CS30A7402 Software and						

ex-change studies (ECTS)	Innovation BK50A4200 Product Flow in Job Shops BK50A4300 Managing Job Shops		Application Innovation BK50A4200 Product Flow in Job Shops BK50A4300 Managing Job Shops						
All studies, sum	*1 period*	14	*2 period*	16	*3 period*	15	*4 period*	15	60

The publication status of the **objectives** and **learning outcomes (intended qualifications profile)** that shall be achieved by the Bachelor degree programmeComputer Science remains unclear.

The following **curriculum** is presented:

1. Academic year Compulsory courses in BSc degree	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	Workload of studies in the first academic year
	CT10A0102 Introduction to Studying Computer Science		CT10A0102 Introduction to Studying Computer Science		CT10A0102 Introduction to Studying Computer Science		CT10A0102 Introduction to Studying Computer Science	3	
	LM10A2000 Introduction to Information Systems	3	LM10A3000 Introduction to Office Software	3	CS30A0952 Innovation and Technology Management: a Basic Course	3	CS30A0952 Innovation and Technology Management: a Basic Course	3	
	BM20A5800 Functions, Linear Algebra and Vectors	3	BM20A5810 Differential Calculus and Applications	4	FV13A1200 Swedish for Technology Students 3 or 4 per	3	FV13A1200 Swedish for Technology Students 3 or 4 per		
	CS90A0012 Basic Course in Business and Management	1	CS90A0012 Basic Course in Business and Management	2	CT30A2802 User Interfaces and User-Centric Design	3	CT30A2802 User Interfaces and User-Centric Design	3	
	CT60A0201 Introduction to Programming	3	CT60A0201 Introduction to Programming	3	BM40A0101 Foundations of Information Processing	3	BM40A0101 Foundations of Information Processing	3	
	BM40A0101 Foundations of Information Processing	3	BM40A0101 Foundations of Information Processing	3	CT60A0220 Principles of C-Programming and Testing	3	CT60A0220 Principles of C-Programming and Testing	3	
Compulsory	*1 period*	13	*2 period*	15	*3 period*	15	*4 period*	15	58

stu-dies, sum									
Elec-tive / op-tional cours es / ex-chan ge stud-ies (ECTS)	Basics of Linux 1-3 per.	2							2
	1 period	15	*2 period*	1 5	*3 period*	1 5	*4 period*	1 5	60
2.	**1. period**	op	**2. period**	o	**3. period**	o	**4. period**	o	Wor

Academic year Compulsory courses in BSc degree				p		p		p	kload of studies in the second academic year
	BM20A1401 Statistics I	1	BM20A1401 Statistics I	2	CT60A4002 Software Engineering	3	CT60A4002 Software Engineering	3	
	BM20A1410 Statistics Assignment		BM20A1410 Statistics Assignment	1	LM10A1000 Project Management	3	LM10A1000 Project Management	3	
	CS31A0102 Basic Course in Cost Management	6			FV18A2800 Finnish Spoken and Written Communication for Engineers	3			
	BM40A0301 Data Structures and Algorithms	3	BM40A0301 Data Structures and Algorithms	3	English Communication for Engineering Professionals 2-3 vsk	2	English Communication for Engineering Professionals (lask. 2, lukkariin 2)	2	
	CT30A3370 Operation Systems and System Programming	3	CT30A3370 Operation Systems and System Programming	3	CT60A4302 Databases	3	CT60A4302 Databases	3	
	CT60A2411 Object-Oriented Programming	3	CT60A2411 Object-Oriented Programming	3					
			BM20A1501 Numerical Methods I	3					
Compulsory studies,	*1 period*	16	*2 period*	15	*3 period*	14	*4 period*	11	56

sum									
Elective / optional courses / exchange studies (ECTS)					Elective studies	4			4
All studies, sum	*1 period*	16	*2 period*	15	*3 period*	18	*4 period*	11	60
3. Academic year Com-	**1. period**	op	**2. period**	op	**3. period**	op	**4. period**	op	Workload of studies in
	CT30A3202 Webbed Applications	3	CT30A3202 Webbed Applications	3	English Communication for Engineering Professionals 2-3 vsk		English Communication for Engineering Professionals 2-3 vsk		

pulsory courses in BSc degree					CT30A3401 Distributed Systems	6	CT10A0400 Work Internship in Bachelor's Degree 1-3 vsk	2	the third academic year
					Research/Industry Forum in Software Technology and Engineering		Research/Industry Forum in Software Technology and Engineering	6	
	FV18A4001 Scientific Writing in Finnish	2	FV18A4001 Scientific Writing in Finnish		FV18A4001 Scientific Writing in Finnish		FV18A4001 Scientific Writing in Finnish		
	CT10A4000 Bachelor's Thesis and Seminar		CT10A4000 Bachelor's Thesis and Seminar	2	CT10A4000 Bachelor's Thesis and Seminar	3	CT10A4000 Bachelor's Thesis and Seminar	5	
	Minor studies	9	Minor studies	9	Minor studies	6			
Compulsory studies, sum	*1 period*	14	*2 period*	14	*3 period*	15	*4 period*	13	56
Elective / optional courses /		4							4
	Elective studies								

ex-change stud-ies (ECTS)									
All stu-dies, sum	*1 period*	18	*2 period*	14	*3 period*	15	*4 period*	13	60

According to the "Study-Guide 2015-16" the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Computer Science:

"The degree programme in Computer Science provides for the students the necessary theoretical and practical knowledge, skills and capabilities required in the ICT industry. A person who graduates from the degree programme is also capable of continuing his/her studies to doctoral level in the field of computer science. The degree programme combines up-to-date research knowledge with the fundamentals of computer science and learning is supported by modern and efficient teaching methods. The LUT Computer Science programmes have been awarded the Euro-Inf® quality label from EQUANIE and the seal of ASIIN e.V. for both the Bachelor's and Master's degree programmes. The accreditations were issued for the first time on September 28th, 2012, and are valid till September 30th, 2018.

The degree programme in Computer Science educates Masters of Science in Technology for the needs of industry, research institutions, businesses, and public administration. The graduates with a Master's degree from the programme are able to participate in software projects in the role of an expert or as a project manager and they are able to apply their knowledge and capabilities in projects. The graduates are able to apply scientific knowledge and methods in practice, they are able to communicate both orally and in written form and they are able to participate in a project group also in a multicultural environment. The education is given in English language and as such, the graduates can communicate both orally and in written form using English language. Furthermore, the graduates from Software Engineering

- are able to apply modern design techniques and methods in daily software engineering
- are able to participate in software projects as an expert in their specialisation area or as a project manager
- are able to recognise problems in software development and improve processes from technical, project management, and organisational viewpoints
- are able to design, model and implement applications and services for various environments.

The Master of Science (Tech.) degree programme takes two calendar years from which the spring of the second year is dedicated to the development of the Master's thesis. The first three semesters cover courses on general studies, major, minor, and elective ones."

1. Academic year Compulsory courses in MSc degree	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the first academic year**
	Introduction to M.Sc. Studies in Computer Science							1	
	Research Methods in Software Engineering			6	Object-Oriented Programming Techniques			6	
	Software Projects, Processes and Entrepreneurship			6					
	Minor studies		Minor studies		Minor studies		Minor studies		
	Academic Writing in English Course 1 period 1 OR 3		*Running a Software Project*	3	Academic Writing in English Course 1	2	Academic Writing in English Course 2	2	
	Finnish 1 period 1 OR 3, year 1 or 2	2	*Academic Writing in English Course 2 period 2 OR 4*						
Compulsory studies, sum	*1 period*	2	*2 period*	18	*3 period*	4	*4 period*	9	33
Elective / optional	User and Design Research in Software Engineering			6	Green IT and Sustainable Computing			6	12
	Embedded System Programming			4	Architecture in Systems and Software Development			7	
	Fundamentals of Game Development			6	Seminar on Software Engineering			6	

courses / exchange studies (ECTS)	Distributed Database Systems			6					
All studies, sum	*1 period*	2	*2 period*	24	*3 period*	4	*4 period*	15	45
2. Academic year Compulsory courses in MSc de-	**1. period**	ECTS	**2. period**	ECTS	**3. period**	ECTS	**4. period**	ECTS	**Workload of studies in the second academ**
	Models and Methods of Software Engineering			6	Software Systems as a Service: Technology and Engineering			6	
					Master's Thesis			30	
	Internship year 1-2, 2-10 cr	3							

gree	Minor studies		Minor studies		Minor studies				**ic year**
Compulsory studies, sum	*1 period*	3	*2 period*	6	*3 period*	0	*4 period*	36	45
Elective / optional courses / exchange studies (ECTS)	Personal Literature Study 1-6 cr			10	Architecture in Systems and Software Development			7	17
	Personal Design Science Study 1-6 cr				Seminar on Software Engineering			6	
	Code Camp 1-5 cr				Personal Literature Study 1-6 cr				
	Research Project in Software Engineering 1-10 cr				Personal Design Science Study 1-6 cr				
	Software Business Development INT 43, 6 cr				Code Camp 1-5 cr				
	Software and Application Innovation 6 cr				Research Project in Software Engineering 1-10 cr				
	Real-time Operating Systems and Programs 6 cr								
	International Summer School in Novel Computing 1-3 cr								
	Internship year 1-2, 2-10 cr								
All stu-	*1 period*	3	*2 period*	16	*3 period*	0	*4 period*	4	62

dies, sum								3	