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Lappeenrannan teknillinen yliopisto
Lappeenranta University of Technology

Self-Assessment Report for International Accreditation
– Bachelor's and Master's degree programmes
in Mechanical Engineering

Editors: Eskelinen Harri, Nurkka Annikka, Varis Juha

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**Self-Assessment Report for International
Accreditation – Bachelor's and Master's degree
programmes in Mechanical Engineering**

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FORMAL INFORMATION

Name of the degree programme (Finnish)	Konetekniikan koulutusohjelma – Tekniikan kandidaatti
Name of the degree programme (English)	Bachelor of Science (Technology) in Mechanical Engineering
Language of instruction	Finnish
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Name of the degree programme (Finnish)	Konetekniikan koulutusohjelma – Diplomi-insinööri
Name of the degree programme (English)	Master of Science (Technology) in Mechanical Engineering
Language of instruction	Finnish
Contact person	Head of Department, Prof. Juha Varis
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1. FORMAL SPECIFICATIONS

1.1 Names of degree programmes

Bachelor of Science (Technology) in Mechanical Engineering and Master of Science (Technology) in Mechanical Engineering

1.2 Type of the programme

Both the Bachelor's degree programme and the Master's degree programme are more research-oriented full time programmes. The Master's degree is consecutive to the Bachelor's degree.

The Bachelor's and Master's degree programmes are aimed at Finnish students, and teaching is mainly given in the Finnish language. However, some modules taught in English can be included in the studies. Obligatory studies in foreign languages are included in the degree programmes, 6 ECTS credits in total.

Studying abroad is not obligatory, but the university encourages students to do so. LUT takes part in a number of international student exchange programmes (such as Erasmus, and Nordtek), and has many bilateral student exchange agreements. Studies in foreign universities can be included in the student's degree in LUT, if they are suitable to substitute studies in the LUT degree programme. It is recommended that students present a study plan before starting studies abroad, if they intend to apply for the recognition and inclusion of the studies abroad.

LUT Metal Technology also has teachers and researchers from foreign universities, which makes it possible to widen both the educational and cultural perspective.

1.3 Final degrees

The degrees awarded are Bachelor of Science (Technology) in Mechanical Engineering and Master of Science (Technology) in Mechanical Engineering.

The degrees and the Finnish universities that can award these degrees are defined in the Universities Act (558/2009) (enclosure 1) and in the Government Decree on University Degrees (794/2004) (enclosure 2).

A degree programme is an entity of studies with scholarly and also professional aims. It is planned and organized by a number of units of the university in cooperation and it focuses on professional fields connected to Mechanical Engineering, e.g. such fields as design of mechanical engineering structures, welding technology and modelling of multi-technical systems, and on the development of these fields.

A degree programme has two cycles: the lower (Bachelor) and the higher (Master) university degrees. The department also offers separate Master's programmes which are not an objective of the accreditation.

1.4 Standard period of study and credit points gained (according to ECTS)

The academic year is divided into two semesters. The autumn semester (divided into periods 1 and 2) and spring semester (divided into periods 3 and 4) each include two standard periods lasting seven weeks and at least one additional examination week. It is recommended that new students enrol in the autumn for the first standard period, but it is also possible to enrol at other times.

Courses can last from one to four periods. However, the university also offers courses in intensive format. In those cases, the length of the courses varies depending on the course. All of the course details are given in the course descriptions available in the study guide (enclosure 3).

The extent of studies required for a lower university degree (Bachelor) is 180 credits and for the higher university degree (Master) 120 credits. The university must arrange teaching to enable the student to complete the lower degree in three years, and the higher degree in two years of full-time study (The Government Decree on University Degrees 794/2004, enclosure 2).

The extent of studies is measured by credit units. Courses are quantified according to the work load required. The average input of 1600 working hours needed for the studies of one academic year corresponds to 60 credits (The Government Decree on University Degrees 794/2004, enclosure 2)

The study guide (curricula) (enclosure 3) presents how courses are divided between the study years. The scheduling of courses is planned accordingly.

1.5 Expected intake for the programmes

The expected intake for the academic year 2011-2012 is 55 enrolments for consecutive programmes (Bachelor's + Master's degrees ^(*)) and 45 enrolments for non-consecutive Master's programmes, which are not included in the accreditation process.

^{*)} In Finland it is typical that students continue directly to the Master's degree programmes after having passed their B.Sc. studies.

1.6 Programmes start dates within the academic year and first time the programmes are offered

The consecutive degree programmes in Mechanical Engineering have been granted in LUT since 1970's. The programmes (Bachelor's + Master's degrees), which are included in this accreditation process, have been offered for six years so far (since year 2005). The next academic year of the university starts on the 1st of August 2011 and ends on the 31st of July 2012.

1.7 Amount and type of fees/ charges

According to the Universities Act education leading to a university degree and entrance examinations relating to student admission shall be free of charge for Finnish students. The admission is also free of for citizens of countries within the EU/EEA as well as Switzerland.

However, to have the right to study, students must pay the student union membership fee. For the academic year 2011-2012 the fee is 103 Euros. This membership entitles students to have lunch at a reduced price in all the student canteens in Finland and receive free medical treatment from the National Student Health Service in all the universities in Finland.

In 2011-2012 three of LUT's nine master's programmes will introduce tuition fees. In general, individuals who are citizens of countries outside of the European Union (EU), European Economic Area (EEA) and Switzerland are required to pay tuition fees in following degree programmes: Master's Degree Programme in Mechanical Engineering, Master's Degree Programme (CBU) in Business and Administration in International Technology and Innovation Management, MITIM and Master's Degree Programme in Strategic Finance (MSF) .

2. DEGREE PROGRAMMES: CONTENT, CONCEPT AND IMPLEMENTATION

2.1 Aims of the programme studies

The Degree Programmes in Mechanical Engineering aims at training top national and international professionals, producing new information and expertise in its fields of specialisation and promoting the creation of new businesses and the development of entrepreneurship.

The Degree Programmes in Mechanical Engineering are carried out at the department of LUT Metal Technology in the Faculty of Technology (see the organization chart in chapter 5.3.1). The areas of emphasis in the Faculty of Technology are forest industry, metal industry and energy technology. Its research and services are multidisciplinary.

Internationality is strongly present in both research and education. The faculty plays an active role in international forums, presenting research results as well as coordinating and directing research. Students are trained to work in international, multidisciplinary and multicultural environments by offering them many international Master's programmes and opportunities for student exchange.

The Degree Programmes in Mechanical Engineering emphasize machine design, steel structures, machine automation, welding technology, production engineering, virtual design, wood technology, laser technology and packaging technology. The department has two Master's programmes in English: the Master's Degree Programme in Mechanical Engineering and the Master's Degree Programme in New Packaging Solutions. Specialized Master's programme entitled – AIMO – is designed to be completed concurrently with a full-time job. This self-assessment report only deals with the Bachelor's and Master's programmes offered in Finnish.

The degree programmes in Mechanical Engineering offer a wide-ranging overall view of future product design and production engineering. The training is based on a strong theoretical foundation and on the effective application of this theoretical knowledge to practical technological and economic questions. It also provides the possibility to specialize in design or production.

The general educational objectives for Bachelor's and Master's Degree Programmes in Mechanical Engineering are derived from the previously mentioned superordinate educational objectives:

- students learn about practical professional tasks in their field and how to use theoretical knowledge to solve practical mechanical problems that require creativity.
- students learn about the physical operation of machines and how to control them, and about the stress applied to different parts of machines and equipment and how resistant the structural materials are
- students learn about the most recent production systems and manufacturing methods and their effective implementation
- students learn to search for information from different sources and apply it to create improved technical and economic solutions
- students learn to follow the international development of the mechanical engineering field and its infrastructure and use the latest and most reliable information to solve problems in the field
- students learn to work as a supervisor and manage and develop goal-oriented activity in the work place

- students acquire basic knowledge and skills for scientific postgraduate studies that lead to a doctorate

The superordinate educational objectives for the Bachelor's degree and for the Master's degree are based on Finnish university legislation and are defined in the university's regulations on education and the completion of studies, which have been approved by the rector on 16th June 2010 (Enclosure 4). The superordinate objectives are accessible to all students, staff members and all other interest groups on LUT's web pages. In this self-assessment report, the superordinate objectives both for the Bachelor's degree and for the Master's degree have been analysed in the light of the ASIIN reference framework, and as a result of the analysis, it can be stated that the objectives correspond well with the special and social competences established by ASIIN (Enclosure 5).

Superordinate educational objectives for the Bachelor's degree include (Enclosure 4):

- fundamental knowledge of the major and minor subjects in the degree, and the ability to follow developments in one's professional field,
- a capacity for scientific thinking and the application of scientific working methods,
- the knowledge and skills required in education leading to the higher university degree and in life-long learning,
- the ability to apply one's knowledge and skills in the world of work, and
- sufficient communication and language skills.

Superordinate educational objectives for the Master's degree include (Enclosure 4):

- a good knowledge of one's major subject and a fundamental knowledge of one's minor subjects,
- the ability to apply scientific knowledge,
- the ability to take on duties as an expert in and a developer of one's professional field,
- the capacity to carry out scientific postgraduate studies,
- good communication and language skills, and
- good presentation, cultural and leadership skills.

These superordinate educational objectives for the Bachelor's degree and for the Master's degree have been linked to the general learning outcomes of the Degree Programme in Mechanical Engineering, and the nature of the knowledge, skills and competences produced by the degree programme have been assessed. The linkage between the aims of the Bachelor's degree and the Master's degree and the learning outcomes of these degree programmes are depicted in Enclosure 5.

2.2 Learning outcomes of the programmes

The targeted learning outcomes for the Bachelor's and Master's degree levels of the Degree Programme in Mechanical Engineering are introduced in the following and in the study guide (Enclosure 3), which is accessible on the LUT web site to all students, staff members and all other parties interested.

The relationship between the learning outcomes according to ASIIN's subject-specific criteria (classified in specialist and social competences) and the aims of the degree programme (Bachelor's and Master's levels separately) according to the module handbook are evaluated in Enclosure 5. Further, each course module is evaluated according to ASIIN's criteria. Finally, an overview (presented in Enclosure 5) of both degree programmes is compiled for curricular analysis. The overview is presented in a format which indicates the classification of the modules or courses into

subject groups or curricular categories. In this context, the credit points of some modules are divided among several categories. The categories are based on the ASIIN subject-specific criteria (SSC). The results of this analysis show that both degree programmes (Bachelor's and Master's) meet the requirements of percentage portions of each SSC and the requirements of minimum ECTS credit amounts according to ASIIN's criteria.

The Bachelor's degree studies start with compulsory general studies. The general studies include e.g. mathematics and physics, language and communication studies, an internship and compulsory general studies in the student's field of studies, creating a foundation for more advanced studies. Moreover, the general studies contain courses from other degree programmes at the university, and studies in economics.

All students in the Degree Programme in Mechanical Engineering complete the Bachelor of Science (Technology) degree in their major subject. The major studies include basic studies in mechanical engineering and they are compulsory for all students. The Bachelor's degree also includes a compulsory Bachelor's thesis and seminar worth 10 ECTS credits. The Bachelor's thesis and seminar are included in the student's major studies.

Students also complete minor studies in either Engineering Design or Manufacturing Technology. These elements lay the groundwork for the completion of the Master's degree.

In addition, the B.Sc. degree contains elective and language studies.

2.2.1 The targeted learning outcomes for the Bachelor's degree Programme in Mechanical Engineering

Students who have completed their B.Sc. (Tech.) degree with minor studies in Design Engineering or Manufacturing Technology are able to:

- describe and define the physical operating principles of machines
- calculate the stresses applied to different parts of machines and equipment
- use mathematics and physics to solve mechanical engineering problems and design tasks
- describe and define the operating principles of different manufacturing methods and production systems, and recognise their uses
- acquire information from different sources, evaluate its reliability and use it to solve technical and economic problems
- work in a group of experts, carry out a project in a goal-oriented manner and work in international projects
- communicate about research activity both orally and in writing, meeting the criteria set by the scientific community

Students who have completed their B.Sc. degree with minor studies in Engineering Design or Manufacturing Technology possess the basic knowledge and skills needed for Master's level studies.

All students in the Degree Programme in Mechanical Engineering complete the Bachelor of Science (Technology) degree in their major subject.

2.2.2 The targeted learning outcomes for the Master's degree levels of the Degree Programme in Mechanical Engineering

After the Bachelor's degree, students complete the degree programme of Master of Science. The degree programme of Master of Science (Technology) contains compulsory general studies, which include e.g. language and communication courses and an internship. The major studies consist of compulsory, alternative and elective specialization studies. The degree programme of Master of Science includes a Master's thesis worth 30 ECTS credits, with which the student demonstrates his or her knowledge of a topic of scientific and societal importance. The Master's thesis is part of the student's major studies and involves a seminar. The degree programme of Master of Science also includes an elective minor subject and elective studies.

Students who have completed their M.Sc. (Tech.) degree are able to:

- take a systematic and analytic approach to solving practical mechanical engineering problems and abstract problems
- design and develop machines, devices and machine systems
- manage and organise engineering work in an industrial and research oriented, national or international working environment
- draw conclusions to solve optimisation problems in mechanical engineering applications using mathematical and physical reasoning
- solve complex mechanical engineering problems which include issues involving strength, material technology, manufacturing and marketing
- conduct research that meets scientific criteria

The major subjects in the Degree Programme in Mechanical Engineering are

- Engineering Design
- Manufacturing Technology

In addition, M.Sc. graduates with minor studies in Engineering Design are able to:

- analyze machines and structures, their dimensioning, operation and control, and choose the most appropriate methods for their design and dimensioning
- use a variety of simulation and computing software as design tools

In addition, M.Sc. graduates with minor studies in Manufacturing Technology are able to:

- choose, give grounds for and design competitive development solutions for production in machinery industry applications
- develop technologies needed in the further processing of products

M.Sc. graduates have the basic knowledge required for postgraduate studies.

2.3 Learning outcomes of the modules/ module objectives

A detailed description of the objectives of individual university courses is presented in the module handbook, i.e. study guide (Enclosure 3). The curriculum matrix tool (Enclosure 5) shows the linkage between the superordinate objectives and the learning outcomes of the Degree Programme in Mechanical Engineering. The Bachelor's degree and the Master's degree have been described and discussed separately. In addition, the curriculum matrix (Enclosure 5) shows how the learning outcomes of the Mechanical Engineering programmes are linked to individual courses. The presented matrix also displays the level of know-how (knowledge, skills and competences) each course provides for the student. The correlation between the aims of degrees and ASIIN's subject-specific criteria is

also evaluated in the matrices. Information about the modes of study and the assessment formats used in each course are collected into the module handbook (Enclosure 3). As a result of this process, the levels of all specialist and social competences (according to ASIIN's guide e.V) for each course have been defined in terms of low/average/high. The evaluation is carried out by utilising the requirements presented in ASIIN's subject-specific criteria SSC01 for Mechanical Engineering.

The curriculum is designed to cater to the professional needs of Bachelor's and Master's level graduates. In Finland, the Bachelor's degree is primarily considered as a gateway to Master's degree studies, introducing the student to scientific thinking and methods. According to ASIIN's criteria, the Bachelor's degree in Mechanical Engineering consists of:

- 19.1% mathematic-scientific studies,
- 33.3% fundamental engineering studies,
- 15.4% engineering application studies,
- 7.3% advanced/focal subject studies,
- 18.3% multidisciplinary studies
- 4.1% Bachelor's thesis
- 2.4% practical internship training.

According to ASIIN's criteria, the Master's degree in Mechanical Engineering consists of:

- 19% advanced fundamentals in mathematics, natural sciences and engineering studies,
- 20% advanced engineering application studies
- 23% advanced/focal subject studies
- 11% multidisciplinary studies
- 16 % Master's thesis
- 12% practical engineering activity

The content, learning outcomes and workloads of individual courses are presented in the study guide (Enclosure 3), which is accessible on LUT's web pages. In addition to the learning outcomes, the study guide provides students with information about the year and period of study, teacher(s) in charge, course content, modes of study, evaluation, study materials and prerequisites for the course. This information and the learning outcomes are also introduced to students during the first lecture/meeting of the course.

2.4 Job market perspectives and practical relevance

In Finland's engineering education system, the Bachelor's degree is generally considered as an intermediate phase in the progress towards a Master's degree ^(*). However, the competency profile of Bachelor's degree graduates of Mechanical Engineering shows good preparedness both for industrial work as well as consecutive Master's level studies.

^{*)} For Finnish industry the Bachelor's degree in Mechanical Engineering is relatively new and therefore there has been a little demand for it so far.

2.4.1 Industry focus and the competency profile

The Master's degree in Mechanical Engineering aims at the design and manufacture of production machines, transportation equipment, components, devices and structures needed in different fields of industry as well as various consumer products. Early on in their career graduates often work as design specialists on tasks related to the design of machines, devices and components or as production engineers on the research and development of production methods and their practical application.

They can be promoted to positions with more extensive design and manufacturing responsibilities, even management positions. Training, research and marketing related work is also possible, as well as various tasks that require expertise in e.g. technical inspection and project organisations, or increasingly in their own business.

LUT Metal Technology is an active operator in the national Strategic Centres for Science, Technology and Innovation (SHOK) and the Centre of Expertise Programme (OSKE), through which it collaborates closely with industry. The Degree Programme in Mechanical Engineering contains a multi-aspect Bachelor's thesis and Master's thesis, which are prepared for industrial companies. LUT Metal Technology cooperates with the basic metal industry, traditional machine and metal industry, and energy, electrical, electronics and communications industries. The department's cooperation with forest and wood processing industry plays a regionally important role.

A degree in Mechanical Engineering gives the skills and knowledge needed in a number of positions within trade, industry and public administration. The degree programme is wide-ranging and provides a basis for both design- and production-oriented tasks.

2.4.2 Synergy benefits based on the collaboration with industry

Research at Lappeenranta University of Technology is characterised by multidisciplinary research in different fields of technology and business, which is mainly conducted in independent research institutes. Researchers work in laboratories and research groups of the university's organisational units.

Each department carries out both basic and applied research. The emphasis is on applied research, which is conducted in collaboration with industries with the aim to achieve synergy benefits.

The expertises at the department of LUT Metal Technology and the Degree Programme in Mechanical Engineering are the fatigue of metal structures, dynamics of a mechatronic machine and laser welding. The key research areas are:

- the design of welded structures
- intelligent machines and structures
- the simulation and optimisation of mechatronic machines
- welding methods and robotised welding
- the mechanical joining and part manufacture of sheet metal
- sawmill and cutting tool technology
- birch processing technology

2.4.3 Work internships

The compulsory internship period in the Degree Programme in Mechanical Engineering is divided into a work environment internship that acquaints students with their potential future work environments (B.Sc. degree, 2 ECTS cr), and a professional internship that develops the students' professional skills (M.Sc. degree, 6 ECTS cr). One ECTS credit corresponds to two full working weeks.

In addition to the compulsory internships, students have the opportunity to include in their elective studies an internship of up to 4 ECTS credits related to the specialisation field in their studies. It can be included in either the Bachelor's or the Master's degree.

The work environment internship aims to provide students with an experience of what paid work is like. After the work environment internship, the student will be able to define and explain what is involved in working for an employer and what the basic rules of the world of work are from the employee's

perspective, and further, evaluate how to act in a working community. The objective is for the student to learn to interact as an employee in a working community. Working as an employee in e.g. the following environments is accepted as an internship:

- workshops
- welding and sheet metal departments
- assembly and installation departments
- repair and maintenance departments
- foundries
- wood processing industry departments
- warehouse operations
- transportation operations

The aim of the professional internship is for students to obtain a basic knowledge of the work, work environment and working community in their own field. After the professional internship, students will be able to apply and generalise knowledge and skills acquired during the course of studies to work in their own field. Students obtain practical experience and knowledge of the professional duties, production equipment and software in their field. Typical design, manufacture and operation duties include e.g.

- machine and equipment design and strength calculations
- production line work
- the use and programming of machines (e.g. NC machine tools)
- substitution for a foreman etc.
- the planning of offers
- quality management
- commissioned work

The objective of the specialised internship is to provide students with an understanding of the duties and working community of a Master's level graduate. After the internship, students will be able to analyse how knowledge and skills acquired during studies can be utilised in professional duties and make grounded decisions. The specialised internship also trains students for real-life leadership and project management duties. All work that acquaints students with duties in their field of specialisation is accepted as a specialised internship, e.g.

- planning
- computing
- workshops related to the field of specialisation
- job planning
- CAD/CAM programming
- design of production systems
- quality management
- supervision of work
- work commissioned by industry

In practice, the student obtains a summer job from a company, works as paid employee, requests a work certificate and applies for the approval of the work as an internship. To this end, the student fills out an application form and encloses the required work certificates and an internship report including a job description and the student's own view of the content and importance of the internship. The application form, work certificates and internship report are submitted to the internship coordinator.

The degree of Bachelor of Science (Technology) includes a compulsory internship (see enclosure 3 and enclosure 25) of 2 ECTS credits and elective internships (professional or specialised) worth a

maximum of 4 ECTS credits (the Bachelor's degree may include no more than 6 ECTS credits for internships). All full-time employment relationships of at least 15 days are approved as compulsory internships in the Bachelor's degree. Four full-time working weeks correspond to 2 ECTS credits. The degree of Master of Science (Technology) includes a compulsory internship of 6 ECTS credits and an elective specialised one worth a maximum of 4 ECTS credits. All full-time employment relationships of at least 15 days and related to the student's field are approved as compulsory internships in the Master's degree. Twelve full-time working weeks correspond to 6 ECTS credits. The elective internship of 4 ECTS credits can be included in elective studies in either the Bachelor's or the Master's degree. An employment relationship that took place before the studies can be approved as an internship worth 2 ECTS credits.

The head of the degree programme is responsible for the internship, and the internship is approved by the internship coordinator. The detailed instructions of work internships are presented in the Study Guide (see enclosure 3 and are also presented in a separate enclosure 25)

2.4.4 Professional qualification conferred by the degrees

The major studies in Bachelor's degree programme in Mechanical Engineering consist of basic studies in the fields of Engineering Design and Manufacturing Technology. Moreover, the major subject deals with structural materials used in machines and equipment. The major studies create a foundation for more advanced and professional studies.

The major subjects for the Bachelor's degree in the Department of Mechanical Engineering are Engineering Design and Manufacturing Technology.

The minor studies in Engineering Design focus on machine design and the strength of structures. The minor studies in Manufacturing Technology deal with manufacturing methods and physical metallurgy.

The minor subject chosen in the Bachelor's degree does not affect the choice of the minor subject in the Master's degree. Students who chose Engineering Design as their minor subject in the Bachelor's degree can take minor studies in Manufacturing Technology in their Master's degree and vice versa, but possible prerequisites in the Master's degree courses must be taken into account.

The Bachelor's degree includes a Bachelor's thesis, which is an assignment related to a course in the student's major studies. The work is mainly a literature report, but it may also include an empirical research part. The Bachelor's thesis and related seminar provide a good foundation for continuing one's studies at the Master's level. The thesis and seminar are worth 10 ECTS credits. Students must prepare a written maturity test to demonstrate their language skills and how well they know the topic of their thesis.

Major studies in Master's degree programme in Engineering Design provide the knowledge and skills required for product development, design, computing and research positions in engineering offices or production enterprises. As experience accumulates, the studies enable graduates to manage product development projects with experts in different fields, such as material technology and the strength of materials, manufacture and marketing. Engineering Design is a wide-ranging subject that enables the in-depth analysis of machines and structures, but also the management of larger entities. Combining Engineering Design with studies in other fields enhances the students' competitiveness on the labour market.

The major subject in Engineering Design allows students to specialise in machine design, machine automation and steel structures. The subject includes traditional machine design and its methodology,

as well as virtual design. In the specialisation area of machine automation, students learn about machine automation and mechatronics. Special features of studies in virtual design and machine automation include the design and control of intelligent machine systems. Steel structures examines the dimensioning and durability of structures. Special features include the design and fatigue durability of welded structures.

Major studies in Manufacturing Technology enable students to work in development, management and expert positions in production and manufacture. The studies introduce modern manufacturing technologies which promote the competitiveness of productivity, economic efficiency and quality. In fact, the education also emphasises economic aspects. The major studies in Manufacturing Technology emphasise so-called breakthrough materials and their application to products and production, as well as manufacturability in an automatic networked production environment. Consequently, a close connection to the design of machines and structures is created.

The major subject in Manufacturing Technology allows students to specialise in welding technology, production engineering and wood technology. Welding technology education refers to the overall management and development of welding technology, starting from design and ending in the actual welding (e.g. laser welding and robotisation) and finally finishing. Production engineering deals with machining, sheet metal work, and modern production systems and methods to organise workshops to make production competitive. Laser processing is a current phenomenon in welding technology, and more widely in production engineering. Wood technology focuses on the upgrading of mechanical forest industry products and composite engineering. The studies deal with e.g. raw wood materials, machines and equipment, wood treatment technologies and forestry on a wide scale.

In both major subjects in the M.Sc. degree, the minor subject can be chosen freely also from the minor subjects of any other degree programme. The minor subjects offered by the Degree Programme in Mechanical Engineering are Engineering Design and Manufacturing Technology.

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically or societally important topic. The thesis is a research assignment in the student's major subject organised in the form of a course. It requires approximately six months' work and involves a seminar. The student must demonstrate the ability to carry out the project independently and following a plan. In the thesis seminar, students learn about the theses of others and present their own thesis.

The student's knowledge of the topic of the thesis and his/hers language skills are verified in the maturity test.

If the student has demonstrated his or her language skills in connection with the lower university degree, the language of the maturity test will not be evaluated, only the contents. The student completes the maturity test by presenting a summary of his or her thesis in the Master's thesis seminar.

2.4.5 Placement of graduates on the labour market

Current information about the professional qualification of graduates is provided in graduate surveys and in surveys five years after graduation (Enclosure 6). Based on the collected statistics it can be seen that most of the B.Sc. graduates have continued their studies in M.Sc. degree programmes.

The structure of the curriculum at the undergraduate level mostly includes fundamental engineering studies and fundamental studies in mathematics and natural sciences, and as such, the degree does not result in advanced professional qualifications.

The graduate surveys five years after graduation (Enclosure 6) show that

- in 2005, 67% of graduates from the M.Sc. Degree Programme in Mechanical Engineering were already employed when they graduated
- in 2010, all those who graduated from the M.Sc. Degree Programme in Mechanical Engineering in 2005 were either employed (90%) or full-time students
- 80% were employed by the private sector or a state-owned company
- in 50% of the cases, the graduate's first job was in design, development or administration, in 20% it was in research and in 20% in management or supervisory duties
- in recent years, the share of management and supervisory duties has increased significantly

Graduates are employed by a wide range of organisations. They are employed in different branches and industries. This fact supports the conclusion that graduates can have an influence on their career path. Large enterprises, such as Nokia, Kone, Konecranes, Outotec, ABB, Metso, Andritz, Stora Enso and UPM have often employed several graduates per year. Many other organisations have also employed graduates year after year. The employers are large and small enterprises and consultancies.

The major subject typically determines the student's first job, as it reflects the student's interests and qualifications. On-the-job training periods also have an effect and steer the graduate's career choices. In addition, career prospects are typically discussed during the final Master's degree courses, and students have the possibility to use LUT Career Services. Quite often the first workplace of the graduate is the company which commissioned the Master's thesis and employed the student during the thesis project.

LUT has gathered feedback from Master's thesis employers since 2010. Graduates are also surveyed five years after their graduation regarding their career situation (Enclosure 6).

The Degree Programme of Mechanical Engineering also has been shown to support the birth of new industrial enterprises and the effectiveness of the curricula in the job market is evident. For example MeVEA Oy was started at LUT Metal Technology during the year 2005. The company is focused in developing simulators and simulating software. Today this company employs ten people, who have graduated from LUT Metal Technology.

2.4.6 Demand from industry

The high employment rate after graduation reflects the high demand from industry for graduates of Mechanical Engineering (Enclosure 6). Graduates have been employed well even during the economic downturn. This signals that the graduates are well qualified to work in the industry and that their skills fit the demand.

Also in the future, there will be a strong demand for Mechanical Engineering graduates. The Finnish Association of Graduate Engineers (TEK) and the Confederation of Finnish Industries (EK) have forecasted the future demand for graduates at the Master of Science level.

Enclosure 7 illustrates the expertise emphasised in the recruitment of university-level graduates, as presented by EK. The need for experts in engineering was the greatest (39%).

Based on Reference 1 by the Finnish Association of Graduate Engineers (TEK), which discusses the demands from Finnish industry, excellent problem solving skills are a key strength of Finnish

engineers. These skills are based on in-depth knowledge of the technology and good competencies in mathematics and natural sciences.

According to Reference 1, the most important development areas are related more to teaching methods and curricula, and less to the contents of the studies.

The demands from Finnish industry state [1] that in addition to problem solving skills, there is a need to increase creativity and the ability to question issues. Problems that are encountered at work can rarely be solved through one single correct answer and they are often interdisciplinary by nature. The winning solutions are often unconventional, combining knowledge and skills in an interdisciplinary way. Therefore, future engineers need to be better prepared for collaborative learning and shared expertise. Reference 1 highlights that it is also necessary to strengthen the connection between education and research and development. Engineering education needs field-specific pedagogical models for the development of teaching methods and curricula.

The pedagogic leadership culture in higher education must be strengthened also in the field of technology [1]. The development of qualifications and teaching must be steered in a way that every actor in the institution has a clearly specified role and tasks in the systematic development work. Moreover, successful curriculum work requires a collaborative operating culture. This is the only way to achieve a shared view of the learning obtained by completing the degree, in a way that the student has enough time to learn, and develop competencies and skills towards the desired expertise.

In qualification-oriented education, there is a need to define more clearly what must be learned during Bachelor's and Master's studies and what remains for continuing education. The core content and the student's recommended use of time must be defined for every course. This enables the student to know what he or she is expected to learn and what the advisable timeframe for learning is [1]. Learners are different, but recommendations help students to estimate the required use of time. Moreover, students receive feedback on their learning achievements and learning styles.

LUT Metal Technology has worked a great deal to meet the demands from industry recognised by the Finnish Association of Graduate Engineers. Practical arrangements have been made to carry out new project-oriented education and to further utilize the resources of all nine laboratories and two research teams of LUT Metal Technology. Also the curriculum and contents of individual course modules are developed to include more interdisciplinary viewpoints. From the curriculum analysis presented in this report, it can be seen that in both the Bachelor's and Master's degrees, special attention has been paid to achieving both the required knowledge and additional skills and competencies. LUT Metal Technology also wants to support its students in finding the best learning practices for them, and special attention is paid to the yearly workload evaluation. Feedback and demands from industry have directly influenced the degree structure and teaching approaches of the LUT Metal Technology degree programme. For example, the project work model described in detail in section 3.2.3 was triggered by development needs expressed by industry. As industry has also mentioned the need for training involving leadership, project management and efficient collaboration with experts in different fields, LUT Metal Technology also wishes to meet these needs.

Source: [1] http://www.tek.fi/ci/tekstra/opetuksen_laatu_final.pdf

2.4.7 Utilizing laboratories to link offered training to professional practice

Intensive laboratory work is one of the cornerstones of the education in the Degree Programme of Mechanical Engineering. As illustrated in Figure 1, laboratory work forms a link between industrial applications area including the job market perspectives and the course modules supported by the laboratories.

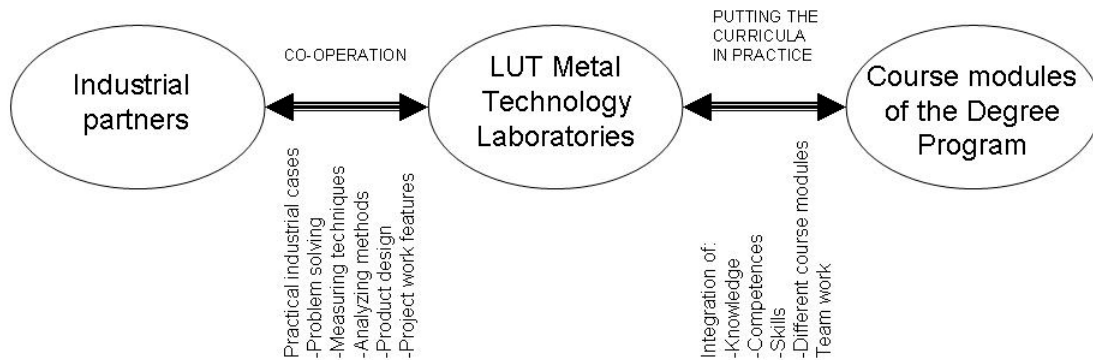


Figure 1. Laboratory work forms a link between industrial applications and the course modules.

The laboratories of Welding technology, LUT laser and Manufacturing technology support the Degree Programmes to form an integrated educational environment, which includes the areas of teaching, research and industrial applications. Smaller research projects are carried out bilaterally with participating companies and larger projects are typically TEKES-projects. These laboratories can also simulate the industrial environment to develop the students' skills and competences in the "Factory of the Future", which includes the facilities of laser processing and sheet metal work. In the "Factory of the Future" these laboratories work together with VTT Technical Research Centre, which is the biggest multitechnological applied research organization in Northern Europe.

The research group of Engineering Design is a member of the Virtual Engineering Forum, which was established in year 1998. This forum is a networking environment, which consists of more than ten research organizations and industrial partners. This type of forum improves the possibilities to develop the education at LUT into the direction, which is desirable in industry.

The research group of Engineering Design is focuses both in national and international large scale research projects. This group presents an important contact surface with the international development of the education in Mechanical Engineering. The most important partners at the moment are as follows:

- University of Illinois at Chicago
- University of Seville
- Johannes Kepler University Linz
- Delft University of Technology
- University of La Coruña
- Pusan National University

The laboratories of Wood Technology and Manufacturing technology are members of a knowledge cluster dealing with renewing wood industry and the Wood laboratory is also a member in the international InnoWood -portal.

The laboratory of Steel Structures has focused in strength analyses of constructions and structures. The laboratory is also internationally famous, for example its contribution to the function of IIW (International Institute of Welding) is remarkable.

Based on the laboratory survey, laboratories take part in practical educational arrangements by supporting several course modules of the degree programmes. The number of supported course modules is presented in Table 1. The two majors of the degree programmes (Engineering Design and Manufacturing Technology) are well represented in this comparison. Further information is collected in Laboratory survey and assessment Forms (enclosure 19). The laboratory facilities are discussed in more depth in chapter 5.3 (Institutional environment, financial and physical resources).

Table 1. The number of supported course modules

Laboratory	Number of course modules in the degree programme supported by the laboratory
LUT Laser	4
Wood technology	8
Welding technology	5
Steel structures	2
Engineering design	12
Manufacturing technology	10
Packaging technology	2
Total	43

This result supports the evaluations of the curriculum made in chapters 2.2 and 2.3. The result emphasizes the observations made in the curriculum analysis (Enclosure 5) and it strengthens the importance of students' laboratory work in providing skills and competences during the studies for future job market perspectives.

2.5 Admissions and entry requirements

According to the Finnish University Law (2009/558) the board of the university decides the number of new students to be selected each year. The Rector decides annually on the selection process and the basis of the selection criteria of the prospective students after hearing the opinion of the faculties. In practice, the student selection into Bachelor's degree for Finnish matriculation examination graduates is mainly organized by a joint universities application system, DIA (joint-application to Studies of Bachelor and Master of Science in Technology). This joint application system is shared by seven technical universities in Finland. The joint application system is coordinated by a joint application committee. This process enables an applicant to apply for five degree programmes in order of preference in one or in several Technical Universities using the same application form and examinations. The application system enables prospective students to apply for several degree programmes at the same time, but the applicant can accept only one student place in degree education in a given academic year.

2.5.1 Entry requirements

Bachelor

The Finnish University Law (2009/558, 37§) rules the entry requirements for Bachelor's degree. Prospective students applying in Bachelor's degree are:

- Applicants who have completed the Finnish matriculation examination or who have completed the Finnish matriculation examination and received a blue certificate.
- Applicants who have completed the EB, IB or Reifeprüfung degree.

- Applicants who will complete the EB, IB or Reifeprüfung degree either in Finland or abroad during the application year. These applicants must include their degree certificate or a certificate of participation in the respective examination from their school with their application form.
- Applicants who are not upper secondary school graduates but who have completed a polytechnic higher vocational degree, vocational polytechnic degree or at least a three-year vocational degree.
- Applicants from other Nordic countries who are eligible for application.
- Applicants who have not completed upper secondary education in Finland are eligible to apply for Bachelor degree courses if they are eligible for studies at a university in their own country.

DIA-applicants have three different quotas where they can be selected in: 1. Success in matriculation examinations, 2. success in matriculation examinations and in the entrance examinations and 3. success in entrance examinations. To be selected by success in matriculation examination the prospective student must have at least grade C in physics or chemistry and must have passed advanced course in mathematics or he/she must have at least M in advanced course in mathematics. Six best grades in matriculation examinations are graded as points which count in the selection process. 40 % of the applicants accepted into a degree programme can be selected because of their success in the matriculation examination. DIA organizes also this selection. The results are communicated to the applicants before the entrance examinations and students accepted because of their success in the matriculation examination are not allowed to participate in the entrance examinations. 70 % of the remaining study places are selected based on the success in the matriculation examinations and entrance examinations. In this case, success in six examinations in the matriculation examinations counts and the points received in the entrance examinations.

The entrance examinations are organized by the joint application procedure. The entrance examination is based on the Finnish upper secondary school curriculum in mathematics, physics and chemistry. There are three separate examinations. Department of Mechanical Engineering requires applicants to take the mathematics exam and an exam in physics or chemistry. If the applicant is willing to take all three, the better result between mathematics and chemistry counts. Prospective students must pass the entrance examination to be selected even if there are fewer applicants than places attained. This guarantees a minimum knowledge level in science for all selected students.

Other applicants, meaning applicants who have performed their matriculation examinations abroad, have a separate application system but they take part in the same entrance examinations as the DIA-applicants.

Information about applicants is available according to law of student selection register (1058/1998).

Prospective students are able to apply online at www.yliopistohaku.fi.

Prospective student can appeal against a negative result of student selection within 14 days of the decision.

Master

All students accepted in Bachelor's degree are also accepted in Master's degree.

There are also several separate variants of entrance directly to Master's degree. Applicants should have a BEng/ B.Sc. degree in the relevant field of study or in a closely related field. In addition, applicants with a Bachelor's degree from Universities of Applied Science in a related field from a Finnish Universities of Applied Science (Polytechnics) are eligible to apply. The degree must be completed by the end of the application period. The programme applied for makes the final decision whether the applicant's previous degree is suitable.

Applicants with a former university degree are selected based on their success in the previous studies and the relevance of their degree.

Prospective students applying for and selected in a Master's degree programme are going to prepare their personal study plan with help of academic advisors. This personal study plan also defines the needed complementary studies for the student to be ready to take part in the master's level studies. The prospective student can appeal against a negative result of student selection within 14 days of the decision.

There are four specialized variants of the higher education entrance in Bachelor's degree.

- Prospective students who have succeeded in defined competitions
- Studies in the Open University (after performing 30 ECTS including 16/19 ECTS mathematics and 5 ECTS physics, average grade at least 2.0)
- IB/EB applicants
- Prospective students who have performed forest industry line METELI in upper secondary school

2.5.2 Transfers from/to the conventional system of qualification

Students at LUT can, at a particular moment, have at the most one study place for technology. Students can request for a change of degree programme. Until now the degree programme into which the applicant wishes to change, has required the applicant to have been successful enough in the DIA-selection to be selected to the particular degree programme. From now on, the faculty is able to decide if the student can change the major within the faculty. Otherwise, the student can take part in the entrance examination again or request the change after completing the Bachelor's degree.

In general, a student can request for a change of degree programme after completing the Bachelor's degree. If there are more requests than the degree programmes applied to is willing to take, quantitative and qualitative success in studies and work experience can be used as criteria for selection. If the student has not completed a Bachelor's degree the criteria for change is his/her success in the previous application process. Previously completed courses can be replaced in the personal study plan which eliminates loss of time. A Student wishing to change universities should have completed the Bachelor's degree and can then apply directly to a Master's degree programme. Recognition and Assessment of prior learning is in use. If a student performs studies in another university or educational institute in Finland or abroad, he/she must request the head of degree to credit the studies performed elsewhere. A student can receive credit and replace study modules also by knowledge gained otherwise. Knowledge can be proved by oral or written examination. Portfolios are also used as a measure to validate previously gained knowledge. Still, at least 90 ECTS of the Bachelor's degree (including Bachelor's Thesis) and 70 ECTS of the Master's degree, including at least 45 ECTS of major, including Master's Thesis, have to be passed at LUT.

2.6 Curriculum/content

Enclosure 3 presents the curriculum in detail. First, an overview of the curricular content of the Bachelor's and Master's programmes is presented. This is followed by a list of course modules which can be included as obligatory or elective studies in the degree.

The general structure of the curricular content of the Bachelor's and Master's degree programmes is as presented in Table 2:

Table 2. *The general structure of the curricular content of the Bachelor's and Master's degree programmes*

The B.Sc. Degree Structure 180 ECTS cr (Years 1–3)	
A. General studies 108 ECTS cr	
B. Major 45 ECTS cr	C. Minor 21 or 23 ECTS cr
D. Elective studies 4-6 ECTS cr	

The M.Sc. Degree Structure 120 ECTS cr (Years 1–2)	
A. General studies 24 ECTS cr	
B. Major studies 60 ECTS cr (min.)	C. Minor studies 20 ECTS cr (min.)
D. Elective studies 10 ECTS cr (min.)	

2.6.1 Individual study plan

The individual study plan allows students to plan their studies. All students prepare a study plan for both their B.Sc. and M.Sc. studies (see enclosures 17 and 18). In the Degree Programme in Mechanical Engineering, the study plan is prepared in the autumn semester of the first year of studies in the course Introduction to Studies in Mechanical Engineering. Students who start their studies directly at the Master's level prepare their study plan at the beginning of their studies. Students update their study plan at different stages of their study path, e.g. when they choose subjects to study.

3. DEGREE PROGRAMMES: STRUCTURES, METHODS AND IMPLEMENTATION

The structure of the consecutive B.Sc. and M.Sc. degree programmes in Mechanical Engineering is constructed to meet the requirements of the modern DFMA (Design for Manufacturing and Assembly) -oriented university level education, which aims to improve the integration between product design and manufacturing, to reduce product design time and cost, to improve product quality and reliability, to shorten lead time, to increase productivity and to answer faster to customer requirements. In the consecutive B.Sc. and M.Sc. degree programmes this is done by ensuring that the design engineers gain enough education and knowledge about manufacturing technology in their university studies and by ensuring that manufacturing engineers know at least the basics of product design methodology. The purpose of the consecutive programmes is to arrange the co-operation between the students who have emphasized either product design or manufacturing aspects in their university studies.

3.1 Structure and modularity

3.1.1 Bachelor's Degree Programme in Mechanical Engineering

The extent of the studies required for the Degree of Bachelor of Science is 180 ECTS credits. The university has to arrange the education so that it is possible to attain the degree in three academic years by studying full time. The structure of the Bachelor's degree is described in the University Regulations on Education and the Completion of Studies, Section 31 (Enclosure 4).

The Bachelor's degree comprises the following studies (enclosure 4):

- | | |
|---------------------|-----------------|
| 1. General studies | min. 70 ECTS cr |
| 2. Major subject | min. 40 ECTS cr |
| 3. Minor subject | min. 20 ECTS cr |
| 4. Optional studies | min. 10 ECTS cr |

Foreign language and communication studies are included in General studies. The Bachelor Thesis including seminar (10 ECTS cr) is included in the Major subject.

The Bachelor's degree programme takes three years, corresponds to 180 ECTS credits and leads to the degree of Bachelor of Science in Technology.

Bachelor's degree in Mechanical Engineering comprises the following studies (Table 3):

Table 3. Bachelor's degree in Mechanical Engineering

A. General studies	108	ECTS cr
B. Major subject, B.Sc. Thesis included	45 (min.)	ECTS cr
C. Minor subject	21 (min.)	ECTS cr
D. Optional studies	4 - 6	ECTS cr
<i>Studies in total</i>	<i>180 (min.)</i>	<i>ECTS cr</i>

Major subjects

1. Engineering Design
2. Manufacturing Technology

Minor subjects

1. Engineering Design
2. Manufacturing Technology

The selection of minor subject in Bachelor's degree does not impose restrictions on selecting major subject in Master's degree.

3.1.2 Master's Degree Programme in Mechanical Engineering

The Extent of studies required for the Degree of Master of Science is 120 ECTS credits. The university has to arrange the education so that it is possible to attain the degree in two academic years by studying full time. The structure of the Master's degree is described in the University Regulations on Education and the Completion of Studies, Section 31 (Enclosure 4).

The Master's degree comprises the following studies (enclosure 4):

- | | |
|---------------------|-----------------|
| 1. General studies | min. 5 ECTS cr |
| 2. Major subject | min. 60 ECTS cr |
| 3. Minor subject | min. 20 ECTS cr |
| 4. Optional studies | min. 10 ECTS cr |

Foreign language and communication studies are included in General studies. The Master Thesis (30 ECTS cr) is included in the Major subject.

The Master's degree programme takes two years, corresponds to 120 ECTS credits and leads to the degree of Master of Science in Technology.

Master's degree in Mechanical Engineering comprises the following studies (Table 4):

Table 4. Master's degree in Mechanical Engineering

A. General studies	24	ECTS cr
B. Major subject, M.Sc. Thesis included	60 (min.)	ECTS cr
C. Minor subject	20 (min.)	ECTS cr
D. Optional studies	10 (min.)	ECTS cr
<i>Studies in total</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

Major subjects

1. Engineering Design
2. Manufacturing Technology

Minor subjects

1. Engineering Design
2. Manufacturing Technology

Minor subject of Master's degree can also be selected among other minor subjects of any other degree programmes of LUT. The full structure of the degree programmes including the modules to be studied in different subject groups are shown in The Study Guide (Module Handbook), Enclosure 3.

3.2 Workload and credit points

The basic unit to evaluate the workload of the studies is one credit point. A Module is scored by the workload required to pass it. To complete the studies of one academic year requires on average 1600 hours, which corresponds to 60 ECTS credit. In the study guide also the individual work of student will be presented. Establishing a total workload with enough time for independent study, as well, is part of operative curriculum design. The LUT course feedback system (Webropol) is used to gather information for workload planning. Students' individual workloads per semester might vary depending on the workload of voluntary course modules, which they have selected. Guiding credit summaries of are presented below in Table 5. Examples of study plans in enclosures 17 and 18 show how the workload is divided during each semester.

Table 5. Guiding credit summaries

Guiding credit summary/ Bachelor's Degree

Studies	1st year ECTS cr	2nd year ECTS cr	3rd year ECTS cr	Total ECTS cr
General studies	60	32	16	108
Major studies		25	20	45
Minor and elective studies		3	24	27
Total ECTS cr	60	60	60	180

Guiding credit summary / Master's Degree

Studies	1st year ECTS cr	2nd year ECTS cr	Total ECTS cr
General studies	24		24
Major studies	23	37	60
Minor studies	13	7	20
Elective studies		16	16
Total ECTS cr	60	60	120

One credit point equals to approximately 26 hours workload, including face-to-face teaching hours, individual studying, as well as preparation and sitting the examinations.

The Bachelor's thesis and seminar amount to 10 ECTS credits and the Master's thesis to 30 ECTS credits (enclosure 4, University regulations on education and the completion of studies).

Obligatory industrial training periods of 2 and 6 ECTS credits are required for the Bachelor and Master degrees, respectively. For training, one ECTS credit equals to two week's working period as an employee. The employment contract has to be at least 15 days.

Studies carried out in another university or learning institution can be applied to be included in the degree. The decision of the acceptance is made by the manager of the degree programme.

More detailed description of the credit point system and inclusion of studies in other institutions has been presented in the University Regulations on Education and the Completion of Studies (Enclosure 4).

Two examples to illustrate the completed degree programme structures and the completed courses within them are presented in enclosures 15 and 16 (two examples of supplements to the degree certificates).

3.3 Educational methods

Both the Bachelor's and Master's programmes are full-time, on-campus programmes. The teaching methods consist of lectures, classroom and laboratory exercises, supervised assignments (individual or team work), projects and seminars.

Some exercises are carried out by utilising e-learning environments, such as Black Board, and some seminars are carried out by utilising distance learning facilities, such as ACP (Adobe Connect Pro). Especially at the Master's level, several exercises are carried out as project assignments with topics given by industry. Representatives from companies participate in the supervision and project meetings. Some of the topics of the exercises originate from research projects of the department. LUT Metal Technology has invested in improving the quality of education, and our university has granted several appropriations to the department for this purpose. Pedagogic advice to teachers is given in the "LUT Teacher's Quality Manual", see Enclosure 8.

The choice of teaching methods is influenced by the learning outcomes, content and quality requirements for instruction, the time and financial resources spent on instruction, the teacher's preference and number of students in the course. As a result of the active pedagogical development of instruction, the department has strongly emphasised a student-oriented approach instead of a teacher-oriented one. The sole use of lectures and literature examinations in instruction has decreased, and pair, group and project work is on the increase. Some of the courses have only oral examinations.

The group sizes are large (up to 100 students) in approximately 35% of courses, and small or medium sized (20–50 students) in 45% of courses. Large courses are mainly included in the Bachelor's degree.

In small and medium-sized groups, which are mainly included in the Master's degree, interactive and collaborative learning and learning by doing play an essential role. Small and medium-sized course groups apply teaching methods that promote skills and knowledge needed in real-life situations in the

world of work. This is achieved through assignments that require practical problem solving, decision making and development of activities, through extensive true-to-life material, and high-pace interactive team work.

Courses typically have more than one instructor. Pair and team work among teachers enhance the possibilities for study guidance.

3.3.1 About the importance of virtual modelling

Information technology and computer-aided methods are extensively utilised at LUT Metal Technology in both major subjects (engineering design and manufacturing technology). Online aspects play an important part in planning today. Multitechnology machine systems or production environments can be developed and planned almost fully in a virtual environment before the manufacture of the first prototype or the beginning of production. Real-life production and manufacturing conditions can be simulated for the competitive use of new, effective production methods, e.g. laser, welding and sheet metal engineering methods as well as manufacturing processes in the wood products industry.

3.3.2 Project-based teaching and learning approach at LUT Metal Technology

In the academic year 2010-2011, the Degree Programme in Mechanical Engineering has created, developed and launched a teaching approach that is based on problem-based project teaching, embedded teaching, collaboration between students at different levels of studies and the industrial product development model with organisational hierarchies and subcontractor bids. The module involves courses on engineering design, manufacturing technology, project management, English and communication.

The teaching approach was preceded by observations over a long time span on the need to develop education at LUT Metal Technology, on industry's request to include leadership training, project management and efficient collaboration with experts of different fields in the curriculum.

The teaching approach is being developed and expanded in two different project-based learning situations: The first is aimed for first year students (Bachelor's degree) and is the simpler project of the pilot. The project is integrated with existing courses, and its duration is the entire academic year. For the students, the main emphasis of the project is to create a spontaneous motivation for work and to recognise what type of expertise is required of them. This, in turn, generates a motivation for further studies and searching for information. The second part is an extensive Master's level project over degree programme borders. It involves cooperation between LUT Metal Technology, LUT Energy and the LUT Language Centre and takes advantage of the strengths of all parties.

3.3.3 Integration of foreign language instruction in mechanical engineering education

In 2010, LUT Metal Technology started to develop a teaching approach that integrates foreign language and mechanical engineering studies. It is currently applied to the integrated instruction of structural materials and the German language. The approach provides students with the skills to search for and utilise mechanical engineering material in German, and produces the required teaching material, information retrieval instructions and professional vocabulary. The German language instruction aims for applied practical use of the language. The target is, therefore, not to use the language only after graduation or to teach the language as an entity separate from technology. Integrated teaching also improves the ability of teachers at LUT Metal Technology to use the most recent reference material and research results in German in their teaching.

LUT Metal Technology has asked the students to assess both the Bachelor's and Master's degree programmes from their viewpoints. The students were asked to make a brief assessment about the following three main subjects:

- the overall design of the programme
- the programme delivery and operations
- the programme outcomes

The students statement is available in enclosure 20.

3.4 Support and advice

3.4.1 Academic Guidance Methods for Existing Students

The university offers academic guidance measures which together cover the entire span of studies and support studies and learning efficiently, allowing students to complete their studies following an appropriate study plan that they have prepared themselves and to graduate within the desired time. The roles and duties of study guidance personnel and units are listed in the Table 6 below.

Table 6. *The roles and duties of study guidance personnel and units*

Peer tutor	Introduces new students to the university, studies and the student community, and helps them with practical arrangements at the start of studies. A peer tutor introduces new students to the university facilities, study guidance staff and other students. A peer tutor makes sure that students know the most important practices related to studies: registration for courses, attending lectures, taking examinations, preparing a course schedule, social aspects.
Tutoring coordinator	Coordinates and develops the university's peer tutoring together with faculties, Student Services and the student union.
Student adviser	Student advisers are LUT students who work part-time while they study. They provide information and guidance in studies, see to the choice of tutors and arrange their training together with study coordinator, take part in arranging briefings for students.
Study counselling psychologist	Counsels students in problems related to studies and learning, provides expertise in issues involving learning and guidance, supporting other study guidance personnel.
Study coordinator	The study coordinator normally coordinates study guidance for students. The duties include study and degree guidance for students, from applicants to postgraduate and partly even mature students. The study coordinator helps students in preparing their individual study plan (including the recognition of prior learning and studies outside LUT, e.g. through the flexible right to study) and provides guidance in administrative issues related to graduation. The Language Centre study coordinator offers study guidance with regard to language and communication studies, and handles credit transfer applications for language and communication studies completed at other universities and higher education institutions.

Head of degree programme	A head of degree programme is in charge of evaluating and developing study guidance .
Head of study affairs	Is responsible for organising study guidance in the faculty. Is responsible for administration of studies and partly also for study guidance related to administrative affairs.
Teacher/tutor	A teacher/tutor helps students prepare their individual study plan and follow its progress. Teacher/tutors provide guidance in the selection of major and minor subjects from the viewpoint of career guidance. They are study guidance personnel appointed for a department or degree programme. Students may turn to them with any issues involving studies.
Teachers	Teachers are responsible for study guidance related to the completion of the courses/modules they are responsible for.
Introductory course/module	Introductory courses are arranged in to help students get started with their academic studies. Introductory courses usually also guide in preparing an individual study plan.
Professors	Professors provide guidance in the selection of a research topic, and in preparing final theses for undergraduate and postgraduate studies.
International Services	International Services offers general study guidance to international students at the university and coordinates the activity of international tutors. International Services also assists Finnish students in matters related to studies abroad.
Career Services	Career Services guides students in career planning and searching for employment.
Language Centre	The Language Centre offers study guidance related to language, communication and culture studies.
Library	Guidance in information retrieval. Instruction in information literacy.
Origo helpdesk	Support services for the use of information and communication technology in studies.

At the beginning of their studies, students prepare an individual study plan (HOPS). The study plan is made for the entire duration of the studies, i.e. until the M.Sc. degree is completed. An independent study plan is a tool that helps students plan their studies. Its purpose is to help students to see their studies as a whole from the very beginning, and to support students in choosing courses and minor subjects that best suit them. The aim is also to avoid delaying graduation unnecessarily. It also awakens students to realise their own responsibility for their studies, and motivates and incites them to make a commitment to their studies.

3.4.2 Specialized support and advice for finishing Bachelor's and Master's thesis

The final thesis instructions are approved by the vice-rector on June 9th 2010 and they enter into force August 1st 2010. The instructions are available on the internet. The main aspects are as follows.

At LUT, most Master's theses in engineering are prepared on topics given by companies or other sponsors, in which case the student must discuss the topic with the sponsor as well as with the professor (or docent) who is acting as the supervisor and examiner. Together with the professor, the

student ensures that the subject meets the scientific requirements set for academic theses. Students must, from the very start, discuss at least the following issues with the employer's representative:

- the contact information of the contact persons in the sponsoring organisation as well as that of the supervisor at employer
- the aim of the theses from the perspective of the sponsor/employer
- the schedule (the nominal scope of a Master's thesis in engineering is 20 LUT/30 ECTS credits)
- the instructions laid down by LUT which students must follow when working on their Master's theses (www.lut.fi/opinto/ohjeita/)
- adapting the sponsor's/employer's aims to the requirements for a Master's thesis
- possible partners (individuals and organisations) and the main principles to be followed in cooperation
- the publicity of the thesis
- immaterial rights (the rights to inventions)
- the terms and rules for financing

In addition to the above, it is necessary to discuss issues related to the confidentiality and protection of invention concepts made by the student themselves. Master's theses are normally public after being accepted.

The full instructions are presented in enclosure 11. The evaluation form of Master's thesis is presented in enclosure 10.

3.4.3 Academic Guidance Methods for Prospective Students

LUT has built and continuously maintains contacts with study advisors and teaching staff at Finnish high schools and polytechnics to ensure that the counselling staff has up-to-date information about study possibilities at LUT and also about the scientific focus of LUT's research activities. Printed material is posted to these educational institutions each autumn, and emphasis is given to changes in the study possibilities or application procedure (if any). The teachers and study advisors are provided the opportunity to bring groups of students to LUT and visit the physical premises (laboratories, library etc) and have a guided tour on LUT campus. Annually in November, all high schools in the surrounding regions (about 200 km range) are invited to an open house event, where the programmes and information provided is tailored for high school seniors.

LUT's own degree students systematically visit high schools and education events at garrisons during each academic year. The motivation for these visits is to provide information on the study possibilities and student life directly to the students (from one young person to another). LUT students aim at highlighting the contents and areas of specialty in each of the degree programmes offered at LUT, and also at giving examples on career opportunities after graduation. More than one hundred of these presentations are given by LUT students each academic year. LUT also takes part in the most important national fairs targeted at young people seeking higher education opportunities.

LUT-Metal also offers a forest industry related study programme for some of the closest located high schools. The programme is conducted in cooperation with the global forest industry related companies operating in the South-Eastern part of Finland. The admitted students complete five courses that will be credited in their high school study programme. The students are guaranteed summer jobs in the partner companies, and will also be able to apply to LUT without taking part in the entrance examination.

4. EXAMINATIONS: SYSTEM, CONCEPT AND ORGANISATION

4.1 Evaluation criteria

Written and oral examinations are the most typical ways to grade students. In addition to them seminar works, case-studies and reports may also count towards the grade. The assessment methods used in a particular course are presented in the study guide. Teachers can fit the examinations to correspond the course in question. In the Degree Programme of Mechanical Engineering the amount of arranged oral exams has risen during the past years. For example course modules BK50A0200 Technical Drawing II, BK10A1000 Research Methods Seminar, BK20A2100 Structural Materials, BK50A0601 Laboratory Course in Manufacturing Systems and BK50A2200 Design Methodologies and Applications of Machine Element Design can be passed with oral exams instead of traditional written exams.

The modes of study are determined in the curriculum. The possible coursework affects the final grade of the course together with the possible examination. In individual cases and for a specific reason, the teacher responsible for a course has the right to determine an alternative mode and date of completion. The assessment criteria are chosen to support the learning outcomes of the course.

Courses are evaluated either on the scale excellent (5), very good (4), good (3), very satisfactory (2), satisfactory (1) and failed (0), or pass – fail.

Teachers shall forward the grades to the Student Affairs Office and make them known to the students or post them online within a month. Teachers shall keep examination scripts and other equivalent material, and participant lists of examinations for at least six months after the grades have been published. Grades for courses are entered into the student information system.

Students who are dissatisfied with the assessment may request a correction to the assessment orally or in writing from the teacher who made the assessment or the person who made the recognition decision. Pursuant to the Universities Act (558/2009), section 44 (Enclosure 1) students have the right to obtain information about the application of assessment criteria to their study attainments. They shall be given the opportunity to see the assessed study attainment.

After the assessment, students have the right to receive a duplicate of the paper assessed. Four examination dates are set for each course. Students may take part in two of them. All teachers prepare and grade examinations in the subjects under their responsibility as determined by the head of the degree programme. For more information see Enclosure 4, sections 67-75. (University regulations on education and the completion of studies).

4.2 Students' rights and responsibilities

Examinations for each course are organized four times. However, students may take part in two of them. If students fail to attend an exam they have signed up for and have failed to cancel their participation in the exam within the due period, the exam is considered having been taken.

Examination dates and times for each department and changes thereto can be found on the university Web site. Therefore, the exam schedule is always up-to-date.

Students who have enrolled as attending or students who have enrolled as non-attending due to student exchange have the right to take part in examinations. The aim is to provide students who have been absent due to illness, military service, maternity or parental leave, or studies abroad the same rights upon their return as they had when they left. The rights shall remain in force until the end of the following semester. (Regulations on education and the completion of studies, section 69, approved on 16 June 2010)

Students register for examinations and intermediate examinations during the academic year through WebOodi. If needed, students may register by telephone or in person at the customer service desk in the Student Affairs Office or by e-mail to opinto@lut.fi. Registration starts four weeks before the examination date and ends one week before the examination. (Regulations for teaching and studies, section 70.) For example, if the examination is on a Monday, students must register on the previous Monday, at the latest, and cancel their registration by the preceding Thursday. Students who have registered for an examination but are unable to take it must cancel their registration through WebOodi. Registrations are to be cancelled two working days before the examination. Registration which is not cancelled, is considered having been taken.

Late registrations are accepted until the day before the examination. Students who register late must do so in person at the customer service desk at the Student Affairs Office during opening hours (Mon-Thu 12-15 and Fri 12-14). A fee of € 5, paid in cash to the Student Affairs Office, is charged for late registration. The Student Affairs Office adds the student to the participant list delivered to the examination hall. Signing up after the deadline is possible only for exams for which other students have signed up for by the deadline! If no one has signed up for the exam within the due period, the exam will not be organized and therefore signing up after the deadline is not possible. If the student cannot register in person the day before the examination, he or she may go to the examination hall and write down the required information and invoicing address on the invigilators' participant list. In such cases, the Student Affairs Office charges € 20 for late registration and sends the student an invoice after the examination. The student's grade will be registered in the student's records after the payment is made. Invigilators do not accept payments. Teachers have no obligation to arrange an examination for a student who has not registered for it in advance.

4.3 Additional exam retake

According to LUT's regulations on education and the completion of studies (Enclosure 4, section 69) students may take the final examination for a course twice. If a student does not pass the examination after taking it twice, he or she may apply for an additional retake. A retake must be applied for in advance of the exam date in University's exam schedule.

In order to be granted permission to take the examination again, the student must improve his or her knowledge of the topic area by completing additional assignments or other tasks assigned by the teacher. The assignment may be a discussion with the teacher during the teacher's office hour, answering questions from a previous examination, taking part in an examination feedback session, or any other task considered suitable for the purpose by the teacher. The aim is that the teacher and student together discuss why the student has not been able to complete the course successfully, and to determine how the student's knowledge of the topic area could be enhanced. The motivation of this practice comes from the fact that when the number of attempts was unlimited, students sometimes just participated in the exam without any real attempt to pass it. The new practice has proved to be more efficient. In cases of mid term exams and exams to improve the grade, applying for additional exam retake is not needed.

4.4 Practical arrangements of examinations

Exam weeks for the academic year 2011-2012 are as follows:

Week 34	22 - 27 Aug. 2011
Week 42	17 - 21 Oct. 2011
Week 50	12 - 16 Dec. 2011
Week 1	2 - 5 Jan. 2012
Week 9	27 Feb. - 2 Mar. 2012
Weeks 14	3 - 5 Apr. 2012
Week 18	2 - 4. May 2012
Week 19	7 - 11 May 2012

Examinations during the teaching periods are arranged according to the examination schedule on Mondays, Tuesdays, Wednesdays and Thursdays from 16:15 to 19:15 (five-hour lectures from 15:15 to 20:15). On examination weeks in August, October, December, January, March and May, examinations are arranged from Monday to Friday: 8:30-11:30, 12:00-16:00 (only Language Centre exams) and 16:15-19:15 (five-hour examinations 15:15-20:15). On 3 - 5 April 2012, examinations will be arranged 8:30-11:30 and 16:15-20:15 (five-hour exams 15:15-20:15). No lectures are given during this time.

Examinations may be arranged on the Saturdays November 12th 2011 and March 24th 2012 according to demand. The exam and course schedules will be available on the university web site. The lists of exams for specific courses are available on university's web-pages (an example is in enclosure 9. Students can use the WebOodi-application to register for the exam. More information about the practical arrangements of exams is available at www.lut.fi/en/lut/studies/tools/exams.

4.5 Examinations connected with final theses

Bachelor's thesis and seminar (10 ECTS cr)

The Bachelor's degree includes a Bachelor's thesis, which is an assignment related to a course in the student's major studies. The work is mainly a literature report, but it may also include an empirical research part. The Bachelor's thesis and related seminar provide a good foundation for continuing one's studies at the Master's level. The thesis and seminar are worth 10 ECTS credits.

The student also makes a poster of his/hers work before the seminar and presents the Bachelor's thesis (aims, methods, results and conclusions etc.) in the seminar with the help of the poster. In addition, the student answers to questions from the audience and also gets to know other students Bachelor's theses. Posters are on hand in the Gallery-lobby for one week after the seminar.

Maturity test (Bachelor's thesis)

Students must prepare a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. The maturity test is supervised in the Origo exam aquarium and students are not allowed to use reference material. The test must be taken at least five to six weeks before graduation. The maturity test is evaluated by the supervisor of the Bachelor's thesis and a language reviser approved by the university.

Master's thesis and seminar (30 ECTS cr)

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically or socially important topic. The thesis is a research assignment in the student's major subject organised in the form of a course. It requires approximately six months' work and involves a seminar. The student must demonstrate the ability to carry out the project independently and following a plan. The supervisor and first examiner of the Master's thesis is the professor specialised in the field. In the thesis seminar, students learn about the theses of others and present their own thesis.

Maturity test (Master's thesis)

If the student has demonstrated his or her language skills in connection with the lower university degree, the language of the maturity test will not be evaluated, only the contents. The student completes the maturity test by presenting a summary of his or her thesis in the Master's thesis seminar. The supervising professor or a person acquainted with the field and appointed by the professor evaluates the presentation. The student's knowledge of the topic of the thesis is verified with a maturity test. The test must be taken at least five to six weeks before graduation. To evaluate Bachelor's and Master theses also formal evaluation forms are utilized (the example of the evaluation form for Master's thesis is presented in enclosure 10).

5. RESOURCES

5.1 Staff involved

To ensure that the learning outcomes of the degree programme can be achieved in the expected time period enough teaching staff is needed. The overall situation at LUT Metal Technology is good, as illustrated in Table 7.

Table 7. Summary of Staff contributing to the Degree Programme
Summary of Staff contributing to the Degree Programme

Position type	Permanent or equivalent positions	Total number of employees
Professorships	4 / 4,5	8,5
Lectures	8,5	8,5
Other academic staff (permanent)	1 / 0	1
Other academic staff (fixed-term)	0 / 9	9
LfbA (incl. junior lectures)	0 / 27	27
Supernumerary professorships	1 / 1	2
Honorary professorships, external	1	1
Contract teachers	0 / 4	4
Other	0 / 15	15
TOTAL ACADEMIC STAFF		76
Technical staff	13 / 8	21
Other (clerical, manual)	1 / 0	1
TOTAL NON-ACADEMIC STAFF		22
STAFF TOTAL		98

Staff Handbook, which is prepared according to ASIIN's criteria, shows the educational level of the teaching staff and their scientific contribution (see enclosure 14). For laboratories' own purposes many of laboratories at LUT Metal Technology have collected more detailed analysis of their staff, which include the information about the knowledge, skills and competences of each employee. This type of information is added as the annex into the end of the Staff Handbook. This additional analysis has shown that there are quite many specialists at LUT Metal Technology, who have a long scientific career and more than 10 or even 20 years professional experience. The collected data also shows that both the teaching and the laboratory staff are widely working in different types of industrial projects and they have written several scientific articles and papers during their academic career. From the additional information it can be seen that some of the university lecturers have also completed their academic pedagogic studies. Some of the laboratories employ the young students, who are preparing their Master's thesis, as research assistants.

The development of the amount of teaching and research staff related to amount of students is presented in Figure 2 (a small amount of students from other degree programmes can participate in the courses arranged by the department of LUT-Metal). The student/staff-ratio has been relatively stable during the past five years (mean value is 5.8).

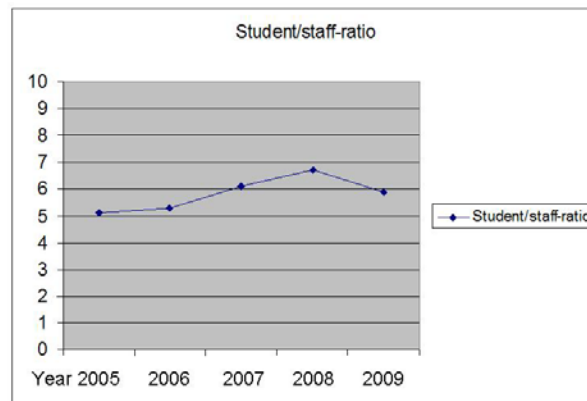


Figure 2. Development of student/staff -ratio

5.2 Staff development

Lappeenranta University of Technology aims to create a good working environment for its staff, and to support their professional development and well-being at work. Functions related to human resources administration are presented (in Finnish) in operations manuals of support services.

The university has a human resources committee, which is responsible among others for personnel training. Through this committee, the university personnel has a representation in decision-making concerning the development of the working environment and conditions. The chair of the human resources committee is the vice-rector in charge of education. The names of other members and committee memoranda are available on the University intranet.

The university supports its staff members in maintaining and developing their professional expertise and in career planning. The human resources committee annually revises its measures for professional development and maintaining professional expertise, which e.g. determine the focus

areas of personnel training at the university. Measures for professional development and training are presented on the university intranet, in the memorandum of the human resources committee.

University also regularly organises training in university pedagogy, which aims to strengthen the practical teaching competences of the teaching personnel. University pedagogy is a multidisciplinary field that deals with learning, studying, teaching and assessment in the Higher Education context. The workload of the university pedagogy -course is 25 ECTS credits total, and it consists of five modules. The aim of the course is to provide university teachers the basic principles of learning and teaching in Higher Education institution, curriculum planning and assessment of learning and teaching. After taking the course, the teacher is expected to be able to evaluate and develop his/her own teaching and assessment methods.

The costs of staff training organised by the university are covered by general personnel training appropriations. Moreover, each unit offers its staff members the possibility to take part in staff training outside the university in order to support their professional development and expertise. Personnel training is part of each staff member's duties, and therefore, training is usually arranged during working hours. The university supports the professional development of its personnel by allowing them to take two lessons (2 x 45 minutes) per week for independent study if the employee's supervisor and head of the unit consider that the studies serve the purposes of the working community.

University staff members have annual performance and development discussions with their immediate supervisor. The parties of the discussion examine results obtained, set goals for the near future also concerning the professional development and personnel training needed. Instructions for performance and development discussions are available on the university intranet

LUT's research and innovation services help and support LUT's research staff in questions dealing with research funding, administration and practical arrangements of contracts. The main task of the persons working in the unit of research and innovation services is to make it easier to transfer the results of scientific research to be utilized in the society and help to establish new enterprises and business. This unit also supports the researches in the matters of patents and novelty criteria of inventions.

5.3 Institutional environment, financial and physical resources

5.3.1 Institutional environment

University education is governed by the Universities Act (558/2009), the Government Decree on University Degrees (794/2004) and Regulations of Lappeenranta University of Technology 9/2009 (Enclosures 1, 2, and 26). The roles and responsibilities of the management of education are defined in the Regulations of Lappeenranta University of Technology (Enclosure 4). The educational goals are agreed upon annually in the negotiations between the University and the Ministry of Education and Culture. The achievement of goals affects the financing granted to the University by the Ministry. The financing decisions are made on annual basis. The aim of the university regulations (enclosure 26) is to lay the groundwork for academically and financially productive management and high-level administration at the university. These regulations describe the objective, mission, organization and administration of LUT. The organization of LUT is also presented in LUT Quality Manual (Enclosure 12) and it is illustrated in general in Figure 3.

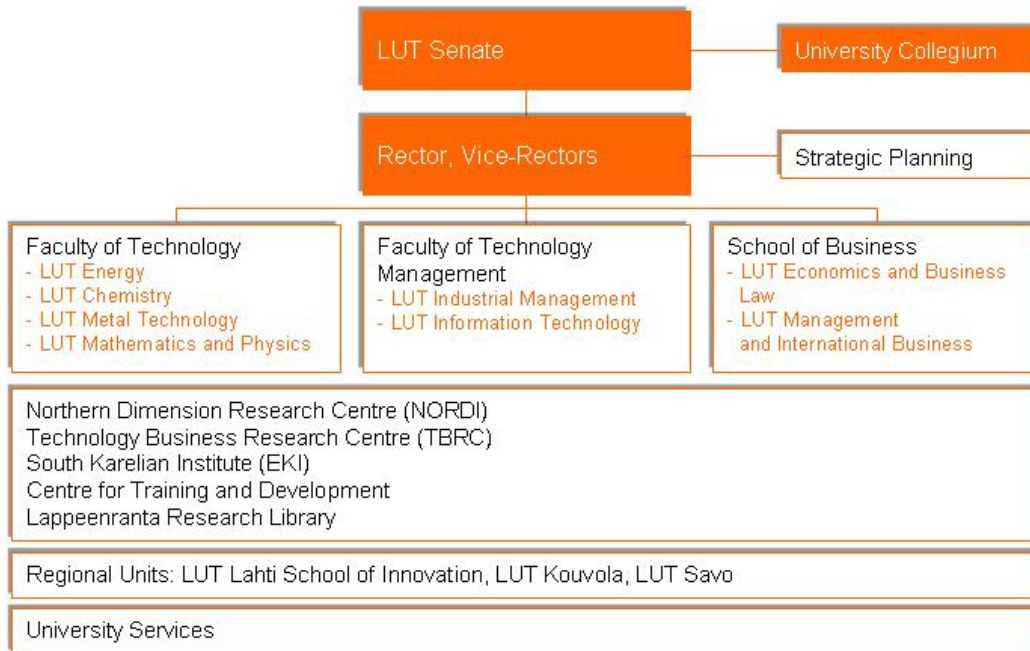


Figure 3. The organization of LUT

The University Board decides the strategic long-term goals of the university teaching and education, the total number of new entrants and the degree programmes provided by the University. The strategic long-term goals are presented in LUT's Strategy 2013 (Enclosure 13).

The Rector decides the entry requirements and the total number of new entrants to each faculty. In addition, the Rector also makes the decision on the approval of new entrants to the degree programmes. The Rector also appoints, when necessary, the board of examiners to consider the remedial requests concerning the study attainments.

The University applies the The University Regulations on Education and Completion of studies (enclosure 4) approved by the Rector. The regulations define the basic ways of action concerning the teaching and studying at the University, and the degree programmes provided by the University. The guidelines are published on the University's web-pages.

The University has a Vice Rector responsible for education. In addition, each degree programme has an appointed director. The Vice Rector organizes a meeting between the directors of the degree programmes once in every two months to discuss the leading, evaluating and developing principles of the degree programmes. The memos of the meetings are published in the University intranet. The Vice Rector also leads the University's supervisory and development group for teaching appointed by the Rector. The goal of the group is to promote the internal cooperation within the University in developing the teaching customs.

The student representation in the University's administrative bodies is determined by the Universities Act and the Regulations of Lappeenranta University of Technology. In accordance to the statutory representation in the administrative bodies, the students also have a representation in the University's supervisory and development group for teaching. In addition, the students participate in the development of teaching through the course evaluation carried out annually in each University study course, and through the teaching feedback enquiry organized by the Students' Union.

5.3.2 Committees responsible for teaching in the degree programmes

The Faculty of Technology has a development group for teaching appointed by the Dean of the Faculty. The group is responsible for developing the quality of teaching and the contents of the degree programmes within the Faculty. The group has representation from each degree programme provided by the Faculty and from the study affairs services of the faculty. The group also has three student representatives that are appointed on the basis of the recommendations of the Students' Union.

The Faculty Council is responsible for supervising the quality of teaching. The Council also decides the curricula of each degree programme. In addition, the Council makes the proposal to the Rector concerning the entry requirements and the number of new entrants accepted to the degree programmes.

The quantitative and qualitative goals of the Faculty's actions are agreed upon on yearly basis in the negotiations between the Faculty and the University. The University takes into account the results of the Faculty's operation in previous years and the Faculty's development needs in allocating the money received from the Ministry of Education and Culture.

The Faculty is responsible for the equipment needed in teaching and research. The Dean of the Faculty is responsible for the resources needed in teaching. The Dean also appoints the directors of the Faculty's degree programmes. In addition, the Dean accepts the theses of the graduate students.

The Heads of the Faculty's degree programmes are responsible for producing, evaluating and developing the degree programmes. The heads of the degree programmes accept the topics of the theses of graduate students. Each department of the Faculty also has an advisory group to support the work of the director of the programme.

The contents of the Major Subjects of degree programmes are decided by the professors responsible for carrying out the research in the corresponding field of science. The major subjects are congruent with the focus areas of the research. The professors are also responsible for organizing teaching in their own remits. In addition, the professors make the propositions to the heads of the degree programmes regarding the topics of the theses of their own students.

Teachers in charge of the study courses are responsible for executing, evaluating and developing their own teaching. The University has published a handbook called LUT Teacher's Quality Manual (Eclosure 8) to support teaching. The handbook contains information about the planning and implementation of study courses. It also gives instructions for defining the learning outcomes of the study courses, and for evaluating whether the learning outcomes have been achieved. In addition, the handbook provides the teachers with tools to measure of workloads of courses. The handbook is published as a printed version and in an electronic format in the University's intranet.

5.3.3 Financing of the programmes

In this chapter the true costs of LUT Metal Technology are presented from the period of years 2006 to 2010. In average the funding is covered 50% by the University budget and the rest 50% by the research projects carried out by the unit. Costs related to teaching, teaching materials and maintenance of teaching equipments are financed from the budget. During the past five years LUT Metal technology has managed to decrease the personnel costs. On the other hand, the funding received from industrial projects has increased regularly meanwhile the total costs (without investments) have remain between 6...9 million euros. Also the investments have turned to increase.

The overall picture of the financial situation of the degree is secure. Relevant statistical data is presented in Figures 4...6.

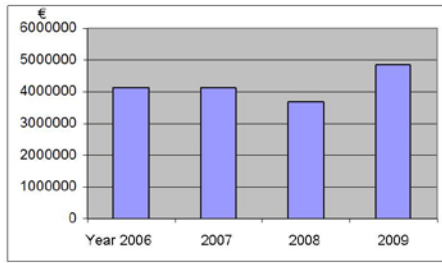


Figure 4. Funding received from the research projects (investments are not included), period 2006...2009.

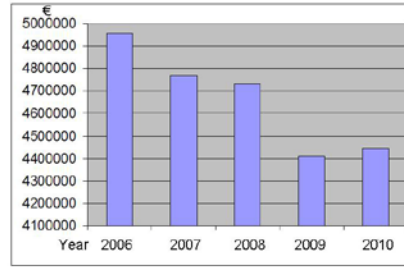


Figure 5. Development of personnel costs, period 2006...2010.

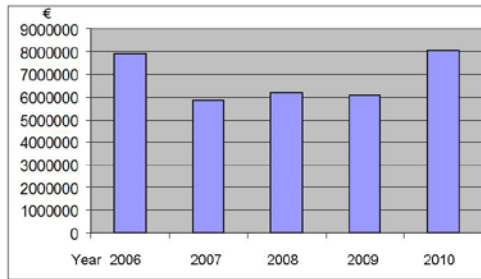


Figure 6. Total costs, period 2006...2010.

5.3.4 Research activities and laboratories

Based on the laboratory survey, laboratories have estimated their financial resources per academic year. Results are presented in the following Table 8. Further information is collected in the Laboratory survey and assessment Forms (enclosure 19). The laboratory facilities are discussed in more detail in chapter 5.3 (Institutional environment, financial and physical resources).

Table 8. Estimated financial resources of each laboratory per academic year

Laboratory	Estimated financial resources per academic year (€)
LUT Laser	650 000
Wood technology	900 000
Welding technology	1 000 000
Steel structures	1 000 000
Engineering design	1 200 000
Manufacturing technology	900 000
Packaging technology	800 000

The Department of LUT Metal Technology has seven laboratories and three research groups. The degree programme has achieved the national leading position in the following research areas:

- design of welded constructions
- smart pr adaptive machines and constructions

- simulation of mechatronic machines and their optimal design
- mechanical joining technologies of sheet metal components and their manufacturing technologies
- saw and cutting technology
- birch refine process technology

Key technologies, which form the basis of the high level scientific research are as follows:

- optimization of structures
- finite element methods (FEM)
- machine dynamics
- 3D-simulation and –modelling of machines
- control and adjustment systems of machines
- simulation of production systems
- welding technology
- material technology
- manufacturing technologies for component manufacturing
- wood processing technologies

The degree programmes utilize the support from the following laboratories:

- Welding technology
- Manufacturing technology and sheet metal work
- Laser processing
- Packaging technology
- Wood technology (two laboratories; one in Lappeenranta and the other in Ruokolhti)
- Steel structures
- Materials Technology

The degree programmes utilize the support from the following research groups:

- mechatronics
- virtual engineering
- engineering design

To form an overall picture of laboratories contribution to the degree programme, the Department of LUT Metal Technology has carried out a survey, which focused on clarifying the following aspects dealing with each laboratory and research group:

- Which are the areas of emphasis in research at the laboratory?
- How are the wishes and needs of industry taken into account in the research conducted at the laboratory?
- How are the research and development work of the laboratory integrated into education?
- How does the research of the laboratory promote a high level of education?
- How is the laboratory organisationally (management etc.) connected to other activity at the department?
- How is the laboratory organisationally (management etc.) connected to other activity at LUT?
- What are the most important external stakeholders of the laboratory?
- How and on what scale does the laboratory collaborate with external stakeholders?
- What are the internal stakeholders of the laboratory?
- How and on what scale does the laboratory collaborate with internal stakeholders (the department's own laboratories, laboratories of other LUT departments)?
- What facilities does the laboratory have at its disposal?
- What are the human resources of the laboratory?

- What key equipment does the laboratory have at its disposal?
- What are the financial resources of the laboratory (per academic year)?
- To what extent do undergraduate students take part in research at the laboratory?
- How is the productivity of the laboratory measured, and how are the results evaluated?
- How many publications did the laboratory produce in 2008, 2009 and 2010, and what is the anticipated number for 2011 (numbers conference papers, journal articles and others)?
- What courses does the laboratory support in terms of teaching and studying?

The detailed results of this survey are presented in enclosure 19. The key results of this survey are as follows:

- as presented earlier in chapter 2.4 laboratories and research groups actively support the educational arrangements of the degree programme
- laboratories and research groups aim to integrate the results of their research and development work with the education given in the degree programme
- the research topics and practical design tasks have an extensive integration with industrial applications
- laboratories and research groups have recognized their internal and external stakeholders and work intensively with them
- the amount of scientific publications is relatively high and laboratories and research groups have a clear vision of how to publish the key results of their research in the future
- laboratories have good equipment and sufficient financial and physical resources to carry out their research work
- the strong co-operation within the international scientific community is noticeable

5.3.5 Library

Lappeenranta Academic Library collections consist of c. 150.000 printed monographs, 68.000 printed journals, 65.000 electronic books, and 22.300 e-journals. The number of printed maps is 41, documents in microfiche form c. 1.100, and audio recordings 550. The annual procurement of printed monographs is c. 7.000 and the number of subscribed printed journals is 900 volumes per year. The Library provides its customers with library and information services both on-site and online. Information literacy education for the entire University is also arranged and given by the Library personnel. Electronic material is available remotely for LUT staff and students only. The Librarians act as experts in publishing LUT series. The Library personnel also manage the use the customer and office space of the Library. Within LUT, the Library is one of the Independent Institutes. There are c. 400.000 yearly visits to the Library. The Library is open to LUT staff, students, and general public during terms on workdays: Mon-Thu 8:30-18:00 and Fri 8:30-15:30. In summer and during the holiday season the Library closes at 15:30 on each workday. There are no restrictions to the number of loans. The customers access the Library catalog Wilma 600.000 times per year. The Wilma database includes information about both printed and electronic books as well as the storage information of printed journals. Electronic books can be accessed via a link the Library catalog. There are over 20 database vendors with more than 182 databases available for the Library customers. Most database hosts allow IP access to their information sources. Students and staff have also remote access to e-journals and electronic books. The number of Library staff is 21, nine of whom have Master's degrees in science or arts. Ten staff members have professional library qualifications which equal to Bachelor's degrees. One of the staff members is an IT specialist. The number of seats for reading in the Library is 170. There are 100 computer workstations available for the customers. The Library also offers six workshop rooms with a total of 44 seats for group work.

5.3.6 Other premises

At LUT there are 34 lecture rooms for teaching, 9 language laboratories and 14 computer classrooms. LUT Library has about 100 seats for students' individual learning purposes, several rooms for teamwork and two computer classrooms. The reading hall is open 24 hours.

5.3.7 IT provision and computer facilities

University offers the personnel windows computers of a known brand for normal use, or a similar computer with more memory and enhanced display adapter for those who use CAD-software. The screens are LCD screens. Both color and b/w printers and scanners are available to the personnel. Students can use the computers which are in common use in the library area (Origo) or in the classrooms. Those are windows computers of a known brand. Also printers and scanners are available for students. There is very little need for supervision and most of it is done with centralized electronic means such as browsing installed software. However, the student helpdesk Origo is located on the library area and the supporting team also supervises the students. Part of the supporting staff is students. They have direct access to support team in the university information services and technology (IS&T). The IS&T staff qualify as B.Sc. or M.Sc. in their field. Every student has access to every computer. There are 84 computers located in the library area, and they are available during the library opening hours. 325 computers located in classrooms are available when there are no lessons. There are 14 computing classrooms, 3 of which are equipped for CAD use and have 63 heavy use computers in total. One classroom with 21 computers has Linux setup. In addition there are 9 workshop rooms which have one or two computers each. On passageways there are some computers that can be used only for web browsing. These are typically used for email checking. Centralized services, such as learning environments can be accessed also outside of the campus. The university offers Eduroam WLAN services to enable use of students' own computers at the campus. Students search and use publications that are available in the library or on the databases (www.lut.fi/en/library). They write reports, essays and theses. They enroll in the modules they are going to take (<https://weboodi.lut.fi/oodi> --> in English), they get the course information, learning material and assignments of the modules they have enrolled in (noppa.lut.fi --> in English) and they participate in the web-based modules on the University BlackBoard learning space. They use software specific to studies to solve problems and tasks that belong to their studies. Also email and net browsing belong to their daily tasks.

6. QUALITY MANAGEMENT: FURTHER DEVELOPMENT OF DEGREE PROGRAMMES

6.1 Quality assurance and further development

The key aim in the quality management and development at Lappeenranta University of Technology is to incorporate quality management into the normal activity of the university, with the underlying idea of continuous improvement. The university's quality management system covers the entire range of education provided by the university (undergraduate education, postgraduate education, continuing education and open university education), research, societal and regional interaction, and support services.

The university's quality management system is described in LUT Quality Manual (Enclosure 12) and operations manuals of support services. The university's quality management documents and other related material are available on the LUT intranet.

LUT Quality Manual depicts the university's quality policies and goals, key resources, the university's management practices, the university's key processes and their quality management, and practices related to the assessment, measurement and development of activities. LUT Quality Manual lays a foundation for describing the entire quality management system of the university and gives both internal and external stakeholders a comprehensive picture of the quality management of the university's different activities. The LUT Quality Manual depicts these activities and practices that apply to and obligate the entire university community.

The university has set quality targets, which have been derived from the university strategy. The following quality targets apply to education:

- 1. Competitiveness and internationality: LUT will be known for the best Finnish university education in technology and business, and will be a sought-after partner in cooperation at an international level.
- 2. High quality of degrees: International academic expertise as a result of education, which consists of a) specialist skills in one's own field and b) transferable skills.
- 3. Satisfaction with studies at LUT: the students of the university and employers of graduates are satisfied with the content and implementation of the education; the teaching staff is satisfied with the tools, facilities and support for educational purposes.
- 4. The possibilities for lifelong learning are numerous and flexible, and the training meets the needs of target groups.

The university has also published LUT Teacher's Quality Manual in order to guide teachers to good teaching (Enclosure 8).

In its meeting of March 5th 2009, the Finnish Higher Education Evaluation Committee decided, based on the presentation and report of the audit group, that the quality assurance system of the Lappeenranta University of Technology meets the criteria set for the quality assurance system as a whole and for quality assurance of its basic tasks. The audit is valid for six years (see the details from the enclosure 21).

LUT Metal technology has aimed at international and national accreditation to ensure the quality of the education. The International Institute of Welding (IIW) has accredited two educational programmes (not included to this accreditation process) carried out by LUT's Welding Laboratory: International Welding Engineer/ Technologist (IWE/IWT) – and International Welded Structures Designer (IWSD) - programmes. In addition to those European Welding Federation has accredited special courses for Laser Welding and Robot Welding educational programmes. These accreditations are valid for three years.

One of the vice-rectors is in charge of education at the university. He/she manages the educational affairs and development of education of the university in cooperation with the heads of degree programmes and steering and development committee for teaching. The vice-rector and the Heads of degree programmes have regular meetings, where they evaluate and discuss about procedures concerning education and needs for development. The steering and development committee for teaching, in an advisory capacity, aids the vice-rector in decision making. The committee, headed by

the vice-rector, coordinates and promotes the development of LUT education, and prepares the application procedure for the quality bonus for teaching and prepares the allocation decision for the rector.

In each degree programme there is an advisory steering committee for the degree programme. It supports the head of the degree programme in producing, assessing and developing the degree programme.

6.1.1 Further development of the degree programmes

In chapters 3.3.1...3.3.3 it has been presented, how the department of LUT Metal works intensively with selecting the most appropriate educational methods (e.g. virtual engineering, project-based teaching, integration of foreign language education) to carry out both degree programmes.

The key areas in terms of developing the quality of education at LUT are the following:

- development projects for teaching
- LUT's internal quality bonus for education
- a pay system with incentives for high-standard education and its development
- pedagogical and other continuing education for the teaching staff
- support services for teaching
- system for the recognition of teaching qualifications.

LUT is actively involved in a number of different national and international development projects for teaching. The vice-rector in charge of education decides on development projects which LUT engages in and starts to promote.

The university grants quality bonuses for the development of education for a year at a time. The quality bonus is a reward for development measures taken and an incentive for the further development of education and teaching. The steering and development group for education makes the preparations for the application procedure and the decision to grant a quality bonus, and the rector appoints the recipients of the bonus. Department of Mechanical Engineering has been and is involved in several education development projects, which are rewarded with LUT's internal quality bonus (e.g. during the year 2011 Integration of modern material selection and German language studies and Integration of research methodology, research philosophy, communication skills and industrial proficiency in mechanical engineering).

The pay system provides an incentive for teachers to develop their teaching and pedagogical skills. The job classification of the teaching staff is based on scientific qualifications and their development, the development of teaching skills and the variety of teaching duties, and responsibility for one's field of science and its development (pay system guidelines on the intranet).

The university annually offers its teaching staff a study module in university pedagogy worth 25 ECTS credits. The teaching staff is also offered other training that supports their teaching and its development, such as training in the use of information and communication technology in instruction. The training is coordinated by Personnel Services. Some teachers from the department of Mechanical Engineering have already participated in this voluntary study module.

The support services for education allow teachers to focus on actual teaching and study guidance. The support services provide administrative services related to instruction, as well as technological support e.g. in setting up web-based instruction and educational technology. The responsibility for

these support services is shared by Student Services and Information Services and Technology, which operate within the context of University Services, and by faculty support services.

The recognition of teaching qualifications and the adoption of teaching portfolios in the appointment of teaching personnel supports the development of teaching. For teaching positions, the university recruits professionals with not only strong scientific expertise in the field in question, but with pedagogical skills, as well. To this end, applicants for teaching positions must also submit a teaching portfolio or another report on their teaching qualifications. Instructions for compiling a teaching portfolio are available on the intranet. In addition, the appointment of professors requires a trial lecture from the applicant. The faculty in question supplies the applicant with instructions regarding the trial lecture. Instructions are also available from the university registrar's office.

Internal auditing is an important part of quality management of Lappeenranta University of Technology. Internal audits are carried out systematically in every two years. Primary focus in first audits was on units' quality documentations with relation to LUT Quality Manual and practical operations. Under inspection was how well things described in quality documentation come true. Results of all internal audits are reported, and the reports are published on the university's intranet. On the 14th of October 2008, the internal auditing focused on quality management system of research activities in the technical faculty. The report stated that the description of quality management system had supported the faculty's management in developing the faculty. The faculty's personnel was well disposed towards auditing and development suggestions. According to the report good practices were e.g. co-operation with working life in research activities and further safety instructions are mainly well described and documented. The research projects presented in the auditing interview are documented carefully and appropriately.

Lappeenranta University of Technology supports faculties in developing their education and delivers each year so called quality bonus within LUT. Every spring, the Student's Union of LUT nominates the lecturer of the year and the course module of the year. The nomination of the course module of the year 2009 was given to the course module of BK20A2100 Structural materials, which belongs to the Degree Programme of Mechanical Engineering.

The most recent distinctions of noticeable development of the degree programmes are given to the department of LUT Metal Technology by the Finnish PedaForum-2011 (Forum for pedagogic subjects of university education) and by the International WEE 2011-conference (SEFI annual Conference of World Engineering Education), which both accepted papers to be presented and published in their proceedings and web-sites.

6.2 Instruments, methods and data

6.2.1 Evaluation during the degree programmes

During their studies students full fill out several questionnaires by which they can give feedback and tell their opinions concerning the studies and conditions in the university. At the beginning of the studies the freshmen are asked to full fill out a questionnaire concerning the progress of studies and the tutoring of freshmen. A feedback questionnaire to students and peer tutors helps to evaluate whether the start of studies and initial study guidance have been successful. The feedback survey is carried out annually by the Student Affairs Office. The feedback is discussed with the peer tutors and personnel in charge of study guidance. The feedback combined with practical experiences will be used to develop study guidance for new students and tutor training.

The Student Union also compiles student feedback regularly every other year. This questionnaire mainly concentrates on the well being of the students, and it often points out some needs for

development in education. The results of the questionnaire are communicated to the university personnel.

A study plan is an important tool to evaluate the progress of studies of an individual student. All LUT students prepare a study plan (HOPS) at the beginning of their studies. All individual study plans are evaluated and confirmed in accordance with faculty or department procedures.

The progress of studies and the accumulation of credits are monitored by the Student Affairs Office. The results are reported to the degree programmes, and the follow-up reports are available on the LUT intranet. The accumulation of credits is also examined annually to confirm students' eligibility for student financial aid from the Social Insurance Institution of Finland (KELA).

The accumulation of ECTS credits is controlled individually for each module. Credit accumulation is a key method of performance assessment. Statistics on ECTS credits accumulated are compiled annually for each faculty, and the number of completed credits is one of the criteria for resource allocation to departments.

Student feedback for modules is collected for all of the university's modules in accordance with a university-wide procedure. Teachers together with the feedback system administrators are responsible for collecting student feedback. The electronic feedback questionnaire applies the same assessment criteria to all modules. The objects of assessment include the expediency of the module and a general impression of the module.

The following questions deal with the fulfilment of these criteria:

1. The working methods applied were appropriate for the purposes of the course and they supported my learning during the course. Answers on a scale of 1-5 (5 = I agree completely, 1 = I disagree completely).
2. Overall evaluation of the course (scale of 1-5).
3. Open feedback on the course.

The feedback system also allows teachers to add questions to the questionnaire, thus collecting feedback for their own purposes. This, combined with the open feedback field in all of the questionnaires, supports the teachers' own professional development. Students are motivated to give feedback by preparing course-specific questions in addition to the general ones and by sending students a response to the feedback. The feedback for each course is recapitulated by the system administrator every semester with a general reporting form. The reports are forwarded to the heads of degree programme and to the quality manager, who then submits the reports to the vice-rector in charge of education before the performance and development discussions between the university management and faculties. The units' performance target negotiations deal with student feedback, and if the average assessment for a course is very low (e.g. 2.5 or lower), the vice-rector in charge of education discusses the topic with the head of the degree programme.

6.2.2 Evaluation of the success of the degree programmes

The university management, faculty management, heads of departments and heads of degree programmes shall ensure that the education provided by the university is efficient and of a high standard. Success of the degree programme is evaluated in many ways, which are described in the following. Alumni activities and employment of graduates are evaluated systematically.

A. Competence of graduates

Skills and knowledge accumulated by students during the entire education process are demonstrated in a final thesis, which is prepared by all Bachelor's and Master's level students. Skills in the student's native language are demonstrated in a maturity test at the end of the Bachelor's degree studies.

B. Quantitative results of a degree programme

Information on the number of graduates, the time in which their degree was completed and their employment is compiled into statistics by the LUT Student Services. The cost-efficiency of the education is also evaluated annually when the final accounts are drawn up. The frequency of student mobility is monitored annually by International Services. Student exchange statistics are compiled on the university intranet and published in the university's final accounts documents.

C. Satisfaction in the education

Satisfaction in LUT education is surveyed among LUT graduates at the time of graduation and after five years in the world of work, and among their employers.

Graduate feedback is collected from all LUT students at the time of their graduation – both Finnish and international students. The feedback is gathered together annually in February-March, and the results are reported at the university level on the intranet and broken down into individual degree programmes. Quality manager is responsible for this process together with the Student Services.

Moreover, feedback is collected annually from LUT graduates with a Master's degree and five years of experience in the world of work. The survey is conducted by LUT Career Services as a part of a national career follow-up. Employer feedback is collected e.g. through an extended teaching council including employer representatives. A new procedure concerning employer feedback has been introduced at the beginning of 2010: University follows up on the satisfaction of employers/supervisors in the outcome of thesis projects and in the skills of the students as they transition into the world of work. This questionnaire is sent to the employers and results annually reported by quality manager. Moreover, International Services collects feedback on student and support services from incoming exchange students at the end of their stay and analyses it systematically. LUT students leaving for student exchange write a report upon their return. The report is then read by International Services and published on the university web site. These follow-up practices are described in further detail in LUT Quality Manual and operations manuals of support services. The key results of the quality assurance are presented in the following data tables.

6.2.3 Collected relevant data from the quality assurance system

First year enrolments over the past five years on the consecutive Bachelor's and Master's degree programme in Mechanical Engineering have varied during the past five years and it seems to settle near 50 enrolments (Table 9). The drop out rate is illustrated in Table 10.

Table 9. First year enrollments

Degree prog.	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006
Bachelor	48	58	87	75	43
Master	1	9	7	12	11
Total	49	67	94	87	54

Table 10. Number of students per course and degree programme / drop out rate

Academic year	1	2	3	B.Sc. N	4	5	M.Sc. N	Total
10/11	53	47	56	158	53	45	62	474
09/10	51	61	39	72	55	33	47	358
08/09	69	41	40	49	37	34	43	313
07/08	50	40	36	9	29	51	10	225
06/07	41	25						

The head of the degree programme has noticed the problems in the first year studies and special actions are carried out if the cumulative amount of credits of some students remains too far from the mean. Teachers and students try together to find the right ways to improve the success in studies to avoid interruptions of studies during the first two years. The progress of studies and the accumulation of credits of first and second year B.Sc. students are presented in Table 11.

Table 11. The progress of studies and the accumulation of credits of first and second year B.Sc. students

	Year 2009	Year 2008	Year 2007	Year 2006	Year 2005
Cumulative credits after the 1 st year (mean)	49,3	42,9	43,4	39,6	39,3
Cumulative credits after the 2 nd year (mean)	N/A	95,4	85,8	101,5	60,5

Table 12. Number of students in the international degree programmes

	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006
Students in the international degree programmes	22	13	15	7	8

The results in the Table 12 show that the number of students in international degree programmes has increased constantly. In the near future, it is necessary that LUT Metal Technology considers to get prepared for accreditation of the international degree programmes as well.

From the number of graduates (Table 13) it can be seen that the Master's degree programme has increased its percent proportion from 41% to 59% and the total amount of graduates of Master's degree programme has more than doubled in five years.

From the distributions of final grades (weighted mean) of the graduates (Table 14 and Figure 7) and their grades in the Bachelor/Master Theses (Table 15 and Figure 8) a slight emphasis towards grade 3 (good) in final grades and grade 4 (very good) in the grades of final theses can be seen. The grading scale of final theses seems to practically omit grade 1. This observation is justified, because the professors at the department of LUT Metal technology have agreed with the principle that their common objective is to aim for grade 3 (good) in each evaluated Bachelor/Master's theses. Professors regard the final theses more like processes, which are carried out in co-operation with the students,

supervisors and the guiding professors and therefore it is reasonable to continue these processes with the students until they have reached the requirement level of grade 3 (good).

Table 13 . Graduates per degree programme

Degree programme	Year 2010	Year 2009	Year 2008	Year 2007	Year 2006
Bachelor (in accreditation procedure)	32	25	6	18	27
Bachelor (other programmes)	N/A	N/A	0	7	4
Bachelor (Total)	32	25	6	25	31
Master (in accreditation procedure)	61	65	25	20	19
Master (other programmes)	43	36	38	46	27
Master (Total)	104	65	63	66	46
Graduates (Total)	136	90	69	91	77

The mean duration of the studies in the Master's Degree programme is 6,1 years and in the Bachelor's Degree Programme 4,8 years. However, many of the students do their military service (6 months to 11 months) during the measured time period. Therefore the real duration of the studies are near 5,5 years (M.Sc.) and 4,3 years (B.Sc.), see Table 16. The more clear distinction between B.Sc. and M.Sc. degrees is under discussion in Finnish academic environment, especially in the branch of sciences dealing with engineering.

Table 14. Final grade (weighted mean) distributions of the graduates / year 2010

Degree programme	1-1,99	2 – 2,99	3 – 3,99	4 - 5
Master	4 %	59 %	30 %	7 %
Bachelor	10 %	58 %	22 %	10 %

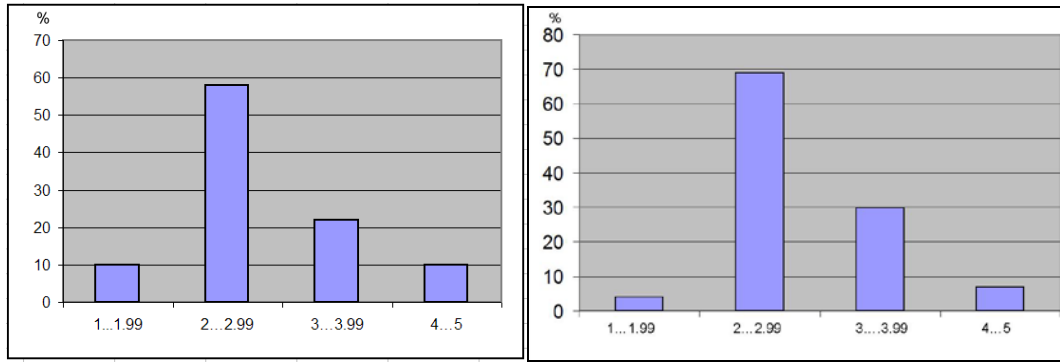


Figure 7. Final grade distributions (Left: B.Sc., Right: M.Sc.)

Table 15. Grades of Bachelor's and Master's Thesis

Year	1	2	3	4	5
M.Sc.	0 %	4 %	35 %	50%	11 %
B.Sc.	0 %	0 %	16 %	55 %	29 %

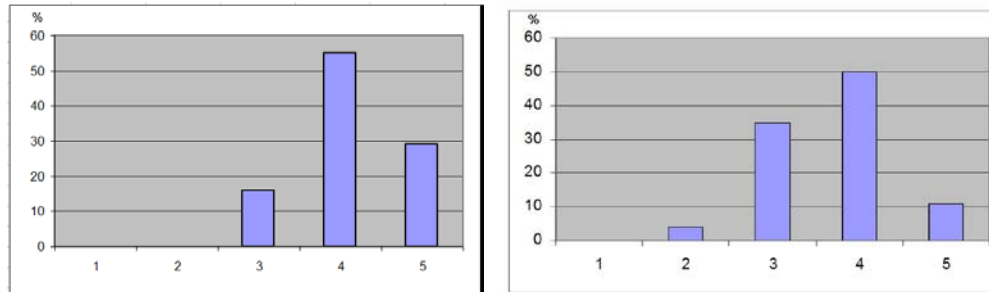


Figure 8. Left: Grades of Bachelor's Thesis ; Right: Grades of Master's Thesis

Table 16. Duration of the studies from the beginning in B.Sc. programme to graduation in M.Sc. programme.

	Year 010	Year 2009	Year 2008	Year 2007	Year 2006
Time of study, median (Master's Degree Programme, consecutive programmes B.Sc.+M.Sc)	6,5 years (8,1 years*)	5,9 years (6,9 years*)	5,7 years	6,5 years	5,8 years
Time of study, median (Bachelor's Degree Programme)	5,0 years	4,6 years	4,8 years	N/A	N/A

*) During the years 2009-2010 many old students graduated, because year 2010 was the time limit to complete the degree without additional studies.

The mean value of the course evaluation given by the students has been quite stable through the years (mean 3,56). The main observation of course feedback reports is the relatively small replying percentage (in average about 40 %) and it even seems to be decreasing (Table 17). This spring we have tested during one course module (BK10A1000 Research Methods Seminar) the possibility of making the feedback survey by phone calls and the replying percentage was increased up to 70%.

Table 17. Course feedback reports

	2009/ Spring	2009/ Autum n	2008/ Spring	2008/ Autum n	2007/ Spring	2007/ Autum n	2006/ Spring	2006/ Autum n
Mean value of evaluation	3,63	3,75	3,50	3,56	3,58	3,52	3,48	3,47
Total number of opinions (%-portion)	416 (32,3 %)	496 (31,6 %)	554 (38,7 %)	506 (32,7 %)	693 (44,3 %)	616 (43,0 %)	810 (54,7 %)	760 (43,8 %)

The calculated mean values of numerical evaluations (Table 18) collected from the feedback from graduated Masters of Science in 2006 -2010 show, that the satisfaction level has remained relatively stable within the graduated students (mean values between 3.6...4.0). According to this target group our strengths are the capabilities to produce good professional skills (mean value 4.0) and our guidance of the Master's Thesis is regarded very good (mean value 4.0). The utilized questionnaire in the survey for graduated students is in enclosure 22 and an example of a questionnaire used in Career and employment survey for the graduates in 2003 is in enclosure 23. LUT Metal Technology is focused on developing the degree programme into the direction which best meets the requirements of the job market. Therefore several types of surveys are in use. The third example is the utilized questionnaire on employment for LUT graduates (enclosure 24). Feedback by the commissioner of Master's Thesis is summarized in Table 19.

Table 18. Feedback from graduated Master of Science in 2006 -2010 (Scale 1-5)

Satisfaction of the graduate on...	2010	2009	2008	2007	2006	Mean value
Course content	3,76	3,70	3,62	4,09	3,76	3,8
Development of professional abilities	4,09	3,86	4,09	4,15	3,91	4,0
Development of transferable skills	3,49	3,70	3,49	3,60	3,32	3,5
Knowledge on my own field	3,64	3,65	3,81	3,87	3,60	3,7
The ability to apply theoretical knowledge into practice	3,75	3,41	3,65	3,98	3,49	3,7
Study guidance and atmosphere in the department	3,67	3,62	3,56	3,75	3,52	3,6
Guidance of the Master's Thesis	3,91	3,90	4,02	4,33	3,94	4,0
Mean value	3,8	3,7	3,7	4,0	3,6	

Table 19. Feedback by the commissioner of Master's Thesis (Results based on the Webropol-survey 17.2.2010)

	Year 2010
Basic knowledge and skills (Scale 1-7)	5,57
Project management and collaboration competences (Scale 1-7)	5,75
Communication and presentation skills (Scale 1-7)	5,12
Over all satisfaction on (Scale 4-10)	8,6

From the Career and Employment Survey for LUT Graduates it can be seen, that The LUT Metal Technology has focused on the right development aspects of The Degree Programme of Mechanical Engineering by emphasizing both the factors having an effect on employment and by trying to improve the features enabling students to be provided with better working life skills during their university studies (see enclosure 6).

7. DOCUMENTATION AND TRANSPARENCY

7.1 Relevant regulations

To receive the Degree of Bachelor of Science from Lappeenranta University of Technology, at least 90 ECTS credits including the bachelor Thesis, have to be passed in this university (total degree 180 ECTS cr). For the degree of Master of Science in Technology, the minimum is 70 ECTS credits including the Master Thesis. The degrees and the Finnish universities that can award these degrees are defined in the Universities Act (558/2009) (enclosure 1)

The Head of the Degree Programme makes the decision of the modules included into the structure of the degree of an individual student.

The detailed regulations of the Degree are given in the University Regulations on Education and the Completion of Studies (Enclosure 4). National, master regulations on Master's level studies for universities are given in the Government Decree on University Degrees (National degree regulations 794/2004) (Enclosure 2).

7.2 Diploma Supplement

At LUT a diploma supplement (DS) is formulated by following the directions of the National Board of Education and always attached to the B.Sc. and M.Sc. degree certificates (the actual degree certificate are in Finnish). The DS is in English and meant for international use. Diploma supplement is attached to the degree certificate along with the transcript of records. It includes the information about the University, modules included into the degree, as well as the grades of the modules and the structure of the degree (see enclosure 4, University Regulations on Education and the Completion of Studies, § 22). Both major and minor subjects are given an overall grade. The overall grade is the average of all the LUT courses completed by the student in the subject in question, weighted according to the workload of each course (see instructions of calculation in Enclosure 27) .More detailed information is available from the attached models of the LUT diploma supplements, (Enclosures 15 and 16, B.Sc. and M.Sc. supplements separately).