STUDY GUIDE 2008-2009

STUDY PROGRAMMES AND COURSES IN ENGLISH

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

University of Technology and Economics

Lappeenranta University of Technology is a university specialised in technology and business. Education in technology began in 1969, and business administration education was launched in 1991. Approximately 5 500 students study on the Skinnarila campus. By the end of 2007, the university has educated 6256 Masters of Science in Technology, 1189 Masters of Science in Economics and Business Administration, 196 licentiates and 286 doctors.

Expertise in technology and business are combined in a unique way in studies and research at Lappeenranta University of Technology (LUT). The university's areas of strength involve the forest and metal cluster, energy, Russian business and industry, and information and communication technology. The university has three faculties: the Faculty of Technology, the Faculty of Technology Management, and the School of Business. Nine different degree programmes are available to students.

Values that impact the activity of Lappeenranta University of Technology are ethics, high quality and the "Skinnarila spirit". The Skinnarila spirit consists of industriousness, innovation, commitment, cooperation, encouragement, openness, and the cheerful and friendly Karelian way of life. In keeping with this spirit, the university trains international specialists with a strong ethical foundation and the ability to continuously learn and develop themselves.

THE UNIVERSITY'S ACADEMIC YEAR 1 August 2008 – 31 July 2009

The periods and exam and intensive course weeks for the academic year 2008-2009:

AUTUMN SEMESTER 2008   **SPRING SEMESTER 2009**

Periods   **Periods**

1st 1 Sep. – 17 Oct. 2008   3rd 12 Jan. – 27 Feb. 2009
2nd 27 Oct. – 12 Dec. 2008   4th 9 Mar. – 30 Apr. 2009 *

Intensive Week   **Intensive Weeks**
Week 43   20 – 25 Oct. 2008   Week 2   5 Jan. and 7- 9 Jan. 2009
                                                 Week 10   2 – 7 Mar. 2009
                                                 Week 19   4 – 8 May 2009

Exam Weeks   **Exam Weeks**
Week 35   25 – 29 Aug. 2008   Week 2   5 Jan. and 7 - 9 Jan. 2009
Week 43   20 – 25 Oct. 2008   Week 10   2 – 7 Mar. 2009
Week 51   15 – 19 Dec. 2008   Weeks 15-16 9 and 14-15 Mar. 2009 *
                                                 Week 19   4 – 8 May 2009
                                                 Week 20   11 – 15 May 2009

Examinations are organised during the periods on Mondays and Wednesdays at 16.15 (five-hour exams start at 15.15) and on Fridays at 14.15. On exam weeks examinations are organised Monday-Friday at 9.15 and 16.15 (five-hour exams start at 15.15).

* On the **Easter exam week** 9 April and 14-15 April 2009, examinations are organised Monday-Friday at 9.15 and 16.15 (five-hour exams start at 15.15). **No lectures** are given during this time.

Saturday exams may be organised on 25 Oct. 2008 and 7 Mar. 2009; the degree programmes and faculties will decide on the arrangements at a later date.

The **exam and course schedules** will be available on the university web site.

Orientation for new international students is organised 27–29 August 2008 and 8 January 2009.

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1 Studying at Lappeenranta University of Technology

Study Right and Registration

LUT degree students must register each academic year as attending or non-attending. Each student who wishes to take part in lectures, assignments, examinations or other forms of teaching must register as attending and pay the student union membership fee. Students registered as non-attending can not take part in instruction or exams.

Registration for the academic year 2008-2009 starts 1 June 2008 and ends 25 August 2008. **The student union membership fee must be paid by all students registered as attending.** *You may not register for courses or exams before you have registered for the academic year and paid the student union fee.* Students who have not registered by the deadline (22 August) will be removed from the student register and will no longer be entitled to study at LUT.

Under the Universities Act, students who have been admitted to complete both the Bachelor's degree (180 ECTS cr) and the Master's degree (120 ECTS cr) must carry out their studies in 7 years. Those who complete only the Master's degree (120 ECTS cr) have 4 years to do so. The time limit does not apply to students completing the so-called old Master's degree worth 180 credit units.

For further information on registration and the duration of the study right, please contact the Student Affairs Office.

Study Guidance

Orientation for new students will be organised at the beginning of the academic year. The students will learn more about the university, degree programmes and studies, and they will be helped with the practical arrangements related to starting studies at LUT. There will also be assemblies regarding important issues later on during the studies. Students will be informed of them separately.

You can find answers to many general questions in studies from this guide and on the university web site. Individual study guidance is offered by the degree programmes' study coordinators, student advisers, heads of study affairs at the faculties, tutors and teachers. Furthermore, the study counselling psychologist, the staff of the Study Affairs Office and the entire university is there to help students with issues related to their tasks.

Each faculty has a **head of study affairs** who manages the faculty's study affairs. Their tasks differ a bit in each faculty. They can, however, tell you who to turn to with different questions. **Study coordinators** are experts in studies provided by their degree programme. They offer study guidance from the very beginning of the studies until graduation. They help with e.g. the personal study plan (credit transfer from previous studies and other universities, substituting courses etc.) and with students' applications and other administrative issues. The faculties and degree programmes also have **study affairs secretaries** who attend to study affairs.

Student advisers are students themselves and offer individual assistance in practical matters related to studies. You can turn to them in questions involving e.g. the course schedule, choosing courses and your personal study plan or other practical matters.

Student tutors assist new students with practical arrangements at the beginning of their studies. During orientation, freshmen are divided into small groups led by older students or tutors. The tutors help new students start their studies.

Teachers and assistants are naturally the best sources of information in their own field and courses, and instruct students with matters related to them. Students can consult them during their office hours. **In addition, there are teacher tutors. The degree programmes will provide more information on their services.**

Study coordinators of international students:

•	Faculty of Technology	Ms Jutta Luostarinen	05 621 2268
		Ms Minna Loikkanen	05 621 2268
•	Faculty of Technology Management	Ms Riitta Salminen	05 621 2659
		Ms Susanna Koponen	05 621 2817
•	School of Business	Ms Essi Reponen	05 621 7214
•	International Business and Technology Management	Ms Virpi Maunuksela	05 621 6083

You can turn to the **study counselling psychologist** when you need help e.g. with different learning styles and techniques, or when you want to talk confidentially about other issues that have an impact on your studies.

WebOodi

WebOodi is the user interface for LUT students through which they register for exams, courses and the academic year, modify their contact information in the student register and monitor the records on the courses they complete. In WebOodi you can also request that an unofficial transcript of records be sent to you directly via e-mail.

WebOodi and instructions on its use are available on the university web site. New students will receive instruction on the use of WebOodi during orientation.

You should primarily register through WebOodi. If for some reason you can not do so, you can also register before the relevant deadline at the Study Affairs Office either in person, by telephone or by sending e-mail to opinto@lut.fi.

Students themselves are responsible for updating their personal information in the student register. You can update the information (e.g. address, municipality of residence, e-mail and telephone) in WebOodi. If you cannot access WebOodi, you should give the information directly to the Study Affairs Office.

Registration for Courses

The times and places of the courses are given in the course schedule on the university web site.

You must register for a course before it begins. You should register for courses again each year if you wish to take part in the related lectures, tutorials or other instruction. If you plan to retake an exam you should only register for the exam.

Students can register for courses through WebOodi.

Enrolment for courses in the autumn semester 2008 starts on 1 August 2008, and for courses in the spring semester 2009 on 1 December 2008. Enrolment for each period ends as follows:

Registration for courses in Period 1 ends	Sat, 30 Aug 2008 at 20:00
Registration for courses in Period 2 ends	Thu, 23 Oct. 2008 at 23:59
Registration for courses in Period 3 ends	Sat, 10 Jan. 2009 at 20:00
Registration for courses in Period 4 ends	Thu, 3 Mar. 2009 at 23:59

In the autumn semester, lectures start on 1 September 2008, and in the spring semester on 12 January 2009.

Further instructions on registering for language courses are provided in the Language Centre study guide and on their web site.

Remember to register for both courses and exams separately.

Registration for Exams and Midterms

The dates and times of examinations and midterms are listed in the course schedule on the university web site. Registration for the exams is done through WebOodi.

Registration starts 4 weeks before the exam date and ends 1 week before the exam.

If you have registered for an exam but are unable to take it, you must cancel your registration through WebOodi. You can cancel your registration 3 working days before the exam.

Exam Date	Registration Deadline	Cancellations
Monday	Monday, a week before the exam	Wednesday, a week before the exam
Tuesday	Tuesday, a week before the exam	Thursday, a week before the exam
Wednesday	Wednesday, a week before the exam	Friday, the week before the exam
Thursday	Thursday, a week before the exam	Monday, the week of the exam
Friday	Friday, the week before the exam	Tuesday, the week of the exam

You can only take one exam during one exam session (morning of afternoon exam). This means you can take one morning and one afternoon exam in the same day.

Evaluation of Completed Courses

Courses are evaluated either on the scale excellent (5), very good (4), good (3), satisfactory (2), sufficient (1) and failed (0), or pass – fail. The basis for the course evaluation (exam, assignment etc.) is given in the course descriptions in the study guide.

Language skills in the other official language of Finland (Finnish or Swedish, whichever is not the student's native language) are graded good (H) or satisfactory (T). Oral and written communication skills are evaluated separately.

If students are not satisfied with their grades, they may request a correction from the teacher who gave the grade. Students can make the request orally or in writing within 14 days of the day the grade was made known. They also have the right to find out why they were given the specific grade. If the student is not satisfied with the teacher's reply to the correction request, he or she may take the matter up with the university's degree committee. The correction request must be submitted to the Student Affairs Office within 14 days of receiving the teacher's reply. The decision of the degree committee is final, no appeal can be made.

Regulations on Studies

The provisions laid down in the Universities Act and the Universities Decree apply to LUT.

Provisions on education, studying and degrees are laid down in the Government Decree on University Degrees (794/2004) and LUT's regulations for teaching and studying (approved 24/01/2007). The decree and regulations are available on the university web site.

Disciplinary Measures
LUT's regulations for teaching and studying (section 91) include provisions on disciplinary measures.

Students in breach of rules and regulations related to studies or research can be cautioned or expelled for up to one academic year. The decision to caution a student is made by the rector and to expel by the university senate.

Before the issue is processed, the student is told what he or she is accused of and given the opportunity to be heard on the matter.

If a student is caught cheating on an exam, the supervisor must remove the student from the exam hall immediately. If a student is caught cheating after the exam is over, the teacher who grades the exam must fail the student. The dean is to be notified of these measures.

When the invigilator or other teacher notices or has cause to suspect that a student has committed an offence, he or she shall notify the teacher who prepared the exam, the dean of the student's faculty and the administrative director in writing.

The administrative director together with the rector decides on the appropriate measure depending on the case. If needed, the matter will be brought before the university senate and the student may be expelled for a fixed period. As for exchange students, the home university will be notified of the offence.

In practice, expulsion for a specified period means that the student will receive a mark in his or her record: he or she will not be mentioned in the student register as an enrolled student during the period. The student's username and passwords will be revoked and the magnetic key confiscated. No student financial aid is granted for the period of expulsion.

Degree Certificates

Students receive separate degree certificates for the Bachelor's degree (180 cr) and Master's degree (120 cr).

The certificate will show e.g. the graduate's degree, degree programme, major and minor subjects and their overall grades, and the topic of the thesis and its grade.

The student is given an overall grade, which is the weighted average of all the student's LUT courses that were graded with a number, excluding the student's thesis.

Average	Grade
1,00 - 1,49	Satisfactory
1,50 - 2,49	Very Satisfactory
2,50 - 3,49	Good
3,50 - 4,49	Very Good
4,50 - 5,00	Excellent

Also major and minor subjects are given an overall grade according to the table above. 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.

With regard to language skills, the certificate will mention the language in which the student received his or her education, the language of the maturity test and the written and spoken skills in the other official language of Finland.

Students will receive a special mention in their Master's degree (120 ECTS cr) certificate of having carried out their studies *with distinction* if their overall grade is at least 4 and the grade for their Master's thesis is 4 or 5. In addition to this, at least 40 credits included in the degree must be carried out at LUT and graded on a scale of 1 – 5.

As an appendix to the degree certificate, students will receive a transcript of records in Finnish and English, and a Diploma Supplement in English.

Graduates from English Master's programmes receive both a Finnish and an English degree certificate.

Students must fill out an application for the degree certificate. The forms are available on the university web site.

2 Student Support Services

Student Affairs Office

The **Student Affairs Office** is located on the 1st floor of the university's main building. It provides general guidance and services for students in e.g. the following matters:

- registration for the academic year
- registration for courses and exams
- WebOodi
- registration certificates
- study guides
- records of completed courses
- official transcripts of records
- the exam schedule
- degree certificates and
- student financial aid.

You may visit the office from Monday to Thursday between 12.00 and 15.00 and on Friday between 12.00 and 14.00. At other times you can reach the office staff by telephone.

The Study Affairs Office phone numbers are 05-621 6061, 05-621 6062 and 05-621 6063, and you can send e-mail to opinto@lut.fi.

Transcript of Records and Registration Certificate

You can order a transcript of records in Finnish or English from the Student Affairs Office. A fee is charged for an official transcript.

You can also ask for a registration certificate if you need to prove you are a registered student at the university. The registration certificate is available in Finnish or English. There are different registration certificates for different purposes, so please mention why you need it.

International and Career Services

The International and Career Services of Lappeenranta University of Technology are in charge of student exchange and international internships and help students find employment and employers find specialists for various professional tasks.

International Services provide guidance and counselling in practical matters to all international students studying at LUT. International services are in charge of the university's international student exchange – both students going abroad to study and those coming to Lappeenranta. Thanks to an extensive cooperation network, LUT students have the opportunity to take part in exchange programmes around the world and welcomes international exchange students from over 140 partner universities.

Students of Master's degree programmes in English are not, however, entitled to participate in student exchange. Students participating in MITIM Double Degree programme made an exception; part of their studies is carried out abroad.

International Services are responsible for the International Business and Technology Management programme. Both international exchange students and LUT's own students may take courses in the programme.

Career Services help students to plan internships, Master's thesis projects and other employment as well as international internships. They provide facilities and tools for searching for information on

jobs, employers and looking for work. Students may use the telephone, copy machine, fax and computers free of charge.

Career Services give students tools for looking for employment and for planning their career. In practice, this means that students are offered training and personal guidance related to job searching and working life. Furthermore, Career Services annually organise various recruitment and corporate events.

LUT's International and Career Services are located in the university's main building, the 3rd floor of the 1st section. The office is open from Monday to Thursday 9.30-15.00 and on Friday 9.30-14.00

Origo and the Learning Centre

Origo provides LUT students a working and study environment complete with information services. Origo houses both the LUT library and the Learning Centre. The facilities are equipped with top-of-the-line technology and software for online studies, information retrieval, assignments, etc.

The Learning Centre's services concentrate on supporting students and making their studies more flexible. The services include user support for an online platform (Blackboard), a feedback system (W-Pol) and exam aquarium software (SoftTUTOR), and consultation with a study counselling psychologist. In addition, the Learning Centre coordinates LUT's peer tutoring and offers related training in cooperation with the faculties.

Online instruction has increased in importance. At the moment, there are only a few fully web-based courses at LUT, but a large number of courses include online instruction in one form or another.

An example of making studies more flexible for studens is the exam aquarium application. Students have a chance to take their maturity test and a number of other exams in the exam aquarium at a time of their choice.

The study counselling psychologist provides support in questions involving studies. The psychologist can help students e.g. in recognising their own unique learning style, getting studies going and finding motivation. The counselling is fully confidential.

Library

The library provides a wide range of services and has an extensive collection of electronic and printed publications for the students and staff to use. The LUT library is a scientific library open to the public.

Students need the library when they borrow course books or search for information for their assignments or theses. Books are borrowed and returned at the check-out desk or the self-service machine. The library also provides instruction on information retrieval for studies. Tailored education is available at different stages of studies. The information desk provides help on a daily basis.

Material that is not available in the library's own collections can be loaned from other libraries.

The opening hours during the semester are Mon-Thu 8.30-18.00 and Fri 8.30-15.30. Information on changes in the regular opening hours will be posted by the library entrances and on the library's web site.

3 Degrees in Technology

General Information

At Lappeenranta University of Technology, the lower university degree in technology is Bachelor of Science (Technology) 180 ECTS credis and the higher university degree is Master of Science (Technology) 120 ECTS credits. Students first complete the Bachelor's degree studies, which are followed by the Master's degree studies.

A description of the so-called old degree structure - the Master of Science degree worth 180 credit units - can be found in the 2004-2005 Study Guide and older editions.

Students are admitted into degree programmes, which lead to these degrees. A degree programme is an entity of courses with scholarly and professional aims. Students specialise in a professional field of technology and its development. The degree programmes at LUT are:

- the Degree Programme in Chemical Technology
- the Degree Programme in Electrical Engineering
- the Degree Programme in Energy Technology
- the Degree Programme in Environmental Technology
- the Degree Programme in Mechanical Engineering
- the Degree Programme in Industrial Management
- the Degree Programme in Information Technology
- the Degree Programme in Technomathematics and Technical Physics (in English)

The Master's degree programmes in English are:
- Master's Degree Programme in Bioenergy Technology
- Master's Degree Programme in Chemical and Process Engineering
- Master's Degree Programme in Electrical Engineering
- Master's Degree Programme in Information Technology
- Master's Degree Programme in Mechanical Engineering
- Master's Degree Programme in New Packaging Solutions
- Master's Degree Programme in Technomathematics and Technical Physics
- CBU Master's Degree Programme in Information and Communications Technology

Measurement of Studies
The studies are measured in credits (cr). The average annual workload of a student is 1600 hours of work, which is worth 60 ECTS credits. One credit refers to an average input of 26 hours of work by a student. Credits are recorded only in whole numbers, not decimals.

Courses included in the degrees are either obligatory, optional or elective.

Major Subjects
The degree programmes are divided into major subjects. In the Bachelor's degree, the major studies contain basic and intermediate studies. In the Master's degree, the major studies are advanced studies.

Students must usually apply for a major subject and the head of the degree programme decides on admissions. The application period and admissions are usually in the spring semester. Further information will be provided by the degree programmes.

Minor Subjects
Minor studies in the Bachelor of Science (Technology) degree are at least 20 ECTS credits, with the exception of Industrial Engineering and Management where the minor studies in technology are 30

ECTS credits. A minor subject in the degree of Master of Science (Technology) is at least 20 ECTS credits.

Some minor subjects started in the Bachelor's degree studies may be continued in the Master's degree. The minor studies in the Bachelor's and Master's degrees both worth 20 ECTS credits will then compose an extensive minor subject (a minimum of 20+20 ECTS credits, or for the technology minor in Industrial Engineering and Management, 30+20 ECTS credits).

There may be restrictions in selecting a minor subject in certain degree programmes. Further details on these restrictions are provided in the section of each degree programme.

Minor subjects for degree programmes in technology are listed in this guide in the section of each degree programme. Other minor subjects are listed at the end of the guide under "Other Minor Subjects for Technology Students".

Personal Study Plan

A personal study plan is an outline prepared by the student of the content and schedule of his/her studies. The plan includes the courses the student wishes to include in the degree and the organisation of the studies, following the requirements set in the study guide. The studies are completed according to the study guide.

The study plan is made for the entire duration of the studies, i.e. until the higher university degree is completed. The personal study plans are reviewed and revised three times during the studies: at the beginning during orientation, when obtaining the Bachelor's degree, and when applying for the Master's thesis topic. For further information, please contact the study guidance staff of the degree programmes.

The WebOodi eHOPS tool has been adopted in autumn 2008 by the majority of degree programmes. More information on eHOPS will be provided by the student adviser of your degree programme.

Credit Transfer

Credits from studies in other Finnish or foreign universities or institutes can be transferred into LUT degrees. In such cases, students must submit an application to the degree programme. The Language Centre decides on credit transfer for compulsory language studies.

However, the Bachelor of Science (Technology) degree must include at least 90 ECTS credits completed at LUT (80 ECTS credits and a Bachelor's thesis and seminar 10 ECTS credits).

A Master's degree (120 ECTS credits) must contain at least 70 ECTS credits completed at LUT (Master's thesis 30 ECTS credits and other studies 40 ECTS credits of which at least 15 must be major studies). A maximum of 30 ECTS credits can be transferred to the M.Sc. degree from a higher university degree in another Finnish university.

Transferred courses will be entered into the student's records and given the grade 'passed' (H).

More information on credit transfer is given by the study guidance staff.

Internship

The degree of Bachelor of Science (Technology) can include an internship worth 2 ECTS credits. During the internship students learn about their professional field, the workplace and its relationships, conventions, problems and solutions.

The degree of Master of Science (Technology) includes a compulsory internship (at least 2 ECTS credits). Further information on the extent of the compulsory internship in each department is given in the department's study guide. Students may receive a maximum of 10 ECTS credits for their internship in the Master's degree. The internship aims at furthering the student's professional skills and teaching the student to apply theoretical knowledge to practical issues. Further information on

the extent of the compulsory internship in Master's degree programmes in English – if any required – is given in the section of degree structures of each study programme.

Two weeks of full-time work corresponds to one ECTS credit. If the employment lasts less than 15 working days, it will not be approved as an internship.

The internship is assessed and approved by a person appointed by the head of the degree programme.

Employment prior to the studies may be accepted by the appointed coordinator as an internship if it has not been included in any previous degrees.

Further information and details on internships are available from the study guidance staff of the degree programme in question and the university web site.

Maturity Tests

Students must take a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. The maturity test is taken in the language in which the student has received his or her education in Finland. If the student has received his or her education in a language other than Finnish or Swedish, the head of the degree programme determines the language of the maturity test. In such cases only the contents of the maturity test is evaluated, not the language.

The maturity test for the Bachelor's degree is supervised and students are not allowed to use reference material. The maturity test is evaluated by the supervisor of the thesis with regard to the content and a language specialist appointed by the university with regard to the language.

Students must take a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. If the student has demonstrated his or her Finnish or Swedish skills in connection with the Bachelor's degree or another previous university degree, only the content of the maturity test will be evaluated and the head of the degree programme may decide to accept the presentation given by the student in the Master's degree seminar as the maturity test. Degree programmes may also have other ways of substituting the maturity test.

If a student has not passed the maturity test in the Bachelor's degree or in another previous university degree (or if the student completes the 180-credit unit Master's degree in accordance with the old degree structure), he or she must take a supervised maturity test. No reference material is allowed and both the contents and language will be evaluated. The contents will be assessed by the 1st examiner of the Master's thesis and the language will be evaluated by a language consultant assigned by the university.

The maturity test is evaluated on a scale of passed/failed.

Further instructions on the maturity test are available in the Language Centre study guide and the university web site.

Bachelor of Science (Technology)

The workload of the degree of Bachelor of Science (Technology) is 180 ECTS cr. The degree usually takes three years of full-time studies to complete. The Bachelor's degree is composed of the following studies:

- general studies, at least 100 ECTS cr or in Industrial Engineering and Management at least 90 cr
- major subject and supporting studies 40-50 ECTS cr
- minor subject, at least 20 ECTS cr or in Industrial Engineering and Management at least 30 ECTS cr
- elective studies 10-20 ECTS cr

Language and communication studies and the internship are included in general studies. The Bachelor's thesis and the related seminar are included in the major studies.

Bachelor's Thesis

At the end of their lower university studies students prepare a Bachelor's thesis. The Bachelor's thesis is an independent course or an assignment connected with a course in the student's major studies (which is not included in the course in question). The workload of the thesis and the related seminar is 10 ECTS cr.

The thesis is supervised and examined by the instructor of the course in question or someone else assigned by the degree programme. The thesis is evaluated on the scale excellent (5), very good (4), good (3), satisfactory (2), sufficient (1) and failed (0).

Students from all faculties prepare their Bachelor's thesis according to the instructions given by the vice-rector in charge of teaching. The instructions are available at the end of this guide and on the university web site. Faculties may give their own instructions for the Bachelor's thesis.

Master of Science (Technology)

The workload of the degree of Master of Science (Technology) is 120 ECTS cr. The degree usually takes two years of full-time studies to complete. The Master's degree is composed of the following studies:

- general studies, at least 20 ECTS cr
- major subject and supporting studies at least 60-70 ECTS cr
- minor subject, at least 20 ECTS cr
- elective studies at least 10-20 ECTS cr

Language and communication studies and the internship are included in general studies. The major studies include the Master's thesis, which is worth 30 cr. In the Master's degree programmes in English, the number of credits in the degree elements may deviate from the above presented.

Complementary Studies for Students Admitted Directly into a Master's Programme

If a student has been admitted into the university only to complete the Master's degree (120 cr), the degree programme in question may require complementary studies depending on the student's previous studies. The student may need to carry out up to 60 ECTS credits of complementary studies. They are not included in the Master's degree, but are an addition to it.

Master's Thesis

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 related to his or her professional field. The Master's thesis is a research project which requires approximately 6 months of work and it is worth 30 credits. The Master's thesis is related to the student's major subject and its topic is agreed on by the supervisor and the student together.

The topic of the Master's thesis is approved by the head of the degree programme, who will also appoint a supervisor from among the university's professors or adjunct professors. The head of the degree programme will appoint two examiners, the first of which is always the supervisor.

The Bachelor's degree and possible complementary studies must be completed before applying for the approval of the thesis topic. Other conditions are specified in the instructions for preparing a Master's thesis issued by the vice-rector.

The Master's thesis can also be a group project of two or more students. However, in such cases one should be able to distinguish the parts of the thesis prepared independently by each student.

These parts should be evaluated separately. The thesis can be prepared in Finnish, Swedish or English. Permission for using other languages is granted by the head of the degree programme. In Master's programmes taught in English, the Master's thesis is also prepared in English.

The faculty council will assess the thesis. The thesis is evaluated on the scale excellent (5), very good (4), good (3), satisfactory (2), sufficient (1) and failed (0).

Before starting their thesis, students must read the related instructions given by the vice-rector in charge of teaching. The instructions are available at the end of this guide and on the university web site. Faculties may also give their own instructions for the Master's thesis.

Postgraduate Degrees

After the Master's degree, LUT offers good possibilities for completing the postgraduate degrees of Licentiate of Science (Technology), Doctor of Science (Technology) and Doctor of Philosophy.

The licentiate degree usually requires two years of full-time studies. The doctoral degree, on the other hand, requires approximately four years of full-time studies. The workload of the postgraduate studies is 60 credits, which is divided into 35-40 ECTS credits of major studies and 20-25 ECTS credits of supporting studies. The studies are composed of courses organised by a graduate school or equivalent, university courses, literature exams or other scientific courses. In addition, postgraduate students must prepare a licentiate thesis or a doctoral dissertation, which is defended in a public examination.

If you wish to take part in postgraduate studies, you should consult the professor of the major subject in question and submit your application and study plan to the faculty council. The rector decides whether or not to grant the right to postgraduate studies after hearing the faculty council.

Details are also available from the faculty study guidance staff and on the university web site.

4 Master's Degree Programme in Bioenergy Technology

The Master's degree programme in Bioenergy Technology corresponds to 120 ECTS credits and leads to the degree of Master of Science in Technology.

The Aims of the Master's Degree Programme

The Master's degree programme responds to the needs of the changing society regarding sustainable energy and environmental engineering in a socially responsible international context.

The graduate is expected to

- be able to describe sustainability in energy production
- be able to design power engines in renewable energy
- understand and describe the special characteristics of the waste-to-energy technologies compared to other energy production technologies
- be able to explain the function of the most important emission reduction methods
- be familiar with the techniques of integrating environmental issues into decision-making processes
- be able to identify the advantages of using bioenergy, name the most important bioenergy sources and recognise the technical and economical possibilities to use bioenergy technology solutions
- be able to work with others in task-orientated groups, participating and interacting in the group in a productive manner for him/herself and for the group as a whole
- be familiar with mathematical tools needed, optimization, simulation, numerical methods

The Degree Structure of the Programme

Degree Structure		
General Studies	11	ECTS cr
Major Subject	30	ECTS cr
Minor Subject	20 (min.)	ECTS cr
Elective Studies	29	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
Total	*120 (min.)*	*ECTS cr*

General Studies (11 ECTS credits)
General studies are common to all the students in the programme.

Major Subject (30 ECTS credits)
The major subject Environmental Energy Technology is common to all the students in the programme.

The major subject focuses on reducing the environmental impacts of energy production, such as energy production technologies using different types of renewable fuels and new pollution control technologies.

Master's Thesis (30 ECTS credits)
The Master's thesis is a demanding research or design project carried out in the field of student's major subject.

Minor Subject (min. 20 ECTS credits)
Students can choose any minor subject taught in English at LUT.

The minor subject Bioenergy Technology consists of 21 ECTS credits.

Elective Studies
To attain the full 120 ECTS credits, the students need to take additional courses. Elective studies can include any courses taught in English at LUT if the required prerequisites are completed. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

Contact Information:
Programme Coordinator: Professor, D.Sc. (Tech.) Esa Vakkilainen
Phone +358 5 621 2755, room 3416

General Studies

Obligatory Studies (11 ECTS cr)		year	per.	ECTS cr
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV18A9101	Finnish 1		1, 3	2
FV18A9201	Finnish 2		2, 4	2
FV11A9000	Academic Seminar for International Programs		2–4	6

Major Studies: Environmental Energy Technology

Obligatory Studies (60 ECTS cr)		year	per.	ECTS cr
BH60A2200	Air Pollution Control	M.Sc. (Tech.) 1	3-4	3
BH60A2400	Solid Waste Management related to energy production	M.Sc. (Tech.) 2	1-2	4
BH80G0000	Bioenergy	M.Sc. (Tech.) 1	1	3
BH80G0100	Bioenergy Technology Solutions	M.Sc. (Tech.) 1	2-3	6
BH40A1300	Power Engines in Renewable Energy	M.Sc. (Tech.) 2	2	5
BH50A1200	Energy Systems Engineering	M.Sc. (Tech.) 1	1-2	6
BH60A2000	Emission Trading	M.Sc. (Tech.) 1	3-4	3
Thesis	Master's Thesis and Seminar			30

Minor Studies: Bioenergy Technology

Obligatory Studies (21 ECTS cr)		year	per.	ECTS cr
BH60A1600	Basic Course on Environmental Management and Economics	B.Sc. (Tech.) 2	1-2	5
BH60A2300	Waste Heat Recovery Techniques	M.Sc. (Tech.) 2	3-4	6
BH50A1300	Maintenance Management	M.Sc. (Tech.) 2	1-2	4
BH50A1400	Steam Boilers	M.Sc. (Tech.) 1	1-2	6

Additional Information

Personal Study Plans:
At the beginning of their studies, students prepare a personal study plan, in which the student and the Department agree on what studies the student will pursue and in what order. This plan includes detailed information on the major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS cr):
Students with a Finnish degree from the University of Applied Scienes or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous

degree. The course FV13A1200 Teknisk svenska 2 ECTS cr is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further Information:
Faculty of Technology, Study Coordinator Jutta Luostarinen
Phone +358 5 621 2268, room 2321, jutta.luostarinen@lut.fi
Study Coordinator Minna Loikkanen
Phone +358 5 621 2268, room 2321, minna.loikkanen@lut.fi

Courses Offered in English

		ECTS cr
BH40A1300	Power Engines in Renewable Energy	5
BH50A1200	Energy Systems Engineering	6
BH50A1300	Maintenance Management	4
BH50A1400	Steam Boilers	6
BH60A1600	Basic Course on Environmental Management and Economics	5
BH60A2000	Emission Trading	3
BH60A2200	Air Pollution Control	3
BH60A2300	Waste Heat Recovery Techniques	6
BH60A2400	Solid Waste Management related to energy production	4
BH80G0000	Bioenergy	3
BH80G0100	Bioenergy Technology Solutions	6

Course Descriptions

BH40A1300	**POWER ENGINES IN RENEWABLE ENERGY 5 ECTS cr**
	Power Engines in Renewable Energy
Year and Period	M.Sc. (Tech.) 2, Period 2
Lecturer(s)	Professor, D.Sc. (Tech.) Jaakko Larjola
	Professor, D.Sc. (Tech.) Jari Backman
	Researcher/Teacher, D.Sc. (Tech.) Teemu Turunen-Saaresti
Aims	The course gives a comprehensive view on power engines on the market that can be used in bioenergy conversion.
Contents	Gas turbines, compressors, turbines, fuel cells, reciprocative engines.
Teaching methods	Four combined lectures and tutorials, each 4 hours. The students are expected to study the Material Notebook and Blackboard in advance to pass the required exercises and quizzes.
Assessment	0-5. The evaluation is based on the quizzes and final exam, which will be completed in the Exam Aquarium with Blackboard. Extra points for approved (50%) performance in the quizzes and exercises.
Course Material	Material Notebook, Blackboard course material: summary, exercises, quizzes.

BH50A1200	**ENERGY SYSTEMS ENGINEERING 6 ECTS cr**
	Energy Systems Engineering
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Esa Vakkilainen
Aims	The course gives a comprehensive view towards different types of energy production processes. The course focuses on optimum plant requirements in the planning and implementation phases of energy systems.
Contents	Fundamentals of engineering thermodynamics.
	Power plant engineering, combined heat and power production. Fundamentals of steam and gas turbines in power production.
	Control structure. Planning and implementation of energy systems.

Teaching methods	Economic optimization of energy system projects. Lectures and case exercises 14 h, 1st period. Lectures and case exercises 14 h, 2nd period. Written assignment, examination.
Assessment	0-5, written assignment 30%, examination 70%.

BH50A1300	**MAINTENANCE MANAGEMENT**	**4 ECTS cr**
	Maintenance Management	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Professor, D.Sc. (Tech.) Lasse Koskelainen	
Aims	The course gives a comprehensive view towards organising, planning and diagnosing maintenance especially in power plants.	
Contents	Terminology. Maintenance strategies and monitoring. Failure mechanisms and reliability. Organisation and functions of maintenance management. Preventive maintenance. Spare part management. Maintenance information systems.	
Teaching methods	Lectures and case exercises 14 h, 1st period. Lectures and case exercises 6 h, 2nd period. Written assignment.	
Assessment	0-5, written assignment 30%, examination 70%.	

BH50A1400	**STEAM BOILERS**	**6 ECTS cr**
	Steam Boilers	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	Professor, D.Sc. (Tech.) Esa Vakkilainen	
Aims	The course gives a comprehensive view towards steam boilers using different types of fuels. The course concentrates on boilers utilising biofuels.	
Contents	Characteristics of fuels. Combustion and gasification. Design of a steam boiler and its components. Operation and maintenance of boilers: Corrosion, Fouling, Emissions.	
Teaching methods	Lectures and case exercises 14 h, 1st period. Lectures and case exercises 14 h, 2nd period. Written assignment, examination.	
Assessment	0-5, written assignment 30%, examination 70%.	

BH60A1600	**BASIC COURSE ON ENVIRONMENTAL MANAGEMENT AND ECONOMICS**	**5 ECTS cr**
	Basic Course on Environmental Management and Economics	
Year and Period	B.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
Aims	The aim of the course is to introduce students to the challenges that sustainable development poses to business and to the methods that control those challenges.	
Contents	Identifying the influence of sustainable development on business. Identifying corporate stakeholders and their importance. Recognising tools and indicators of environmental management. Knowing the basics of LCA and environmental product design. Recognising eco labels, eco profiles and indicators of environmental load. Knowing the basics of building and maintaining an environmental management system.	
Teaching methods	Intensive course. Lectures 24 h, written assignment, 1st and/or 2nd period. Examination, Blackboard.	
Assessment	0-5, examination 75%, written assignment 25%.	
Course Material	Literature will be announced later.	

BH60A2000	*EMISSION TRADING*	*3 ECTS cr*
	Emission Trading	
Year and Period	B.Sc. (Tech.) 3, Period 3-4	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
Aims	The goal of the course to provide students with the basics of different emission trading schemes and their effects on idustry as well as consumers.	
Contents	Topics include: greenhouse effect and climate change, the Kyoto protocol and Kyoto mechanisms, the EU emission trading scheme, the effect of EU emission trading on different industries.	
Teaching methods	Lectures 14 h, 3rd period. Assignment and seminars, 4th period. Examination. Blackboard.	
Assessment	0-5, examination 100%. An excellent assigment count for additional points for the exam.	
Course Material	Course material will be announced later.	

BH60A2200	*AIR POLLUTION CONTROL*	*3 ECTS cr*
	Air Pollution Control	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Professor, D.Sc. (Tech.) Esa Vakkilainen	
Aims	The course gives a comprehensive view towards different types of gas emissions and gas cleaning techniques. Appliance technology, and the design and manufacture of appliances are introduced.	
Contents	Gas emissions from combustion, industry and municipalities. Emission matter collection, treatment and recycling. Cleaning techniques: cyclones, electrostatic precipitators, fabric filters, scrubbers, incinerators, and adsorption.	
Teaching methods	Lectures 8 h, seminar work and written assignment, written examination.	
Assessment	0-5, 75% exam, 25% seminar work and written assignment.	
Course Material	C. David Cooper, F.C. Alley: Air Pollution Control.	

BH60A2300	*WASTE HEAT RECOVERY TECHNIQUES*	*6 ECTS cr*
	Waste Heat Recovery Techniques	
Year and Period	M.Sc. (Tech.) 2, Period 3-4	
Lecturer(s)	Professor, D.Sc. (Tech.) Esa Vakkilainen	
Aims	The course gives a comprehensive view towards different waste heat recovery techniques.	
Contents	Waste heat recovery opportunities. Dimensioning the heat recovery heat exchanger. Heat recovery in an industrial plant. Economic optimisation for cross flow gas-to-gas heat exchangers. Optimisation of a heat recovery unit in a ventilation system. Recuperative heat exchangers connected with stream flow. Dimensioning of waste heat recovery equipment. Pinch analysis of heat recovery networks. Suitable also for postgraduate studies.	
Teaching methods	Lectures 12 h, seminar work, written assignment, written examination.	
Assessment	0-5, 75% exam, 25 % seminar work and written assignment.	
Course Material	Cource material will be announced during lectures.	

BH60A2400	*SOLID WASTE MANAGEMENT RELATED TO ENERGY PRODUCTION*	*4 ECTS cr*
	Solid Waste Management related to energy production	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	

Lecturer(s)	Professor, D.Sc. (Tech.) Mika Horttanainen
Aims	The course gives a comprehensive view on the waste-to-energy technologies and utilisation of by-products coming from energy production units.
Contents	Waste-to-energy in Finland and other countries, properties of waste as a fuel, waste handling before thermal conversion, preparation of recycled fuel, mass combustion of waste, combustion of recycled fuel, gasification of waste, energy recovery in combustion of waste, emission reduction during combustion, flue gas treatment, utilisation and treatment of ash, utilisation and treatment of other flue gas residues, anaerobic digestion of waste, landfill gas utilisation in energy production.
Teaching methods	Lectures 14 h, exercises 14 h, 1 practical assignment, examination.
Assessment	Practical assignment 30%, exam 70%.
Course Material	Will be announced later.
Prerequisites	Basic knowledge on thermodynamics, chemistry and power plant technology.

BH80G0000 BIOENERGY 3 ECTS cr

Bioenergy

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Tapio Ranta
Aims	The course gives a comprehensive view into the whole bioenergy chain – biofuel production, refining and end use. Students will gain an overview of the biofuel-based energy systems.
Contents	The role of bioenergy in the EU energy policy, incentive programmes and future plans. Raw-material sources of bioenergy, resources and current use. Biomass supply systems and biofuel refining technologies, logistics and international trade. Quality control and standards. Biogas, solid and liquid biofuels.
Teaching methods	Lectures 14 h. Written examination.
Assessment	Examination 100%.
Course Material	Energy Visions 2030 for Finland, VTT Energy, 2001. Additional material will be announced later during lectures.

BH80G0100 BIOENERGY TECHNOLOGY SOLUTIONS 6 ECTS cr

Bioenergy Technology Solutions

Year and Period	M.Sc. (Tech.) 1, Period 2-3
Lecturer(s)	Professor, D.Sc. (Tech.) Tapio Ranta
Aims	The course gives a detailed view into the technological solutions used in the bioenergy sector, the fuel production and bioenergy end-use technologies. Students will learn about the fundamental aspects of the technology for using biofuels in the energy system.
Contents	Technological solutions and case studies from biomass supply and biofuel refining, end-use technologies of biofuels in different sectors.
Teaching methods	Lectures 14 h, study excursion. Teamwork assignment, seminar presentation. Written examination.
Assessment	Examination 60%, teamwork assignment 40%.
Course Material	Energy Visions 2030 for Finland, VTT Energy, 2001. Additional material will be announced later during lectures.
Prerequisites	BH80G0000 Bioenergy

5 Master's Degree Programme in Chemical and Process Engineering

The Master's degree programme, titled as "Innovative Process and Product Engineering" (IPPE), takes two years, corresponds to 120 ECTS credits and leads to the degree of Master of Science in Technology. Three semesters include lectures and exercises, as well as laboratory and project work. The fourth semester is devoted to the Master's thesis. The language of tuition in the programme is English.

The Aims of the Master's Degree Programme

The general objective of the programme is to give students sufficient scientific and technological knowledge for the career of chemical and process engineers in different fields of process industry. Moreover, the students will attain the basis for doctoral/Ph.D. studies and for continuous education in the field.

A specific goal is to promote and develop students' abilities to create innovations and new technology. This is realized by offering interdisciplinary education and special courses focusing on the development of innovation-related skills. The programme also emphasizes internationality and communication skills needed in the modern working environment.

Careers for Graduates

The programme gives students capabilities to work in different kind of assignments in process industry, most typically in R&D, design and operation of plants. Most graduates will find their placement either in chemical, pulp and paper or metallurgical industry. However, nowadays the skills of chemical engineers have more and more demand also outside the traditional process industry.

Major and Minor Subjects

Major Subject: Sustainable Process Engineering
Teacher responsible: Professor Ilkka Turunen
The major subject includes thorough courses on product, process and plant design. The goals of modern engineering work, such as sustainability, innovativeness and interdisciplinary methodology, are emphasized in addition to more traditional, but still important economical and technological objectives. Deep phenomenological description of the most important unit processes is included. Moreover, courses on specific unit operations can be chosen from a wide list.

Minor Subject: Advanced Design Methodology
Teacher responsible: Professor Andrzej Kraslawski
The minor topic gives students skills and knowledge for process design and R&D. The development of new technology and innovations is emphasized in the programme. Therefore courses such as creative design, process intensification and process modelling are included. In addition, courses on important computational tools, e.g. process simulation and computational fluid dynamics, belong to the subject.

The Degree Structure of the Programme

A General studies	9	ECTS cr
B Major subject	70	ECTS cr
C Minor subject	20	ECTS cr
D Elective studies	21	ECTS cr
Credits	*120 (min.)*	*ECTS cr*

General Studies

General studies mainly consist of communication and language courses, emphasizing one of the goals of the programme: to train students to act in modern, international working environment of today.

Obligatory Studies (9 ECTS cr)		year	per.	ECTS cr
BJ10A0500	Cross-Cultural Communication for Working Life	M.Sc. (Tech.) 1	3	2
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV10A 6EC	Language and Communication Studies			6

Major Subject

Sustainable Process Engineering

Obligatory Studies (62 ECTS cr)		year	per.	ECTS cr
BJ20A0500	Chemical Engineering Unit Operations II	M.Sc. (Tech.) 1	1	4
BJ20A0600	Chemical Engineering Unit Operations III	M.Sc. (Tech.) 1	2	4
BJ30A0500	Project on Process and Plant Design	M.Sc. (Tech.) 2	1-2	11
BJ40A0100	Product Design	M.Sc. (Tech.) 1	4	5
BJ90A0700	Chemical Separation Methods	M.Sc. (Tech.) 1	3-4	8
Thesis	Master's Thesis and Seminar			30

Min. 8 ECTS credits should be selected to attain 70 ECTS credits.

List of selectable courses		year	per.	ECTS cr
BJ10A0400	Process Control Systems in Pulp and Paper Industry	M.Sc. (Tech.) 2	1-2	3
BJ20A0800	Treatment Processes of Industrial Discharges	B.Sc. (Tech.) 3	3-4	5
BJ20A1000	Advanced Course in Environmental Technology	M.Sc. (Tech.) 1	3-4	6
BJ20A1100	Filtration and Mixing	M.Sc. (Tech.) 1	3-4	6
BJ60F0100	Chemical Pulping Technology: Chemical Recovery	M.Sc. (Tech.) 1	1-2	4
BJ60F0200	Chemical Pulping Technology: Fiberline Operations	M.Sc. (Tech.) 1	3-4	6
BJ60F0300	Fiber Technology; Personal Assignment		1-4	6

Minor Subject

Advanced Design Methodology

Min. 20 ECTS credits should be selected		year	per.	ECTS cr
BJ10A0300	Dynamics and Control of Chemical Processes	M.Sc. (Tech.) 2	1-2	4
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	2	6
BJ30A1200	Process Intensification	M.Sc. (Tech.) 1	2	2
BJ30A1500	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	6
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BJ40A0200	Basic Process Simulation	M.Sc. (Tech.) 1	2	6
BM20A3900	Modelling Methodology in Process Engineering	M.Sc. (Tech.) 1	1-2	6

Elective Studies

Elective studies are needed to attain the full 120 ECTS credits. All the courses included in the IPPE-programme support the objectives of the programme. Consequently, it is recommended that students would choose their elective studies among the courses that are listed under selectable courses in the major subject. However, elective studies can include any courses offered by Lappeenranta University of Technology. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

Major Subjects for Double Degree Students

Pulp and Paper Technology

Obligatory Studies (58 ECTS cr)		year	per.	ECTS cr
BJ30A1401	Process and Product Innovations	M.Sc. (Tech.) 1-2	1-4	10
BJ60A0700	Interactions in Printing and Converting	M.Sc. (Tech.) 1-2	1-2	8
BJ60F0100	Chemical Pulping Technology: Chemical Recovery	M.Sc. (Tech.) 1	1-2	4
BJ60F0300	Fiber Technology; Personal Assignment		1-4	6
Thesis	Master's Thesis and Seminar			30

Min. 12 ECTS credits should be selected to attain 70 ECTS credits.

List of selectable courses		year	per.	ECTS cr
BJ10A0300	Dynamics and Control of Chemical Processes	M.Sc. (Tech.) 2	1-2	4
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	2	6
BJ30A1200	Process Intensification	M.Sc. (Tech.) 1	2	2
BJ30A1500	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	6
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BJ40A0200	Basic Process Simulation	M.Sc. (Tech.) 1	2	6
BM20A3900	Modelling Methodology in Process Engineering	M.Sc. (Tech.) 1	1-2	6

Process Metallurgy

Obligatory Studies (59 ECTS cr)		year	per.	ECTS cr
BJ20A0800	Treatment Processes of Industrial Discharges	B.Sc. (Tech.) 3	3-4	5
BJ20A1100	Filtration and Mixing	M.Sc. (Tech.) 1	3-4	6
BJ30A1401	Process and Product Innovations	M.Sc. (Tech.) 1-2	1-4	10
BJ90A0700	Chemical Separation Methods	M.Sc. (Tech.) 1	3-4	8
Thesis	Master's Thesis and Seminar			30

Min. 11 ECTS credits should be selected to attain 70 ECTS credits.

List of selectable courses		year	per.	ECTS cr
BJ10A0300	Dynamics and Control of Chemical Processes	M.Sc. (Tech.) 2	1-2	4
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	2	6
BJ30A1500	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	6
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BJ40A0200	Basic Process Simulation	M.Sc. (Tech.) 1	2	6

Additional Information

Master's Thesis
The Master's thesis is a demanding research or design project carried out in the field of the student's major subject.

Language Studies
Please note that there are restrictions concerning courses that can be included in the obligatory language studies.

Further information: Study Coordinator Jutta Luostarinen (room 2321, jutta.luostarinen@lut.fi), Study Coordinator Minna Loikkanen (room 2321, minna.loikkanen@lut.fi).

Personal Study Plans
At the beginning of their studies, students prepare a personal study plan, in which the student and the degree programme agree on what studies the student will pursue and in what order. This plan includes detailed information on the major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (21–60 ECTS cr)
Students with a Finnish degree from the University of Applied Scienes (or equivalent) will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.
Further information: senior assistant Harri Niemi (room 2120, harri.niemi@lut.fi).

Further information
Faculty of Technology, Study Coordinator Jutta Luostarinen (room 2321, jutta.luostarinen@lut.fi), Study Coordinator Minna Loikkanen (room 2321, minna.loikkanen@lut.fi).

Courses Offered in English

		ECTS cr
BJ10A0001	Laboratory Work Course in Chemical Technology	10 - 30
BJ10A0300	Dynamics and Control of Chemical Processes	4
BJ10A0400	Process Control Systems in Pulp and Paper Industry	3
BJ10A0500	Cross-Cultural Communication for Working Life	2
BJ20A0500	Chemical Engineering Unit Operations II	4
BJ20A0600	Chemical Engineering Unit Operations III	4
BJ20A0800	Treatment Processes of Industrial Discharges	5
BJ20A1000	Advanced Course in Environmental Technology	6
BJ20A1100	Filtration and Mixing	6
BJ30A0500	Project on Process and Plant Design	11
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	6
BJ30A1200	Process Intensification	2
BJ30A1401	Process and Product Innovations	10
BJ30A1500	Advanced Process Simulation	6
BJ40A0000	Creative Design	3
BJ40A0100	Product Design	5
BJ40A0200	Basic Process Simulation	6
BJ50A0400	Advanced Course in Membrane Technology and Technical Polymer Chemistry	10
BJ50A0500	Synthetic Polymers: Glues and Resins	5
BJ60A0700	Interactions in Printing and Converting	8
BJ60F0100	Chemical Pulping Technology: Chemical Recovery	4
BJ60F0200	Chemical Pulping Technology: Fiberline Operations	6
BJ60F0300	Fiber Technology; Personal Assignment	6
BJ90A0400	Catalysis	4
BJ90A0700	Chemical Separation Methods	4 - 8

Course Descriptions

BJ10A0001	*LABORATORY WORK COURSE IN CHEMICAL TECHNOLOGY*	*10 - 30 ECTS cr*
	Laboratory Work Course in Chemical Technology	
	Replaces the course BJ10A0001 Laboratory Work Course in Chemical Technology. The course is mainly intended for foreign visiting students. The students register for the course by contacting the supervisor.	
Lecturer(s)	N. N. Lecturer(s) responsible: Head of the Laboratory	
Aims	To give the student a deeper understanding on chemical technology in a specialized area.	
Contents	A specific project which is done in one of the laboratories of the department. The project is planned together with the supervisor(s) and consists mainly of laboratory work, literature work and report writing. The course may contain lectures and seminars. The project may also be planned together with industry and then carried out at some industrial location.	
Teaching methods	The amount of work hours in the project will determine the amount of credits, e.g. three months of work would give 15 ECTS cr. Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.	
Assessment	0-5 or pass/fail, depending on the project carried out.	
Course Material	Literature related to the project.	

BJ10A0300	*DYNAMICS AND CONTROL OF CHEMICAL PROCESSES*	*4 ECTS cr*
	Dynamics and Control of Chemical Processes	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Docent, D.Sc. (Tech.) Leif Hammarström Assistant, N. N. Professor, Ph.D. Andrzej Kraslawski (contact person)	
Contents	Motivation for process control. Repetition of properties of simple dynamic elements and controllers. Properties of typical process units. Behaviour of processes: simple elements and multi-input multi-output units with interaction. Analysis of process behaviour: experiments, modelling, simulation, stability assessment, and evaluation of control variable and disturbance effects. Process control requirements in different process or unit types with consideration of control possibilities and constraints. Control strategies: specifying controller configurations with respect to production needs such as stability, functionality, operability, safety, and quality. Review of advanced control concepts including multivariable control, prediction, estimation, and optimization.	
Teaching methods	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, 2nd period. Project work.	
Assessment	0-5, written examination 100%.	
Course Material	To be specified later. Matlab-Simulink simulation environment, Process Control, System Identification and Fuzzy Control toolboxes, Mathworks 1984 - 2004.	

BJ10A0400	*PROCESS CONTROL SYSTEMS IN PULP AND PAPER INDUSTRY*	*3 ECTS cr*
	Process Control Systems in Pulp and Paper Industry	

Year and Period	M.Sc. (Tech.) 2, Period 1-2
Lecturer(s)	Lic.Sc. (Tech.) Merja Mäkelä
	Professor, Ph.D. Andrzej Kraslawski (contact person)
Contents	Processes and instrumentation. Need of measurements, open loop and closed loop control. Distributed control systems, programmable logic controllers and open control networks. Communication from process sensors, transmitters and actuators to control rooms. Process plant visualization and control room operation. System configuration, engineering and documentation. Single-input, single-output and multiple-input, multiple-output control strategies. Use of PID, fuzzy logic, model predictive and optimization control principles. Paper and board quality online measurement and control. Automation in original and renewal plant investment projects. Maintenance and innovative development in automation.
Teaching methods	Lectures 16 h, 1st period.
	Lectures 12 h, 2nd period.
	Individual or team project work with supervision 12 h, 2nd period.
Assessment	0-5, written examination 60%, project work 40%.
Course Material	Learning Environment for Papermaking and Automation, KnowPap, Licentia 2004, Espoo Finland.
	Learning Environment for Chemical Pulping and Automation, KnowPulp, Licentia 2004, Espoo Finland.
	Matlab-Simulink simulation environment, Process Control, System Identification and Fuzzy Control toolboxes, Mathworks 1984 - 2004.
	Leiviskä, K., Process control, Book 14, in Papermaking Science and Technology, Fapet, 1999, 297 p., ISBN 952-5216-00-4.
	Sell, Nancy J., Process Control Fundamentals for the Pulp and Paper Industry, Tappi, 1995, Atlanta, USA, 612 p., ISBN 0-89852-294-3.

BJ10A0500	*CROSS-CULTURAL COMMUNICATION FOR WORKING LIFE*	*2 ECTS cr*
	Cross-Cultural Communication for Working Life	

Year and Period	M.Sc. (Tech.) 1, Period 3
Lecturer(s)	M.Sc. (Tech.) Mark Middleton
	Professor, Ph.D. Andrzej Kraslawski (contact person)
Aims	To provide students knowledge about problems arising in industrial working environments due to ineffective communication.
Contents	Information exchange and understanding the viewpoints of parties involved. Effective communication, how to understand attitudes, values and danger areas. Cultural aspects and linguistic tools for goal-oriented communication. Project management, negotiations, presentations and resolution of dispute situations.
Teaching methods	Intensive course.
	Lectures 16 h, exercises 16 h, 3rd period.
	No examination.
	The number of participants is limited. Priority is given to the students of the Master's Degree Programme in Chemical and Process Engineering (IPPE).
Assessment	Pass/Fail. Active participation in lectures and exercises.

BJ20A0500	*CHEMICAL ENGINEERING UNIT OPERATIONS 4 ECTS cr II*
	Chemical Engineering Unit Operations II
Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Kallas
	Senior Assistant, D.Sc. (Tech.) Harri Niemi
Aims	To familiarize students with separation techniques and the theory of mass transfer more extensively than in the course BJ20A1600 Kemiantekniikan yksikköoperaatiot I.
Contents	The topics are as follows:
	1. Membrane separation: Mass transfer, modelling, process design, simulation of industrial membrane processes.
	2. Adsorption: theory, equipment, applications in industry and purification of polluted water and air.
Teaching methods	Lectures 12 h, exercises 28 h, 1st period.
Assessment	0-5, written examination 100%.
Course Material	Lecture notes.
Prerequisites	BJ20A1600 Kemiantekniikan yksikköoperaatiot I and BJ80A1000 Kemiallinen termodynamiikka passed.

BJ20A0600	*CHEMICAL ENGINEERING UNIT OPERATIONS 4 ECTS cr III*
	Chemical Engineering Unit Operations III
Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Kallas
	Docent, D.Sc. (Tech.) Marjatta Louhi-Kultanen
Aims	To familiarize students with separation techniques and the theory of mass transfer more extensively than in the course BJ20A1600 Kemiantekniikan yksikköoperaatiot I.
Contents	The topics are as follows:
	1. Industrial crystallization: theory, operation and design of crystallizers, and the basics of precipitation.
	2. Multicomponent mass transfer: differences between mass transfer in binary and multicomponent systems, basic theory and examples in evaporation, distillation, desorption, membrane separation, heterogeneous reaction etc.
Teaching methods	Lectures 12 h, exercises 28 h, 2nd period.
	Laboratory work and reports.
Assessment	0-5, written examination 100%, reports passed.
Course Material	Davey, R.J., Garside, J., From molecules to crystallizers, Oxford: Oxford University Press, 2000.
	Lecture notes.
Prerequisites	BJ20A1600 Kemiantekniikan yksikköoperaatiot I and BJ80A1000 Kemiallinen termodynamiikka passed.

BJ20A0800	*TREATMENT PROCESSES OF INDUSTRIAL 5 ECTS cr DISCHARGES*
	Treatment Processes of Industrial Discharges
Year and Period	B.Sc. (Tech.) 3, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Kallas
	Docent, Ph.D. Sergei Preis
Aims	To familiarize students with engineering solutions of environmental problems concerning water and wastewater treatment, air emissions control and solid waste processing and disposal.
Contents	The course includes three main parts: basics in water and wastewater

treatment, treatment of air polluted with particulate and gaseous matter, and solid waste handling and disposal. Water and wastewater treatment part considers basic methods in water treatment: sedimentation, coagulation/flocculation, filtration, biological treatment, sludge disposal and disinfection. Air treatment part concentrates on dust removal and gaseous pollutant abatement. Solid waste treatment concentrates on the processing techniques: volume reduction, materials recovery, incineration and energy recovery.

Teaching methods	Lectures and exercises 21 h, 3rd period. Lectures and exercises 21 h, 4th period.
Assessment	0-5, written examination 100%.
Course Material	Peavy, H.S., Rowe, D.R., Tchobanoglous, G., Environmental Engineering, McGraw-Hill, 1st ed., 1985.
Prerequisites	Recommended: BJ20A1400 Partikkelitekniikka ja kiintoaineiden käsittely BH40A1400 Virtaustekniikka I BJ20A0100 Mekaaniset erotusmenetelmät BH40A0250 Pumput, puhaltimet ja kompressorit (Kete) BJ20A1600 Kemiantekniikan yksikköoperaatiot I

BJ20A1000	*ADVANCED COURSE IN ENVIRONMENTAL TECHNOLOGY*	*6 ECTS cr*
	Advanced Course in Environmental Technology	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Kallas Professor (Tallinn University of Technology), D.Sc. (Tech.) Rein Munter	
Contents	"Green chemistry" in technology and in treatment of industrial and municipal wastes. Reducing of water demand: closing of water cycles in industry.	
Teaching methods	Lectures 14 h, 3rd period. Exercises and seminars 22 h, 4th period. Literature work, report and seminar presentation.	
Assessment	0-5, written examination 50%, report and seminar 50%.	
Course Material	Lecture notes.	

BJ20A1100	*FILTRATION AND MIXING*	*6 ECTS cr*
	Filtration and Mixing	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Professor, M.Sc. (Tech.) Antti Häkkinen Lecturer, D.Sc. (Tech.) Ritva Tuunila Docent, D.Sc. (Tech.) Tuomas Koiranen Docent, D.Sc. (Tech.) Marjatta Louhi-Kultanen	
Aims	To familiarize students with solid-liquid separation techniques and mixing processes.	
Contents	The topics are as follows: Filtration: fundamentals of filtration, filtration methods, operation of filters, cake formation and washing, deliquoring, design and modeling of filters. Mixing: fundamentals of mixing, rheology, mixing equipment, design of mixers and scale-up.	
Teaching methods	Lectures 14 h, exercises 14 h, 3rd period. Lectures 14 h, exercises 14 h, 4th period. Laboratory work and reports.	
Assessment	0-5, written examination 100%, reports passed.	
Course Material	Additional material will be informed at lectures.	
Prerequisites	BJ20A0100 Mekaaniset erotusmenetelmät passed.	

BJ30A0500	*PROJECT ON PROCESS AND PLANT DESIGN 11 ECTS cr*
	Project on Process and Plant Design
	HUOM! Suomenkielisille työryhmille opintojakso opetetaan suomeksi.
Year and Period	M.Sc. (Tech.) 2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	The purpose is to make students familiar with process and plant design with the help of an extensive project work.
Contents	The projects are carried out in groups of five students. The topics are from industry. A typical topic is a feasibility study of a process covering a brief market survey, comparison of process alternatives, preliminary process design (process flowsheet, mass and energy balances, sizing of main equipment), lay-out, cost and profitability estimation. Different aspects are emphasized in different projects, depending on the topic. Suitable also for postgraduate studies.
Teaching methods	Lectures 5 h, project meetings, 1st period. Lectures 5 h, project meetings, 2nd period. Design and project work about 280 h, 1st-2nd period. No examination.
Assessment	0-5, design reports 100%.
Prerequisites	BJ30A0301 Prosessi- ja tehdassuunnittelu passed. Recommended BJ30A0400 Prosessisuunnittelun seminaari.

BJ30A0700	*COMPUTATIONAL FLUID DYNAMICS IN CHEMICAL ENGINEERING 6 ECTS cr*
	Computational Fluid Dynamics in Chemical Engineering
Year and Period	M.Sc. (Tech.) 2, Period 2
Lecturer(s)	Assistant, D.Sc. (Tech.) Azita Soleymani
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To teach students to use CFD to solve chemical engineering problems, e.g. in equipment design and trouble shooting.
Contents	Theoretical basis of CFD. Introduction of CFX software. Applications of CFD in process industry. Solving chemical engineering problems with CFD.
Teaching methods	Lectures 28 h, 2nd period. Exercises with CFD software 120 h, 2nd period. Seminar presentation. No examination.
Assessment	0-5, seminar presentation 70%, exercise report 30%. At least 90% presence at lectures required.
Course Material	To be announced later.

BJ30A1200	*PROCESS INTENSIFICATION 2 ECTS cr*
	Process Intensification
Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To make students familiar with the methods and latest achievements of process intensification.
Contents	Definitions of process intensification. Intensification of chemical reactors. Intensification of separation processes. Microprocess technology. Methodology of process intensification.
Teaching methods	Lectures 21 h, exercises arranged as brainstorming sessions 9 h, 2nd period.
Assessment	0-5, written examination 100%.

BJ30A1401	*PROCESS AND PRODUCT INNOVATIONS*	*10 ECTS cr*

Process and Product Innovations

Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-4
Lecturer(s)	Professor, D.Sc. (Tech.) Tuomo Kässi
	Senior Lecturer, D.Sc. (Tech.) Ville Ojanen
	Researcher/Teacher, D.Sc. (Tech.) Kimmo Kerkkänen
	Professor, D.Sc. (Tech.) Riku Pöllänen
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To get acquainted with the generation of innovations and new technology, the typical methods, problems and their solutions. To train project and teamwork in interdisciplinary, international environment. To get acquainted with product and process development. To train and deepen many skills learned in other connections.
Contents	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.
Teaching methods	Informational lectures, 6 h/period.
	Project meetings, 6 h/period.
	Independent project and teamwork in groups of 4-8 students.
Assessment	0-5, project work 100%.

BJ30A1500	*ADVANCED PROCESS SIMULATION*	*6 ECTS cr*

Advanced Process Simulation

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Docent, Ph.D. Ben-Guang Rong
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	Applications of process simulation for industrial processes development and design, process retrofit and optimization.
Contents	Process simulation for process development and design, process retrofit, optimization of process flowsheets. Examples of industrial processes synthesis and design with process simulation as a support tool (ASPEN and BALAS-software). Suitable also for postgraduate studies.
Teaching methods	Lectures and exercises.
	Lectures 28 h, 3rd and/or 4th period.
	Simulation exercises as guided individual assignments.
Assessment	0-5, written examination 60%, exercises and presence at lectures 40%.
Prerequisites	BJ20A0300 Prosessisimuloinnin perusteet or BJ40A0200 Basic Process Simulation attended.

BJ40A0000	*CREATIVE DESIGN*	*3 ECTS cr*

	Creative Design
Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, Ph.D. Andrzej Kraslawski
Contents	Types of innovation. Product, process, service innovation. Innovations in process engineering. Models of creativity. Enhancement of creativity (brainstorming, synectics, morphological analysis, case-based reasoning, quality function deployment, TRIZ).
Teaching methods	Lectures and exercises 56 h, 1st period.
Assessment	0-5, written examination 50%, exercises and presence at the lectures 50%.
Course Material	Lecture notes.

BJ40A0100	*PRODUCT DESIGN*	*5 ECTS cr*
	Product Design	
Year and Period	M.Sc. (Tech.) 1, Period 4	
Lecturer(s)	Professor, Ph.D. Andrzej Kraslawski	
Contents	Types of products. Identification of consumer needs. Product functional and physical-chemical properties. High-throughput experiments. Knowledge-based systems for product design. Computer-aided product design.	
Teaching methods	Lectures 15 h, exercises 20 h, 4th period.	
Assessment	0-5, written examination 50%, exercises and presence at the lectures 50%.	
Course Material	Lecture notes.	

BJ40A0200	*BASIC PROCESS SIMULATION*	*6 ECTS cr*
	Basic Process Simulation	
Year and Period	M.Sc. (Tech.) 1, Period 2	
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Yury Avramenko	
	Lecturer(s) responsible: Professor, Ph.D. Andrzej Kraslawski	
Aims	To make students familiar with process simulation as a tool in development, design and operation in chemical and pulp and paper industry.	
Contents	Introduction to process modeling. Basics of process simulation. Overview of existing software. Introduction to ASPEN and BALAS-software. Examples of simple simulation cases for process design.	
Teaching methods	Intensive course. Lectures and exercises 28 h, 2nd period. Simulation exercises as guided individual assignments, 2 classworks and 1 homework.	
Assessment	0-5, written examination 50%, personal simulation work 50%.	
Prerequisites	BJ20A1500 Aineensiirtotekniikan perusteet and BJ20A1600 Kemiantekniikan yksikköoperaatiot I (or equivalent) attended .	

BJ50A0400	*ADVANCED COURSE IN MEMBRANE TECHNOLOGY AND TECHNICAL POLYMER CHEMISTRY*	*10 ECTS cr*
	Membraanitekniikan ja teknillisen polymeerikemian syventävä opintojakso	
	The course will be given in English if required.	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Professor, Ph.D. Marianne Nyström	
Aims	Advanced studies in membrane technology, technical polymer chemistry and pulp and paper technology.	
Contents	Refining of polymeric materials, polymerisation and characterisation of polymers using different methods. Membrane processes.	
Teaching methods	Lectures and seminars 21 h, 1st period. Lectures and seminars 21 h, 2nd period. Personal research project 165 h, 1st–2nd period. Lectures, laboratory work, seminar lectures and possibly a test. Obligatory seminars.	
Assessment	0-5, personal laboratory research work 40%, seminars 60%.	

BJ50A0500	*SYNTHETIC POLYMERS: GLUES AND RESINS 5 ECTS cr*
	Synteettiset polymeerit: Liimat ja hartsit
	The course will be given in English if required. The course will be arranged together with the Department of Mechanical Engineering. The course will be lectured next time during the academic year 2008 - 2009.
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, Ph.D. Marianne Nyström
	Professor, D.Sc. (Agr. & For.) Timo Kärki
	N.N.
	Guest lecturers
Aims	Advanced studies in synthetic polymer chemistry, characterisation of polymer materials and their behaviour in industrial applications.
Contents	Production of resins and glues and their use in industry, especially in the pulp and paper industry. Production of synthetic polymers. Homopolymers, co-polymers and cross-linking. Chemical reactions of polymers and analysis methods. Industrial uses of polymers. Resins and glues. Suitable also for postgraduate studies.
Teaching methods	Intensive course. Lectures 35 h and a seminar report, 1st and/or 2nd period. Obligatory seminar and laboratory work, industrial visit.
Assessment	0-5, written examination 100%.

BJ60A0700	*INTERACTIONS IN PRINTING AND CONVERTING* *8 ECTS cr*
	Interactions in Printing and Converting
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Isko Kajanto
	Visiting lecturer(s)
Aims	Understanding the interactions in printing, coating and other paper conversion operations. Knowledge of the main printing methods.
Contents	Paper physics - fibrous networks, paper strength, interaction of water with paper, dimensional stability. Main printing methods, offset, gravure, inkjet, electrophotography. Interactions with printing ink and the paper surface. A conversion process more closely examined is the manufacturing of pressure sensitive labelstock. Future trends. Printing of electronics.
Teaching methods	Lectures and exercises 28 h, 1st period. Lectures and exercises 28 h, 2nd period. Seminar presentations.
Assessment	0-5, examination 50%, seminar and exercises 50%.
Course Material	Named parts of the books: Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 11, vol. 12, vol. 13, vol. 16.
Prerequisites	Knowledge of paper technology.

BJ60F0100	*CHEMICAL PULPING TECHNOLOGY: CHEMICAL RECOVERY* *4 ECTS cr*
	Chemical Pulping Technology: Chemical Recovery
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, M.Sc. (Tech.) Kaj Henricson
	Assistant, M.Sc. (Tech.) Katriina Kolhonen
Aims	To familiarize the students with the process and equipment technology used in the recovery of cooking chemicals and the manufacturing of bleaching chemicals. To develop understanding of mill emissions, energy and mass balances.

Contents	Chemical recovery and mill systems. Evaporation and combustion of black liquor. Handling of green liquor and non-process elements. White liquor preparation. Manufacturing of bleaching chemicals. Alternative cooking methods. Dimensioning of mill equipment. Mill emissions related to the manufacture of chemical pulp. Suitable also for postgraduate studies.
Teaching methods	Lectures, exercises and seminars 14 h, 1st period. Lectures, exercises and seminars 14 h, 2nd period. Blackboard-support. Lectures, personal assignment and seminars.
Assessment	0-5, written examination 75%, personal assignment 25%.
Course Material	Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 1 (1998), vol. 3 (2000), vol. 6A (1999), vol. 6B (1999) specified sections. Adams, Terry N. et. al., Kraft Recovery Boilers, Tappi Press (1997) specified sections. Vakkilainen, Esa K.: Kraft recovery boilers: principles and practice, Suomen Soodakattilayhdistys, 2005 (specified sections). Blackboard course material, handouts and other specified reading.
Prerequisites	BJ60F0000 Selluloosatekniikan perusteet attended or corresponding knowledge of forest industry.

BJ60F0200	*CHEMICAL PULPING TECHNOLOGY: FIBERLINE OPERATIONS*	*6 ECTS cr*

	Chemical Pulping Technology: Fiberline Operations
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, M.Sc. (Tech.) Kaj Henricson Assistant, M.Sc. (Tech.) Katriina Kolhonen
Aims	To familiarize the students with the process and equipment technology used in the manufacture of chemical pulp with special focus on cooking systems, bleaching, washing, screening and mill emissions related to fiberline operations.
Contents	Cooking, oxygen delignification, screening, and bleaching. Machinery used in the fiberline with special focus on the sulfate process. Handling of high consistency fiber suspensions. Comparing and choosing bleaching sequences. Bleaching chemicals and the manufacture of bleached chemical pulp. Mill emissions related to the manufacture of chemical pulp. Suitable also for postgraduate studies.
Teaching methods	Lectures, exercises and seminars 21 h, 3rd period. Lectures, exercises and seminars 21 h, 4th period. Blackboard-support. Lectures, personal assignments and seminars.
Assessment	0-5, written examination 65%, personal assignments 35%.
Course Material	Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 1 (1998), vol. 3 (2000), vol. 6A (1999), vol. 6B (1999) specified sections. Dence, C., Reeve, D. (eds), Pulp Bleaching - Principles and Practice, Tappi Press (1996) specified sections. Blackboard course material, handouts and other specified reading.
Prerequisites	BJ60F0000 Selluloosatekniikan perusteet attended or corresponding knowledge of forest industry.

BJ60F0300	*FIBER TECHNOLOGY; PERSONAL ASSIGNMENT*	*6 ECTS cr*

Fiber Technology; Personal Assignment

The course is mainly intended for foreign visiting students and students having chemical pulping technology as their major. The students register for the course by contacting the instructor.

Year and Period	Period 1-4
Lecturer(s)	Professor, M.Sc. (Tech.) Kaj Henricson
	Lecturer, N. N.
Aims	To give the student a deeper understanding of a specialized area of fiber technology and give the student training in working independently on a specified subject.
Contents	The personal assignment is planned together with the instructor(s) and consists mainly of a personal assignment, literature work and report writing and/or an examination. The course may contain lectures and seminars. The assignment may also be planned together with industry and then carried out at some industrial location. Suitable also for postgraduate studies.
Teaching methods	As agreed with the instructor. The number of students accepted for the course will be limited.
Assessment	0-5. Depending on the assignment the grade will be given based on an examination and/or the assignment.
Course Material	Literature related to the project.

BJ90A0400	*CATALYSIS*	*4 ECTS cr*

Catalysis

The course will be lectured next time during the academic year 2008 - 2009.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Erkki Paatero
Aims	The course gives the theoretical basis for homogeneous and heterogeneous catalysts and how they work in chemical reactors.
Contents	The focus during the course is on the structures, properties and applications of heterogeneous catalysts. Homogeneous and enzyme catalysts are briefly described. The mechanisms of catalytic reactions and the derivation of rate expressions. How to choose the catalyst and the reactor. Applications in environmental engineering. Suitable also for postgraduate studies.
Teaching methods	Intensive course.
	Lectures and exercises 28 h, 1st-2nd period.
	Laboratory demonstration and homework.
Assessment	0-5, written examination 100%, homework passed.
Course Material	Thomas, J.M. & Thomas, W.J., Principles and Practice of Heterogeneous Catalysis, John Wiley & Sons, Inc., 1997.
Prerequisites	BJ90A1000 Luonnonvarat ja niiden prosessointi kemian- ja energiateollisuudessa passed.

BJ90A0700	*CHEMICAL SEPARATION METHODS*	*4 - 8 ECTS cr*

Chemical Separation Methods

The lectures are included as a part in BJ90A0200 Teknillinen kemia.

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Erkki Paatero

	Senior Assistant, D.Sc. (Tech.) Kimmo Klemola
Aims	The course gives the theoretical basis for chemically assisted separation methods.
Contents	The focus during the course is on the chemistry involved in the application of solvent extraction, ion-exchange, adsorption, chromatographic separation and flotation. Applications of these technologies are found widely in industry although mostly in hydrometallurgy, food industry and pharmaceutical industry. Suitable also for postgraduate studies (8 ECTS cr).
Teaching methods	Intensive course. Lectures and seminars 28 h, 3rd period. Lectures and seminars 7 h, 4th period. Oral or written examination. The students of the Master's Degree Programme in Chemical and Process Engineering (IPPE): the course also includes a literature survey and laboratory work approximately 40 h, the extent of the course will then be 8 ECTS cr.
Assessment	4 ECTS cr: 0-5, examination 100%. 8 ECTS cr: 0-5, examination 70%, seminar 30%.

6 Master's Degree Programme in Electrical Engineering

The Master's degree programme in electrical engineering is structured around a series of subject specific study programs. The degree program provides training in the majors

- Industrial Electronics
- Electricity Market and Distribution

Within these majors the student is given the opportunity to specialize in the subject area of his interest.

The Aims of the Master's Degree Programme

The programme is specifically aimed at students who wish to receive multiple and goal-directed training in electrical engineering technology. It focuses on preparing students to be professionally and academically prepared to address the needs of international entrepreneurial companies seeking for networking opportunities in a globalizing market.

Our aim is to educate industrially orientated, world-class professionals with firm theoretical understanding and profound expertise in the following fields of specialization:
- Electrical drives technology - the studies focus on the management of electromagnetism, power electronics, electromechanical and electrothermal processes.
- Control engineering - the studies concentrate on the industrial applications of real-time control systems, embedded software, digital signal processing, and on the application of these to the modeling and control of electric drives and power electronics.
- Electricity distribution and market - the studies focus on electricity distribution automation and power transmission, network business technology, regulation, and economy

The Degree Structure of the Programme

Depending on the degree and/or on the level and extent of studies the student has obtained from his or her home university and based on his or her field of interest and specialization, **for every admitted student will be composed a personal study plan**. The study programme in electrical engineering is structured of following subject blocks:

Master of Science (Technology)	Major (incl. Master's Thesis), Minor and Elective Studies 120 ECTS cr.		
	Master's Thesis on major subject 30 ECTS credits		Minor subject 20 ECTS credits
	Electrical Engineering General studies 22 ECTS credits **Major** **Industrial Electronics** Major subject studies 26 ECTS credits	Electrical Engineering General studies 27 ECTS credits **Major** **Electricity Distribution and Market** Major subject studies 27 ECTS credits	
			Elective studies
	Select a major subject		

One major and one minor subject have to be chosen from the technology fields in electrical engineering. Economics and languages can be chosen as a minor subject only.

Industrial Electronics

General Studies

Obligatory (22 ECTS cr)		per.	ECTS cr
FV11A9000	Academic Seminar for International Programs	2–4	6
BM20A1300	Complex Analysis	1	3
BM20A2700	Numerical Analysis II	4	3
FV18A9101	Finnish 1	1, 3	2
FV18A9201	Finnish 2	2, 4	2
BH50A1200	Energy Systems Engineering	1-2	6

Major Studies

Obligatory (56 ECTS cr)		per.	ECTS cr
BL30A0400	Design of an Electrical Machine	1	6
BL30A0600	Power Electronics	1-2	6
BL30A1010	Seminar Course in Electrical Drives	1	4
BL30A1200	Numerical Methods in Electromagnetism	3	4
BL40A1100	Embedded System Programming	1-2	4
BL50A0600	Electromagnetic compatibility in power electronics	1	2
Thesis	Master's Thesis and Seminar		30

Minor Studies

Industrial Embedded Systems (21 ECTS cr)		per.	ECTS cr
BL40A1810	Microprocessors A	3-4	6
BL50A1300	Advanced Course in Electronics	3-4	6
BL40A1000	Real-time Operating Systems and Programs	1-2	5
BL40A1200	Digital Control Design	1-2	4

Alternatively to the minor subject suggested in the study programme the student can choose any minor subject taught in English at LUT.

Elective Studies
To attain the full degree amount of 120 ECTS credits the student needs to take some additional courses. Elective studies can include any courses taught in English at LUT if the required prerequisites are completed. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

Electricity Distribution and Market

General Studies

Obligatory (27 ECTS cr)		per.	ECTS cr
FV11A9000	Academic Seminar for International Programs	2–4	6
AB30A0300	International Finance and Emerging Markets	2	5
BM20A1300	Complex Analysis	1	3
BM20A2700	Numerical Analysis II	4	3
BH50A1200	Energy Systems Engineering	1-2	6
FV18A9101	Finnish 1	1, 3	2
FV18A9201	Finnish 2	2, 4	2

Major Studies

Obligatory (57 ECTS cr)		per.	ECTS cr
BL20A0201	Power exchange game for electricity markets	2-3	3
BL20A0401	Electricity market	1	5
BL20A0501	Electricity distribution technology	2-3	8

BL20A0601	Electrical power transmission	2	5
BL30A0600	Power Electronics	1-2	6
Thesis	Master's Thesis and Seminar		30

Minor Studies

Power Electronics and Electrical Drives (20 ECTS cr)	*per.*	*ECTS cr*
BL30A1010	Seminar Course in Electrical Drives	1	4
BL30A1200	Numerical Methods in Electromagnetism	3	4
BL40A1100	Embedded System Programming	1-2	4
BL50A0600	Electromagnetic compatibility in power electronics	1	2
BL50A1300	Advanced Course in Electronics	3-4	6

Alternatively to the minor subject suggested in the study programme the student can choose any minor subject taught in English at LUT.

Elective Studies
To attain the full degree amount of 120 ECTS credits the student needs to take some additional courses. Elective studies can include any courses taught in English at LUT if the required prerequisites are completed.

Additional Information

Personal Study Plans:
At the beginning of their studies, students prepare a personal study plan, in which the student and the Department agree on what studies the student will pursue and in what order. This plan includes detailed information on the major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS cr):
Students with a degree from a Finnish University of Applied Scienes or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska 2 ECTS cr is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further information
Faculty of Technology, Study Coordinator Jutta Luostarinen (room 2321, jutta.luostarinen@lut.fi), Study Coordinator Minna Loikkanen (room 2321, minna.loikkanen@lut.fi).

Courses Offered in English

		ECTS cr
BL10A5000	Basic Finnish course for Russian-speaking students	2
BL20A0201	Power exchange game for electricity markets	3
BL20A0401	Electricity market	5
BL20A0501	Electricity distribution technology	8
BL20A0601	Electrical power transmission	5
BL30A0400	Design of an Electrical Machine	6
BL30A0600	Power Electronics	6
BL30A1010	Seminar Course in Electrical Drives	4
BL30A1200	Numerical Methods in Electromagnetism	4
BL40A1000	Real-time Operating Systems and Programs	5
BL40A1100	Embedded System Programming	4
BL40A1200	Digital Control Design	4
BL40A1810	Microprocessors A	6
BL40A2201	Process and Product Innovations	10
BL50A0600	Electromagnetic compatibility in power electronics	2
BL50A1300	Advanced Course in Electronics	6

Course Descriptions

BL10A5000	*BASIC FINNISH COURSE FOR RUSSIAN-SPEAKING STUDENTS*	*2 ECTS cr*
	Basic Finnish course for Russian-speaking students	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	M.A. Julia Vauterin	
	Lecturer(s) responsible: Lecturer, Raija Hietaranta	
Aims	The aims of the course are to introduce the student into the basics of the Finnish language, to give the student the skills to cope with simple everyday discussions, to offer exercises to assess the student's progress in studies and to encourage the student to learn Finnish independently with the support of internet courses.	
Contents	Pronunciation, oral skills, listening comprehension, writing, reading and grammar.	
Teaching methods	28 h of tutorials, 1nd and 2rd period. Independent studies, group work, written assignment.	
Assessment	0 - 5, active participation in class, examination in writing 100%	
Course Material	Afanaseva Valentina, Razinov P.: Finskij jazyk dlja nachinajushchih. Other material to be distributed during the lectures.	

BL20A0201	*POWER EXCHANGE GAME FOR ELECTRICITY MARKETS*	*3 ECTS cr*
	Power exchange game for electricity markets	
Year and Period	M.Sc. (Tech.) 1, Period 2-3	
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jarmo Partanen	
Aims	The course deepens the student's knowledge of the practical planning and implementation of electricity trade in the form of game training.	
Contents	Planning of the procurement and sale of electricity, OTC markets, physical and financial products of power exchange, risk management on the electricity markets.	
Teaching methods	8 h of lectures, 40 h of game training that is carried out once a week in teams, 2nd and 3rd period. A final report in writing.	
Assessment	0 - 5, final report in writing 100%	
Course Material	Material to be distributed during the lectures.	
Prerequisites	Electricity market	

BL20A0401	*ELECTRICITY MARKET*	*5 ECTS cr*
	Electricity market	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	Professor, D.Sc. (Tech.) Satu Viljainen	
Aims	The course gives the student a basic knowledge of the fundamentals of electricity trade and the electricity distribution business as well as of the related objectives and implementations.	
Contents	The development of electricity markets, loads on the electricity network and load forecasts, power exchange, electricity trade, balance management, the fundamentals of pricing and the regulation of distubtion business.	
Teaching methods	28 h of lectures, 14 h of tutorials, 1st period. Independent studies. Written examination.	
Assessment	0 - 5, examination 100%.	
Course Material	Material to be distributed during the lectures.	

BL20A0501	***ELECTRICITY DISTRIBUTION TECHNOLOGY 8 ECTS cr***
	Electricity distribution technology
Year and Period	M.Sc. (Tech.) 1, Period 2-3
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jarmo Partanen
Aims	The course provides the student with in-depth knowledge of the design and use of distribution networks.
Contents	Network design; the use, protection, and automation of distribution networks; information systems of distribution companies.
Teaching methods	42 h of lectures, 28 h of tutorials, 2nd and 3rd period. Assignment. Written examination.
Assessment	0 - 5, examination 100%. Satisfactorily completed assignment required.
Course Material	Lakervi, Holmes: Electricity distribution network design.
Prerequisites	Students are required to have completed Introduction to Electrical Power Systems, Electrical Power Transmission, and have attended the lectures of Electricity Markets.

BL20A0601	***ELECTRICAL POWER TRANSMISSION 5 ECTS cr***
	Electrical power transmission
Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jarmo Partanen
Aims	This course provides the student with a basic knowledge of the design and use of electricity transmission networks.
Contents	The description of the electricity transmission system. Frequency and voltage control. Calculation of load flow, fault currents and stability in a meshed network. DC power transfer. Relay protection.
Teaching methods	24 h of lectures, 14 h of tutorials, 2nd period. Written examination.
Assessment	0 - 5, examination 100%.
Course Material	Mörsky: Voimalaitosten yhteiskäytön tekniikka (Otatieto Moniste 549).
Prerequisites	Students are required to have completed Electric Circuits and attended the lectures of Introduction to Electrical Power Systems.

BL30A0400	***DESIGN OF AN ELECTRICAL MACHINE 6 ECTS cr***
	Design of an Electrical Machine
	Suomenkielinen opetusmoniste sekä suomenkieliset harjoitustehtävät ovat saatavilla.
Year and Period	M.Sc. (Tech.) 2, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Pyrhönen
Aims	The course will give the student professional knowledge of the design of an electric machine and basic skills required in finding structural solutions based on desired machine characteristics. The students are trained to perform design tasks, to utilize mathematical software in calculation, and to analyze the machine characteristics. Students are also acquainted with materials used in machines, heat transfer and some basic mechanical aspects of the machine design. After having successfully passed the course a student should be capable of further educating him- or herself to work as a motor or generator designer or in the field of motor drives in general. The course may be applied in post graduate studies.
Contents	Electro magnetic principles used in machine design, the magnetic circuit of an electric machine, the windings of an electric machine, impacts of the structure of the electric motor on the motor characteristics, calculation of the parameters of an equivalent circuit from the dimensions of the machine (resistances, inductances), effective-value phasor diagrams for different machine types,

| Teaching methods | principles of electric machine design, insulation materials and systems heat transfer. Suitable also for postgraduate studies.
28 h of lectures, 28 h of tutorials, 1st period. |
Assessment	The design assignment of an electric machine. Written examination.
	0-5, written examination 100%. Satisfactorily completed assignment required.
Course Material	Pyrhönen: Design of a rotating electric machine (Pyörivän sähkökoneen suunnitteleminen). Pyrhönen: Magneettiset materiaalit (where applicable). C.B. Gray: Electrical Machines and Drive Systems (where applicable).
Prerequisites	Students are recommended to have completed Electric Circuits, Basics of Electric Engineering, and Laboratory Course in Electrical Engineering and attended the lectures of Electromagnetism.

BL30A0600	*POWER ELECTRONICS*	*6 ECTS cr*

Power Electronics

Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Lasse Laurila
Aims	The course provides the student with a good general knowledge of the different basic circuits in modern power electronics. The course acquaints students with the features and functions of different switch-mode converters and inverters. In addition, the course will offer an insight into the joint operation of static converters and load as well as the network interferences caused by converters and possibilities for reducing these interferences.
Contents	Operation of the main circuits of different power converters: rectifiers (single and three-phase), DC-DC switch mode converters and power supplies (buck, boost, buck-boost, Cúk, flyback, forward), inverters (single and three-phase), resonance converters (ZVS, ZCS). Characteristics and operation. Pulse width modulation (PWM). Harmonic components. Simulation of power electronic circuits. This course is also suitable for postgraduate students.
Teaching methods	14 h of lectures, 14 h of tutorials, 1st period.
14 h of lectures, 14 h of tutorials, 2nd period. Written examination
Assessment	0 - 5, written examination 100%
Course Material	Mohan, Undeland, Robbins: Power Electronics, converters, applications, and design, where applicable.
Prerequisites	Electric Circuits. Integration and derivation (esp. sine and cosine functions). FFT. Laplace transforms.

BL30A1010	*SEMINAR COURSE IN ELECTRICAL DRIVES*	*4 ECTS cr*

Seminar Course in Electrical Drives

The course is designed for students of the Master's degree program in electrical engineering and for students and postgraduate students interested in the fundamental principles of electrical drives. It is an intensive overview of Sa271000 Sähkökäytöt and will be lectured only if required.

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Pyrhönen
Aims	The course addresses the theory and operation of electrical motor drives. In particular, the course focuses on the operation of modern AC drives. The course is intended for persons working on controlled electrical drives. After having successfully paassed the course a student should have good basic knowledge for working in the field of electric drives.
Contents	Theory, operation and vector equivalent circuits of electrical motor drives. Fundamentals of space vector theory. Synchronous machine drives. Asynchronous motor drive. DC drive. Torque production mechanisms in different machines. Power electronic converter main topologies for motor control. Modulation principles. Scalar control, vector control, direct flux linkage control and direct torque control (DTC).

Teaching methods Assessment Prerequisites	Intensive course. 3 sessions of 6 h lectures, 1 session of 6 h seminar, 1 session of 6 h tutorials, 1st period. Seminar work. 0 - 5, seminar work 100%. The students are recommended to have completed the courses Electric Circuits, Basics of Electric Engineering, and Laboratory Course in Electrical Engineering, and to have attended the courses Design of an Electrical Machine and Power Electronic Components; Introduction to Electrical Drives, Electromagnetic Components.

BL30A1200	*NUMERICAL METHODS IN ELECTROMAGNETISM*	*4 ECTS cr*
	Numerical Methods in Electromagnetism	
Year and Period Lecturer(s) Aims	M.Sc. (Tech.) 2, Period 3 Researcher/Teacher, D.Sc. (Tech.) Janne Nerg This course trains the student to use commercial calculation software and to select the best solution for the specific purpose.	
Contents	The fundamentals of the element method, boundary conditions, the modelling of materials, the post-processing of results. Iron loss models. Eddy current problems, utilisation of circuit model in calculation. This course is also suitable for postgraduate students.	
Teaching methods	28 h of supervised tutorials. 3rd period. Course requirements: participation in tutorials and a satisfactorily completed assignment.	
Assessment Prerequisites	0 - 5, assigment 100% Introduction to Electrical Drives and Design of an Electrical Machine	

BL40A1000	*REAL-TIME OPERATING SYSTEMS AND PROGRAMS*	*5 ECTS cr*
	Real-time Operating Systems and Programs	
Year and Period Lecturer(s) Aims	M.Sc. (Tech.) 2, Period 1-2 Researcher/Teacher, D.Sc. (Tech.) Julius Luukko The course provides the student with skills needed for constructing an application program of an embedded system by using real-time operating system as the architecture. The student is trained to utilise the services of a real-time operating system.	
Contents	Basic concepts of a real-time system. Services provided by a real-time operating system: task management, time management, semaphores, mutual exclusion semaphores (mutex), event flags, mailboxes, message queues, and memory management. Implementation of a real-time operating system: context switch, interrupt management. Processor-specific parts of a real-time operating system and adapting the real-time operating system to a new processor.	
Teaching methods	21 h of lectures, 14 h of tutorials, 1st period. 21 h of lectures, 14 h of tutorials, 2nd period. Written examination.	
Assessment Course Material Prerequisites	0 - 5, examination 100%. Satisfactorily completed assignment required. Labrosse, J.J.: MicroC/OS-II The Real-Time Kernel (2nd Edition). Embedded System Programming.	

BL40A1100	*EMBEDDED SYSTEM PROGRAMMING*	*4 ECTS cr*
	Embedded System Programming	
Year and Period Lecturer(s) Aims	M.Sc. (Tech.) 1, Period 1-2 Researcher/Teacher, D.Sc. (Tech.) Tuomo Lindh The course provides the student with skills to apply C language and its structures in embedded system programming.	
Contents	Embedded system programming, design tools, C language in embedded	

	system programming, the utilisation of microcontroller environment (registers, timers, buses, A/D conversion etc.). Typical data structures, typical program structures in real-time applications. Programming the Windows interface, basic properties of real-time operating systems.
Teaching methods	14 h of lectures, 14 h of tutorials, 1st period. 14 h of lectures, 14 h of tutorials, 2nd period. Assignment. Written examination.
Assessment	0 - 5, examination 100%. Satisfactorily completed assignment required.
Course Material	Wolf, W.: Computers as components: principles of embedded computing system design. Lecture notes.
Prerequisites	Basics of C language.

BL40A1200	*DIGITAL CONTROL DESIGN*	*4 ECTS cr*
	Digital Control Design	

Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Riku Pöllänen
Aims	The course provides the student with skills to design and implement digital control algorithms in a discrete time domain. The focus lays mainly on discrete time state-space design methodology.
Contents	State feedback, state estimator, design of a state-space controller, polynomial control design. Fundamentals of multivariable control system. Simulation of digital control system with Simulink. Programming of digital control for a microprocessor. Design examples. Utilisation of MATLAB in control design. Examples of control solutions in industrial electronics.
Teaching methods	14 h of lectures, 14 h of tutorials, 1st period. 6-10 h of demonstration lectures and laboratory demonstrations, 14 h of tutorials in computer class, 2nd period. Assignment. Written examination.
Assessment	0 - 5, examination 100%. Satisfactorily completed assignment required.
Prerequisites	Control Systems, Introduction and Digital Control, an Introduction.

BL40A1810	*MICROPROCESSORS A*	*6 ECTS cr*
	Mikroprosessorit A	

Year and Period	B.Sc. (Tech.) 3, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Jero Ahola
Aims	The course acquaints the students with the functioning and use of mircoprocerror components. The course gives the students the skills to program and design embedded microcomputer systems.
Contents	The architecture, instruction set and functioning of a microprocessor. Microcontrollers. The structure and design of memory circuits and peripheral components. System design. Programming and development support. Application examples. An introduction to signal prosessors.
Teaching methods	3 rd period: 14 h of lectures, 14 h of tutorials. 4 th period: 14 h of lectures, 14 h of tutorials. Assignment. Written examination.
Course Material	Lecture notes.
Prerequisites	Basic Digital Circuits and Basic Electronics A + B, Fundamentals of Programming.

BL40A2201	*PROCESS AND PRODUCT INNOVATIONS*	*10 ECTS cr*
	Process and Product Innovations	
	Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.	
Year and Period	M.Sc. (Tech.) 1-2, Period 1-4	

Lecturer(s)	Professor, D.Sc. (Tech.) Riku Pöllänen, Professor, D.Sc. (Tech.) Tuomo Kässi, Researcher/Teacher, D.Sc. (Tech.) Kimmo Kerkkänen, Senior Lecturer, D.Sc. (Tech.) Ville Ojanen
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To get acquainted with the generation of innovations and new technology, the typical methods, problems and their solutions. To train project and teamwork in interdisciplinary, international environment. To get acquainted with product and process development. To train and deepen many skills learned in other connections.
Contents	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.
Teaching methods	Informational lectures, 6 h/period. Project meetings, 6 h/period. Independent project and teamwork in groups of 4-8 students.
Assessment	0-5, project work 100 %.

BL50A0600	*ELECTROMAGNETIC COMPATIBILITY IN POWER ELECTRONICS*	*2 ECTS cr*

Electromagnetic compatibility in power electronics

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Pertti Silventoinen
Aims	This course provides the student with skills to understand the occurrence mechanisms of interferences in power electronics, the effects of cable reflection, and the occurrence mechanisms and prevention of network harmonics. The course can also be included in post-graduate studies.
Contents	Power electronics as an interference source, network harmonics, reflection phenomena of cables, conductive RF interference, interference radiation of power electronics, filtering techniques of conductive interferences.
Teaching methods	14 h of lectures, 1st period. An assignment to be completed as pair work. Written examination.
Assessment	0 - 5, written examination 100%. Satisfactorily completed assignment required.

BL50A1300	*ADVANCED COURSE IN ELECTRONICS*	*6 ECTS cr*

Advanced Course in Electronics

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Pertti Silventoinen
Aims	During this course, the student will obtain a deep knowledge of a new topic in electronics. Suitable also for postgraduate studies.
Contents	The course contents are subject related and will be specified during the introductory lectures.
Teaching methods	2h of introductory lectures 2 h, 12 h of seminar presentations, 3rd period. 14 h of seminar presentations, 4th period. No written examination.
Assessment	0 - 5, seminar presentation 100%.

7 Master's Degree Programme in Information Technology

Master's Degree Programme in Information Technology is a two-year programme in English meant for both Finnish and foreign students, who have a Bachelor's degree in Information Technology, Computer Science or equivalent discipline. The programme is worth of 120 ECTS credits and includes coursework of 90 ECTS credits and a Master's thesis of 30 ECTS credits, leading to a Master of Science in Technology degree.

The Aims of the Master's Degree Programme

The aim of the Master's Degree Programme is to prepare the student professionally and academically in those areas of information technology, which are required in positions in industry. Another aim of the Master's Degree Programme is to provide the student with the readiness to undertake post-graduate studies and independent studies in some area of information technology.

Professional Scope of the Master's Degree Programme

The professional scope of the Master's Degree Programme is diverse and rapidly developing. Information systems in industry form a key area in which information processing and telecommunication is combined. Depending on the chosen field of specialisation, the graduate's tasks may include software design and implementation, product design and development as well as specific application of information technology, computational modelling and electronics in monitoring, design and control of production systems. Furthermore, a graduate may also work in the field of research, consulting, sales, and teaching as well as their own business.

Fields of Specialisation

The following alternative fields of specialisation (major subjects) are available at LUT

1. **Intelligent Computing**
2. **Communications Software**
3. **Software Engineering**

1. **Students of Intelligent Computing** get a broad idea of the applications and methods of information processing as well as information processing systems and their design. Advanced studies focus on intelligent information processing and its applications. The graduates can work in:
    - Design, development, and maintenance of information processing systems and software
    - Project planning and management in ICT companies
    - Product development and consulting of intelligent computing
    - Research and teaching in universities and research institutes

2. **Students of Communications Software** gain knowledge of networking by having both technical as well as social point of view. Studies in the major emphasize current and future network technologies that allow communication and networking between humans and/or machines. The highly practical approach to the software aspects of networking links the theoretical knowledge to the real life applications. By completing these studies the students are capable of working in the following fields:
    - Design, implementation, development and maintenance of communication networks and systems
    - Design, implementation and development of communications software and services
    - Product development, consulting and management tasks in the field of communications
    - Research and teaching tasks in universities and research institutes

3. **Students of Software Engineering** will get expertise in software development, its processes, methods and tools. Typical roles for the graduates of this major include software architects, programming experts, software product managers, and systems analysts. Common tasks in the field include

   - Design, development, and maintenance of software and information systems
   - Software and systems analysis and design
   - Participation to software development projects in either supplier or customer role
   - Software research and product development
   - Management of software development organizations.

Prerequisites

Students starting in Master's Degree Programme are expected to have following skills:

Intelligent Computing
Students majoring in Intelligent Computing are expected to have a command of engineering mathematics, especially statistics, matrix calculations and numerical methods. The students are expected to be able to program and justify a choice of data structures and algorithms that solve a given information processing problem. Furthermore, the students must have basic knowledge in theoretical computer science as well as understanding of information technology as a whole including hardware, operating systems, and software levels.

A student in Intelligent Computing must be able to design and implement a program that solves an information processing problem based on a given specification. A student must be able to work both independently and as a part of a team in different kinds of projects. The education is given in English, thus good communication skills in English are necessary both orally and in writing.

Communications Software
Students majoring in Communications Software are expected to master the basic computer science skills from data structures and algorithms up to the practical programming. Student needs to have the basic understanding of protocols as well as communication principles in different network environments. Knowledge of engineering mathematics and physics helps in understanding of the master's level courses.

A student should be able to design and implement a program that is transferring information between two or more computers, terminals or humans. The graduates can work independently and act as a responsible member of a group. The graduates are able to communicate in English both orally and in written form.

Software Engineering
Students majoring in Software Engineering are expected to have understanding of basic engineering mathematics. The students are expected to have an understanding of the role of software and information systems in modern business. In addition, the students need understanding of programming, basics of software analysis and design methodologies, and project management. Knowledge of operating systems and software development environments will make learning easier.

The student must be able to design and implement a program that uses database through a graphical user interface. The students are expected to be able to work both individually and in project groups. The students are also expected to have a good command of English language.

Complementary Studies

Students with a degree from a Finnish University of Applied Sciences or Polytechnics or equivalent will have to study complementary studies (26 ECTS cr) which are not included in the Master's degree. The extent of these studies depends on the content of the previous degree. Further information: International Officer Riitta Salminen, room 4406, phone +358 5 621 2659, riitta.salminen@lut.fi.

The Degree Structure of the Programme

Master of Science 120 ECTS cr

	ECTS cr
General studies	12
Major subject	78
Minor subject	20
Elective studies	10
Total	*120*

General studies

Obligatory (12 ECTS cr)		year	per.	ECTS cr
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
CT10A9500	Research Methods	M.Sc. (Tech.) 1	1-2	3
FV11A9000	Academic Seminar for International Programs	M.Sc. (Tech.) 1	2–4	6
FV18A9101[(*]	Finnish 1		1, 3	2

[*] Teknisk svenska 2 ECTS is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree

MAJOR: Intelligent Computing

Major Subject in Intelligent Computing 78 ECTS cr

Obligatory Studies (46 ECTS cr)		year	per.	ECTS cr
CT20A5100	Introduction to Machine Vision and Machine Learning	M.Sc. (Tech.) 1	3-4	6
CT20A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	1-2	5
CT20A6400	Languages, Compilers and Interpreters	M.Sc. (Tech.) 1	3-4	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

Elective Studies (min. 32 ECTS)		year	per.	ECTS cr
BM20A1900	Statistics II	M.Sc. (Tech.) 1-2	2	3
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT20A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT20A6100	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7
CT20A6200	Computer and Robot Vision	M.Sc. (Tech.) 1-2	1-2	7
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	1-2	8

MAJOR: Communications Software

Major Subject in Communications Software 78 ECTS cr

Obligatory Studies (50 ECTS cr)		year	per.	ECTS cr
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A5500	Network Design, Simulation and Tools	M.Sc. (Tech.) 1	3-4	5
CT30A5800	Communications Software and Architecture	M.Sc. (Tech.) 1	1-2	5
CT30A5900	Communication Software Laboratory Work	M.Sc. (Tech.) 1	3-4	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

Elective Studies (min 28 ECTS cr). Choose freely from the list (courses are grouped according to the subject matter):

Elective Studies in Communications Software

Mobile communications		year	per.	ECTS cr
CT30A5201	Symbian Programming	M.Sc. (Tech.) 1	4	4
CT30A6201	Mobility Management	M.Sc. (Tech.) 1-2	3	5
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1-2	3	5
CT30A8300	Wireless Service Engineering	M.Sc. (Tech.) 1-2	1-2	5

Communications networks		year	per.	ECTS cr
CT30A6801	Local Area Networks, Special Course	M.Sc. (Tech.) 1	1-3	8
CT30A6900	Peer-to-peer Networking	M.Sc. (Tech.) 1-2	1-2	5
CT30A8800	Secured Communications	M.Sc. (Tech.) 1-2	1-2	6

Communications software		year	per.	ECTS cr
CT20A7200	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	5
CT20A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	1-2	8
CT30A7100	Parallel Programming	M.Sc. (Tech.) 1-2	3-4	5
CT30A7400	Distributed Object Programming	M.Sc. (Tech.) 2	1-2	6

Intensive courses and code camps		year	per.	ECTS cr
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT10A9700	Summer School on Communications Engineering	M.Sc. (Tech.) 2	int.	2
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4

Network media		year	per.	ECTS cr
CT30A8100	Information Network Technologies	M.Sc. (Tech.) 1-2	2-3	7
CT30A8550	Work Course on Crossmedia	M.Sc. (Tech.) 1-2	1-4	5
CT30A8901	Service Oriented Communications	M.Sc. (Tech.) 1	2	5

MAJOR: Software Engineering

Major Subject in Software Engineering 78 ECTS cr

Obligatory Studies (53 ECTS cr)		year	per.	ECTS cr
CT20A7200	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	5
CT20A7301	Software Quality, Processes, and	M.Sc. (Tech.) 2	1-2	6

	Organizations			
CT20A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT20A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

Elective Studies (min 25 ECTS cr)		year	per.	ECTS cr
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT20A5100	Introduction to Machine Vision and Machine Learning	M.Sc. (Tech.) 1	3-4	6
CT20A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT20A6400	Languages, Compilers and Interpreters	M.Sc. (Tech.) 1	3-4	5
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A5201	Symbian Programming	M.Sc. (Tech.) 1	4	4
CT30A5800	Communications Software and Architecture	M.Sc. (Tech.) 1	1-2	5
CT30A7400	Distributed Object Programming	M.Sc. (Tech.) 2	1-2	6
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4

Minor Subject
The minor subject is to be selected from the following fields of specialisation:
- Intelligent Computing
- Communications Software
- Software Engineering
- Technomathematics
- Business Administration

The minor subject must include the compulsory courses of the selected topic, mentioned under the major. The rest can be selected freely to complete 20 ECTS credits.

Elective Studies
Any course given in Lappeenranta University of Technology can be included in elective studies. We recommend courses given by the department of Information Technology and Finnish for Foreigners –language courses.

Total minimum of the degree is 120 ECTS cr.

Complementary Studies
Students with a Finnish degree from the University of Applied Scienes or equivalent will have to study complementary studies (26 ECTS cr) which are not included in the Master's degree.

Complementary Studies (26 ECTS cr)		year	per.	ECTS cr
BM20A0500	Matematiikka KoTiB1	B.Sc. (Tech.) 1	3	3
BM20A0700	Matematiikka KoTiB2	B.Sc. (Tech.) 1	3-4	2
BM20A0900	Matematiikka KoTiB3	B.Sc. (Tech.) 1	4	3
BM20A1400	Tilastomatematiikka I	B.Sc. (Tech.) 2	1	3-4
CT20A2310	Tietorakenteet ja algoritmit	B.Sc. (Tech.) 2	2	5
CT20A3000	Unix and System Programming	B.Sc. (Tech.) 3	1-2	5
CT30A2500	TCP/IP -perusteet	B.Sc. (Tech.) 3	1-2	5

8 CBU Master's Degree Programme in Information and Communications Technology

The CBU Master's Programme in Information and Communications Technology is a two-year joint Master's degree programme which is produced in a concerted way in the network of four Finnish and three Russian universities.

The partners in this international study programme are the following universities:

- St. Petersburg State University
- St. Petersburg State Polytechnic University
- Petrozavodsk State University
- Lappeenranta University of Technology
- University of Kuopio
- University of Joensuu
- University of Helsinki

The objective of the study programme is to offer in each of the seven member universities a M.Sc. programme in ICT, which conforms to agreed CBU guidelines and facilitates cross-border collaboration in the exchange of academic resources, development of joint study modules, visiting lecturers etc.

The curriculum contains compulsory and elective modules, a M.Sc. Thesis. The total volume is 120 ECTS credits. The curriculum contains 60 acts of studies that are produced in cross-border collaboration. At Lappeenranta University of Technology, the alternative major subjects are Intelligent Computing, Communications Software and Software Engineering.

Levels of collaboration of the CBU ICT-pilot Master's Programme

- Summer schools and winter schools
- Intensive courses by visiting lecturers
- Student visits to partner institutions
- Internet based courses
- Common projects in cross-border teams
- Jointly supervised M.Sc. projects

Complementary Studies
Students with a Finnish degree from the University of Applied Scienes or equivalent will have to study complementary studies (26 ECTS cr) which are not included in the Master's degree. The extent of these studies depends on the content of the previous degree. Please, see page 52. Further information: International Officer Riitta Salminen, room 4406, phone +358 5 621 2659, riitta.salminen@lut.fi.

Personal Study Plan
At the beginning of their studies, students prepare a personal study plan (PSP). Personal study plans will be approved by the main programme coordinator, Dr. Pekka Jäppinen, who will give further information on how to prepare and update the personal study plan. The workload of the degree of Master of Science is 120 ECTS credits. From the total amount of 120 ECTS cr, 60 ECTS credits must be completed in a Russian CBU-ICT university in cross-border collaboration.

CBU-ICT courses
CBU-ICT courses offered in different partner universities are available on the website www.it.lut.fi -> Studies -> CBU.

The Degree Structure of the Programme

Master of Science 120 ECTS cr

	ECTS cr
General studies	12
Major subject	78
Minor subject	20
Elective studies	10
Total	*120*

General Studies

General studies

Obligatory (12 ECTS cr)		year	per.	ECTS cr
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
CT10A9500	Research Methods	M.Sc. (Tech.) 1	1-2	3
FV11A9000	Academic Seminar for International Programs	M.Sc. (Tech.) 1	2–4	6
FV18A9101[*]	Finnish 1		1, 3	2

[*] Teknisk svenska 2 ECTS is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree

MAJOR: Intelligent Computing

Major Subject in Intelligent Computing 78 ECTS cr

Obligatory studies (46 ECTS cr)		year	per.	ECTS cr
CT20A5100	Introduction to Machine Vision and Machine Learning	M.Sc. (Tech.) 1	3-4	6
CT20A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	1-2	5
CT20A6400	Languages, Compilers and Interpreters	M.Sc. (Tech.) 1	3-4	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

Elective Studies (min. 32 ECTS)		year	per.	ECTS cr
BM20A1900	Statistics II	M.Sc. (Tech.) 1-2	2	3
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT20A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT20A6100	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7
CT20A6200	Computer and Robot Vision	M.Sc. (Tech.) 1-2	1-2	7
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	1-2	8

MAJOR: Communications Software

Major Subject in Communications Software 78 ECTS cr

Obligatory studies (50 ECTS cr)		year	per.	ECTS cr
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A5500	Network Design, Simulation and Tools	M.Sc. (Tech.) 1	3-4	5
CT30A5800	Communications Software and Architecture	M.Sc. (Tech.) 1	1-2	5
CT30A5900	Communication Software Laboratory Work	M.Sc. (Tech.) 1	3-4	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

Elective studies in Communications Software (min 28 ECTS cr). Choose freely from the list (courses are grouped according to the subject matter):

Elective Studies in Communications Software

Mobile communications		year	per.	ECTS cr
CT30A5201	Symbian Programming	M.Sc. (Tech.) 1	4	4
CT30A6201	Mobility Management	M.Sc. (Tech.) 1-2	3	5
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1-2	3	5
CT30A8300	Wireless Service Engineering	M.Sc. (Tech.) 1-2	1-2	5

Communications networks		year	per.	ECTS cr
CT30A6801	Local Area Networks, Special Course	M.Sc. (Tech.) 1	1-3	8
CT30A6900	Peer-to-peer Networking	M.Sc. (Tech.) 1-2	1-2	5
CT30A8800	Secured Communications	M.Sc. (Tech.) 1-2	1-2	6

Communications software		year	per.	ECTS cr
CT20A7200	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	5
CT20A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	1-2	8
CT30A7100	Parallel Programming	M.Sc. (Tech.) 1-2	3-4	5
CT30A7400	Distributed Object Programming	M.Sc. (Tech.) 2	1-2	6

Intensive courses and code camps		year	per.	ECTS cr
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT10A9700	Summer School on Communications Engineering	M.Sc. (Tech.) 2	int.	2
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4

Network media		year	per.	ECTS cr
CT30A8100	Information Network Technologies	M.Sc. (Tech.) 1-2	2-3	7
CT30A8550	Work Course on Crossmedia	M.Sc. (Tech.) 1-2	1-4	5
CT30A8901	Service Oriented Communications	M.Sc. (Tech.) 1	2	5

MAJOR: Software Engineering

Major Subject in Software Engineering 78 ECTS cr

Obligatory studies (53 ECTS cr)		year	per.	ECTS cr
CT20A7200	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	5
CT20A7301	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	6
CT20A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT20A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5

| CT10A6000 | Master's Thesis and Seminar | M.Sc. (Tech.) 2 | 1-4 | 30 |

Elective Studies (min 25 ECTS cr)		year	per.	ECTS cr
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9600	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	2-4	5
CT20A5100	Introduction to Machine Vision and Machine Learning	M.Sc. (Tech.) 1	3-4	6
CT20A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT20A6400	Languages, Compilers and Interpreters	M.Sc. (Tech.) 1	3-4	5
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A5201	Symbian Programming	M.Sc. (Tech.) 1	4	4
CT30A5800	Communications Software and Architecture	M.Sc. (Tech.) 1	1-2	5
CT30A7400	Distributed Object Programming	M.Sc. (Tech.) 2	1-2	6
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4

Master's Thesis 30 ECTS cr

Two examiners will be appointed to supervise the Master's Thesis. The first examiner/supervising professor must be appointed from Lappeenranta University of Technology and the second examiner must be from a Russian CBU-ICT university.

Minor Subject 20 ECTS cr

Compulsory: CT10A9600 Research Methods, Laboratory Project, 5 ETCS
Student chooses 15 credits lectured at the Russian CBU-ICT partner universities, from the CBU Winter and Summer Schools, visiting lectures and intensive courses.

Elective Studies 10 ECTS cr

Student chooses 10 credits lectured at the Russian CBU-ICT partner universities, from the CBU Winter and Summer Schools, visiting lectures and intensive courses. Minimum of the degree is 120 ECTS cr.

For CBU courses please see: www.it.lut.fi -> Studies -> CBU

*** See the newest list at the CBU-ICT website. The suitability of the course for your major should be verified beforehand from Dr. Pekka Jäppinen, pekka.jappinen@lut.fi.

Courses Offered in English

		ECTS cr
CT10A6000	Master's Thesis and Seminar	30
CT10A9100	ECSE International Summer School in Novel Computing	1 - 2
CT10A9500	Research Methods	3
CT10A9600	Research Methods, Laboratory Project	5
CT10A9700	Summer School on Communications Engineering	2
CT20A5100	Introduction to Machine Vision and Machine Learning	6
CT20A5700	Introduction to Computer Graphics	5
CT20A6000	Pattern Recognition	7
CT20A6100	Machine Vision and Digital Image Analysis	7
CT20A6200	Computer and Robot Vision	7
CT20A6400	Languages, Compilers and Interpreters	5
CT20A7200	Architecture in Systems and Software Development	5
CT20A7301	Software Quality, Processes, and Organizations	6
CT20A7400	Fundamentals of Information Systems	7
CT20A7500	Object-Oriented Programming Techniques	5
CT30A5000	Network Programming	5
CT30A5201	Symbian Programming	4
CT30A5500	Network Design, Simulation and Tools	5
CT30A5800	Communications Software and Architecture	5
CT30A5900	Communication Software Laboratory Work	5
CT30A6201	Mobility Management	5
CT30A6801	Local Area Networks, Special Course	8
CT30A6900	Peer-to-peer Networking	5
CT30A7001	Concurrent and Parallel Computing	8
CT30A7100	Parallel Programming	5
CT30A7400	Distributed Object Programming	6
CT30A8001	User-Centric Service Design	5
CT30A8100	Information Network Technologies	7
CT30A8300	Wireless Service Engineering	5
CT30A8550	Work Course on Crossmedia	5
CT30A8800	Secured Communications	6
CT30A8901	Service Oriented Communications	5
CT30A9300	Code Camp on Communications Engineering	4

Course Descriptions

CT10A6000	MASTER'S THESIS AND SEMINAR	30 ECTS cr
	Diplomityö ja seminaari	
Year and Period	M.Sc. (Tech.) 2, Period 1-4	
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Heikki Kälviäinen, Professor, D.Sc. (Tech.) Jari Porras and Professor, Ph.D. Kari Smolander	
Aims	A student learns about independent work and scientific writing, related into specific problems in the field of information technology.	
Contents	An independent thesis done in the field of information technology, according to the instructions given. In the beginning a student must contact the professor responsible for the major subject of a student: Information Processing, Intelligent Computing (prof. Kälviäinen), Communications Engineering and Communications Software (prof. Porras) and Software Engineering (prof. Smolander). Independent work according to the agreed plan. The starting and finishing point of the thesis vary. A seminar presentation of the thesis should be given in an agreed, specific time before the assessment of the thesis in a faculty council meeting.	
Teaching methods	Master's Thesis and a seminar presentation, maturity exam.	

Assessment	0 - 5. Master's thesis 100 %.
Prerequisites	FV11A9000Academic Seminar for International Programs and CT10A9500 Research Methods completed and a minimum of 15 ECTS credits of the major studies completed.

CT10A9100	*ECSE INTERNATIONAL SUMMER SCHOOL IN NOVEL COMPUTING*	*1 - 2 ECTS cr*
	ECSE International Summer School in Novel Computing, Itä-Suomen tietotekniikan tutkijakoulun kesäkoulu	
	Intensive course in summer time.	
Year and Period	M.Sc. (Tech.) 2, Period int.	
Lecturer(s)	Professor, D.Sc. (Tech.) Heikki Kälviäinen	
Aims	A student actively participates in the summer school. A student learns the scientific basics, research activities and application areas of one of the selected topics of the summer school.	
Contents	Content changes every year. Lectures will be held by visiting international lecturers.	
Teaching methods	Lectures and/or exercises, 40 h, and/or practical assignments.	
Assessment	Passed/failed. Participation and practical assigments.	
Course Material	http://www.it.lut.fi/opiskelu/ecse/courses.html.	

CT10A9500	*RESEARCH METHODS*	*3 ECTS cr*
	Research Methods, Tutkimusmenetelmät	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	Lecturer, D.Sc. (Tech.) Arto Kaarna	
Aims	To familiarize the student with the research work and the basic methods in research. To prepare the student to the research approach of her/his master's thesis.	
Contents	Research work, philosophy of research. Research process. Designing research, research questions and hypothesis. Qualitative and quantitative research methods. Reporting scientific work.	
Teaching methods	Lectures 14 h, 1st period. Practical assignments, 2nd period. Exam.	
Assessment	0 - 5. Exam 60 %, practical assignments 40 %.	
Course Material	Creswell, J.W.: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE, 2003. Hirsjärvi, S., Remes, P., Sajavaara, P.: Tutki ja kirjoita, 10. painos, Tammi, 2004. Research reports.	
Prerequisites	B.Sc. studies finished.	

CT10A9600	*RESEARCH METHODS, LABORATORY PROJECT*	*5 ECTS cr*
	Research Methods, Laboratory Project, Tutkimusmenetelmät, laboratorioprojekti	
Year and Period	M.Sc. (Tech.) 1, Period 2-4	
Lecturer(s)	Professor, D.Sc. (Tech.) Heikki Kälviäinen, Professor, D.Sc. (Tech.) Jari Porras	
Aims	To execute a well-defined research task in the laboratory of Information Processing or Communications Engineering.	
Contents	Research work in the topic defined by the laboratory. When starting the course contact one of the professors. Reporting and a seminar presentation of the work implemented.	

Teaching methods	Participation in the work of the research group, 2nd - 4th period.
Assessment	Passed/failed. Research report and seminar presentation.
Course Material	Literature related to the research topic, agreed with the supervisor of the work.
Prerequisites	CT10A9500 Research Methods, excellent grades in studies, evidence of successful research work.

CT10A9700	*SUMMER SCHOOL ON COMMUNICATIONS ENGINEERING* *2 ECTS cr*
	Summer School on Communications Engineering, Tietoliikennetekniikan kesäkoulu
	Intensive course in summer time.
Year and Period	M.Sc. (Tech.) 2, Period int.
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jari Porras
Aims	Student actively participates all three days of summer school event. Student learns the basics and the current status of the selected topic of the summer school. Student gains practical experience by participating code camp.
Contents	Content changes every year. Basics, current status and research activities of the selected field. Practical working on a code camp. Lectures will be held by visiting lecturers and researchers.
Teaching methods	Lectures 18 h, practical assignment 22 h, written report about event.
Assessment	Passed/failed, practical assignment 100%.
Course Material	http://www.it.lut.fi/ssotc/
Prerequisites	Basic programming skills. Recommended CT10A9500 Research Methods.

CT20A5100	*INTRODUCTION TO MACHINE VISION AND MACHINE LEARNING* *6 ECTS cr*
	Introduction to Machine Vision and Machine Learning, Johdanto konenäköön ja koneoppimiseen
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Researcher/Teacher, Docent, D.Sc. (Tech.) Joni Kämäräinen
Aims	Students should know the application areas, restrictions, and structure of machine vision systems. Students should be able to operate on digital images: capture images and extract basic visual information from them. Students should know the basics of machine learning and approaches to decision making using computer.
Contents	Applications of machine vision. Parts of machine vision system and their properties. Basics of digital imaging and image processing. Applications of machine learning. Describing intelligence and decision making in a computer. Approaches: statistical, rule-based, decision trees, neural networks, continuous-value problems, clustering, decision-support systems. Expert systems.
Teaching methods	Lectures 21 h, exercises 14 h, homeworks, 3rd period. Lectures 21 h, exercises 14 h, homeworks, 4th period. Exam.
Assessment	0 - 5. Exam 100 %. Exercises and homeworks.
Course Material	Davies, E.R.: Machine Vision, 3rd Edition, Elsevier, 2005. Mitchell, T.M.: Machine Learning, McGraw-Hill, 1997.
Prerequisites	Matematiikka A and B, CT20A0200 Ohjelmoinnin perusteet.

CT20A5700	*INTRODUCTION TO COMPUTER GRAPHICS* *5 ECTS cr*
	Introduction to Computer Graphics, Tietokonegrafiikan perusteet
	The course will be lectured every second year only.

	The course will be lectured next time during the academic year 2008 - 2009.
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Lecturer, D.Sc. (Tech.) Arto Kaarna
Aims	Basic knowledge in computer graphics and in use of graphics libraries and programs.
Contents	Examples and applications of computer graphics. Introduction to two-dimensional graphics. Principals of graphics hardware. Raster graphics. Introduction to modelling of three-dimensional objects. Algorithms in three-dimensional graphics. Open GL graphics library.
Teaching methods	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h and two practical assignments, 2nd period. Exam.
Assessment	0 - 5. Exam 100 %. Exercises and practical assignments.
Course Material	Hearn, D., Baker, M.P.: Computer Graphics with OpenGL, Prentice-Hall, 3rd Edition, 2004. Foley, J.D., van Dam, A., Feiner, S.K., Hughes, J.H.: Computer Graphics: Principles and Practice. 2nd edition in C. Addison-Wesley, 1997.
Prerequisites	CT20A0210 Käytännön ohjelmointi.

CT20A6000	*PATTERN RECOGNITION*	*7 ECTS cr*

Pattern Recognition, Hahmontunnistus

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2008 - 2009.

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Heikki Kälviäinen
Aims	The course has three basic aims: firstly to understand the field of pattern recognition in general, secondly to get familiar with pattern recognition techniques, and thirdly to obtain the ability to apply techniques to applications.
Contents	Introduction. Bayesian inference and statistical pattern recognition. Discriminants and neural pattern recognition. Decision tree, syntactic and structural approaches. Context-dependent classification. Reinforcement learning. Unsupervised learning.
Teaching methods	Lectures and seminars 21 h, exercises 12 h, 3rd period. Lectures and seminars 21 h, exercises 14 h, 4th period. Practical assignment. Exam.
Assessment	0 - 5. Exam 50 %, exercises 50 %. Seminar presentation, which gives extra points to an exam. Acting as an opponent. Practical assignment.
Course Material	Lecture notes. Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001. Theodoridis, S., Koutroumbas, K.: Pattern Recognition, Academic Press, 2003.
Prerequisites	Matematiikka A and B, CT20A0210 Käytännön ohjelmointi, BM20A1400 Tilastomatematiikka I. Recommended CT20A5100 Introduction to Machine Vision and Machine Learning, BM20A1500 Numeerinen analyysi I, BM20A1601 Matriisilaskenta, or equivalent knoledge.

CT20A6100	*MACHINE VISION AND DIGITAL IMAGE ANALYSIS*	*7 ECTS cr*

Machine Vision and Digital Image Analysis, Digitaalinen kuvankäsittely ja analyysi

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2009 -

	2010.
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Heikki Kälviäinen
Aims	To introduce students to the field of machine vision and image analysis and its application areas.
Contents	Digital image processing: digital image, image transforms, image enhancement, image compression. Image analysis: segmentation, representation and description, recognition and interpretation. Hardware, software and applications.
Teaching methods	Lectures and seminars 21 h, exercises 12 h, 1st period.
	Lectures and seminars 21 h, exercises 14 h, practical assignment, 2nd period. Exam.
Assessment	0 - 5. Exam 100 %. Seminar presentation, which gives extra points to an exam. Acting as an opponent. Practical assignment.
Course Material	Gonzales, R.C., Woods, R.E.: Digital image processing, Prentice-Hall, 2002. Jain, A.K.: Fundamentals of digital image processing, Prentice-Hall, 1989.
Prerequisites	Recommended CT20A5700 Introduction to Computer Graphics, CT20A5100 Introduction to Machine Vision and Machine Learning, CT20A6000 Pattern Recognition, BM30A0500 Applied Optics.

CT20A6200	*COMPUTER AND ROBOT VISION*	*7 ECTS cr*
	Computer and Robot Vision, Tietokone- ja robottinäkö	
	The course will be lectured every second year only.	
	The course will be lectured next time during the academic year 2008 - 2009.	
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2	
Lecturer(s)	Senior Assistant, Docent, D.Sc. (Tech.) Ville Kyrki	
Aims	To understand the theoretical basis and motivation to use geometric and dynamic computer vision, to know the applications of vision in robotics, and to know the basics of using the methods in practice.	
Contents	Vision in Robotics. Imaging models and calibration. Coordinate frames and geometrical primitives. Single and multi-view geometry. Pose estimation. Dynamic vision and tracking. Visual servoing. Structure from motion and SLAM.	
Teaching methods	Lectures 21 h, exercises 14 h, 1st period.	
	Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Assessment	0 - 5. Exam 50 %, exercises 50 %. Practical assignment.	
Course Material	Lecture notes.	
	Trucco, E., Verri, A.: Introductory Techniques for 3-D Computer Vision, Prentice-Hall, 1998.	
Prerequisites	Matematiikka A and B, CT20A0200 Ohjelmoinnin perusteet.	
	Recommended CT20A5100 Introduction to Machine Vision and Machine Learning, BM20A1400 Tilastomatematiikka I, BM20A1500 Numeerinen analyysi I, BM20A1601 Matriisilaskenta or equivalent knowledge.	

CT20A6400	*LANGUAGES, COMPILERS AND INTERPRETERS*	*5 ECTS cr*
	Languages, Compilers and Interpreters, Kielet, kääntäjät ja tulkit	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Lecturer, D.Sc. (Tech.) Arto Kaarna	
Aims	To familiarize the student with theory of compilers and languages for selected formal languages.	
Contents	Languages and grammars. Regular languages and lexical analysis. Introduction to parsing. Tools for compiler generation. Syntax directed	

Teaching methods	translation, attribute grammars, intermediate representation. Machine independent optimization. Lectures 14 h, exercises 14 h, 3rd period. Lectures 14 h, exercises 14 h and a terminal project, 4th period. Exam.
Assessment	0 - 5. Exam 100 %. Exercises and project.
Course Material	Aho, A.V., Lam,M.S., Sethi, R., Ullman, J.D.: Compilers: Principles, Techniques, and Tools, Second edition, Addison Wesley, 2007.
Prerequisites	CT20A2000 Tietojenkäsittelyn perusteet I, CT20A2310 Tietorakenteet ja algoritmit.

CT20A7200	*ARCHITECTURE IN SYSTEMS AND SOFTWARE DEVELOPMENT*	*5 ECTS cr*

	Architecture in Systems and Software Development, Arkkitehtuuri järjestelmien ja ohjelmistojen kehityksessä
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, Ph.D. Kari Smolander
Aims	The student understands the role of architecture in the development of software and information systems and has the basic skills of how to design and describe architecture.
Contents	The role of architecture in development. Software architecture. Systems architecture. Enterprise architecture. Application integration. Architecture design. Architecture documentation. Architectural styles and patterns.
Teaching methods	Lectures, lecture exercises and presentations at lectures 21 h, 3rd period. Lectures, lecture exercises and presentations at lectures 21 h, 4th period. Practical assignment and presentation. Exam.
Assessment	0 - 5. Exam 50 %, practical assignment 30 %, presentation 20 %.
Course Material	Lecture notes based on the following books: Bass, L., Clements, P., Kazman, R.: Software Architecture in Practice, 2nd Ed., Addison-Wesley, 2003. Linthicum, D.S.: Next Generation Application Integration: From Simple Information to Web Services, Addison-Wesley, 2003. Ross, J.W., Weill, P., Robertson, D.: Enterprise Architecture As Strategy: Creating a Foundation for Business Execution, Harvard Business School Press, 2006.
Prerequisites	CT20A4100 Ohjelmistotuotannon menetelmät or equivalent.

CT20A7301	*SOFTWARE QUALITY, PROCESSES, AND ORGANIZATIONS*	*6 ECTS cr*

	Software Quality, Processes, and Organizations, Ohjelmistojen laatu, prosessit ja organisaatiot
	Recommended for CBU-students.
Year and Period	M.Sc. (Tech.) 2, Period 1-2
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Uolevi Nikula
Aims	After the course student can explain quality, process, and organization related issues in software development and how such issues can be solved based on literature and on personal experiences from the course project. Students can also synthesize the knowledge acquired during the course and develop quality and process documentation for a software company.
Contents	Software development issues. Software development processes, their history, maturity, and state of the practice. Quality in software development, approaches to assure and improve quality. Processes and organizations.
Teaching methods	Lectures 14 h and exercises 14 hours, 1st period. Lectures 14 h and exercises 14 hours, 2nd period. Compulsory assignments given in the lectures. Exam.
Assessment	0 - 5. Exam 60 %, compulsory assignments 40%.

Course Material	Robillard, Kruchten, and d'Astous: Software Engineering Process with the UPEDU, Addison-Wesley, 2002.
Prerequisites	CT20A4100 Ohjelmistotuotannon menetelmät or equivalent.

CT20A7400	*FUNDAMENTALS OF INFORMATION SYSTEMS 7 ECTS cr*
	Tietojärjestelmien perusteet
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Lecturer, D.Sc. (Tech.) Erja Mustonen-Ollila
Aims	In order to complete the course the student should be able to: Demonstrate a sound grasp of the history of information systems (IS) in business, including an IS development. Describe the organisational uses of information systems to improve overall quality. Demonstrate the concepts for the specification and design or the re-engineering of organisationally related systems of limited scope using information technology. Explain what is meant by an information system development process, and what performance measurement implies. Show how information technology can be used to design, facilitate, and communicate organisational goals and objectives of information systems. Describe career paths in information systems. Present and discuss the professional and ethical responsibilities of the IS practitioner. Recognise the role and use of IS in technology and in business systems and operations. Identify and describe organisational structure and business processes within these structures. Demonstrate an understanding of the process in systems design and development. Discuss, and describe fundamental concepts of IS theory and IS research methods and their importance to practitioners. Discuss the relationship of IS planning to organisational planning.
Contents	Examination the nature of the information systems discipline and key areas of professional interest and expertise. Introduction of the main topic areas in the study of information systems (IS) from both a theoretical and practical perspective covering also the IS research perspective. To discuss the role of information systems in society. To explain the operations of information systems, and the role of technology, business, and social environment within systems, and how information systems are developed, acquired or outsourced. To explain the use of information systems in business. To discuss and analyse the changing role of the information systems in the achievement of business objectives such as communication, collaboration, performance enhancement etc. Getting familiar with the basic concepts and methods in information systems research.
Teaching methods	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h , 2nd period. Practical assignment. Exam.
Assessment	0 - 5. Exam 50 %, practical assignment 50 %.
Course Material	Stair, R., and Reynolds, G. (2006) The Fundamentals of Information Systems. 3rd edition. ISBN 13: 978-0-619-21560-6. ISBN 10: 0-619-21560-7. Järvinen, P. (2004) On Research methods. Opinpaja, Tampere. Järvinen, P. (2004) Tutkimustyön metodeista. Opinpaja, Tampere.
Prerequisites	CT20A4001 Ohjelmistotuotanto

CT20A7500	*OBJECT-ORIENTED PROGRAMMING TECHNIQUES 5 ECTS cr*
	Object-Oriented Programming Techniques, Olio-ohjelmoinnin menetelmät
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, Ph.D. Kari Smolander
Aims	The student understands advanced concepts and techniques of object-oriented programming, especially design patterns, and can apply these techniques in solving practical programming tasks.
Contents	Introduction to Java. Java run-time object model. Composition, inheritance, and interfaces. Reusability. Collections and containers. Reflection. Serialization.

Teaching methods	Design patterns and their applications. Design rules and principles. Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, practical assignment, 2nd period. Exam.
Assessment	0 - 5. Exam 50 %, exercises and practical assignment 50 %.
Course Material	Lecture notes. Eckel, B.: Thinking in Java, Prentice Hall. Gamma, E. et al.: Design Patterns, Addison-Wesley. Freeman, Freeman, Sierra & Bates: Head First Design Patterns, O'Reilly (2004 or newer).
Prerequisites	Olio-ohjelmointi (Object-Oriented Programming) or equivivalent.

CT30A5000	NETWORK PROGRAMMING	5 ECTS cr

Network Programming, Tietoliikenneohjelmointi

Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Researcher/Teacher, Docent, D.Sc. (Tech.) Jouni Ikonen
Aims	Understand problematics of networked applications. Ability to read and implement protocols described in standards.
Contents	Use of Internet Protocol in communications programming. Server models. Socket interface usage and event-based programming. Synchronous and asynchronous operations, layers, parallelism and security in network programming. Realization of protocols according standards.
Teaching methods	Lectures 14 h, exercises 10 h, 1st period. Exercises 8 h, 2nd period. 6 practical assignments. Final assignment. Assignments can not be combined from multiple years.
Assessment	0 - 5. Practical assignments 70 %, final assignment 30 %. Exercises.
Course Material	Stevens, W.R.: Unix Network Programming, The Sockets Networking API, Vol. 1, 3rd Ed., Prentice Hall, 2004. Internetworking with TCP/IP Vol. 3: Client-Server Programming and Application, Linux/POSIX Socket Version (Comer, D.E., Stevens, D.), 2000.
Prerequisites	C-language. Basic unix workstation usage skills. CT30A2500 TCP/IP -perusteet. Recommended CT20A3000 Unix and System Programming.

CT30A5201	SYMBIAN PROGRAMMING	4 ECTS cr

Symbian Programming, Symbian-ohjelmointi

Year and Period	M.Sc. (Tech.) 1, Period 4
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jari Porras
Aims	Students will understand the special challenges in application development involving new mobiles, terminals and services. Students will learn practical Symbian programming.
Contents	Focusing on the Symbian platform and its features. The course emphasises application development and deals with the Symbian application architecture, user interface architecture, operating system services, asynchronous programming and telecommunications programming. The lecturers include specialists in the Symbian programming industry.
Teaching methods	Lectures 14 h, tutorials 28 h, assignment, 4th period. Examination. The number of participants may be limited.
Assessment	0 - 5. Exam 50%, assignment 50%.
Course Material	Material announced by the teacher.
Prerequisites	Recommended: CT20A2601 Käyttöjärjestelmät, CT30A5000 Network Programming.

CT30A5500	*NETWORK DESIGN, SIMULATION AND TOOLS 5 ECTS cr*
	Network Design, Simulation and Tools, Verkkosuunnittelu
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Kari Heikkinen
Aims	After the course the student is expected to be able
	- to understand the fundamentals and characteristics of network design while utilisising traffic engineering, network simulation and its varying tools
	- to demonstrate the learning with both written assignments and practical assignment.
Contents	Introduction to the network planning problem. Network design fundamentals, algorithms and traffic engineering. Cognitive networking. Simulation and simulation tools.
Teaching methods	Lectures 21 h, exercises 14 h, home assignments, 3rd period.
	Project presentations 8h, Seminars 28 h, and project work, 4th period.
Assessment	0 - 5. Home assignments 33 %, Seminar 33 %. Practical assignment 33%.
Course Material	Robertazzi, T.G.: Planning Telecommunication Networks, IEEE Press, 1999.
	Kenyon, T.: High Performance Data Network Design, Butterworth-Heinemann, 2000.

CT30A5800	*COMMUNICATIONS SOFTWARE AND 5 ECTS cr ARCHITECTURE*
	Communications Software and Architecture, Tietoliikenneohjelmistot
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen
Aims	To give a student the basic knowledge about software, design and development.
Contents	Message Sequence Chart, Finite State Machines, Petri Nets, Specification and Description Language, Abstract Syntax Notation 1, Protocol Design, Implementation and Verification, Protocol Layering Concept, Client/Server Paradigm, Protocol Standards.
Teaching methods	Lectures 14 h, exercises 14 h, 1st period.
	Lectures 14 h, exercises 14 h, project assignment, 2nd period. Exam.
Assessment	0 - 5. Exam 70 %, project 30 %.
Course Material	Lecture hand-outs.
	Popovic, M.: Communication Protocol Engineering, CRC Press, 2006.
Prerequisites	Recommended CT20A4001 Ohjelmistotuotanto, CT30A2001 Tietoliikennetekniikan perusteet .

CT30A5900	*COMMUNICATION SOFTWARE LABORATORY 5 ECTS cr WORK*
	Communication Software Laboratory Work, Protokollaohjelmointi
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jari Porras
Aims	To give a student the basic knowledge about a practical definition and realisation of communications and ability to apply this knowledge for the carrying out of software communications.
Contents	The course includes practical laboratory assignments that deal with usage, design and implementation of protocol software. Protocol software design, implementation, and testing using C/C++/Java programming languages in a development environment.
Teaching methods	Laboratory demonstrations 14 h, 3rd period.
	Laboratory demonstrations 12 h, project work presentation 8 h, project work, 4th period.
Assessment	100 % Project passed/failed.
Course Material	Lecture hand-outs.

Prerequisites	CT30A5800 Communications Software and Architecture.
	Recommended CT20A2310 Tietorakenteet ja algoritmit, CT20A3000 Unix and System Programming, CT30A2001 Tietoliikennetekniikan perusteet .

CT30A6201	MOBILITY MANAGEMENT	5 ECTS cr

	Mobility Management, Liikkuvuuden hallinta
	The course will be lectured every second year only.
	The course will be lectured next time during the academic year 2009 - 2010.
Year and Period	M.Sc. (Tech.) 1-2, Period 3
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Kari Heikkinen
Aims	After the course, the student is expected to
	• understand the basic principles and characteristics of the mobility management
	• demonstrate the learning both with written assignments and with practical assignment
Contents	Basic principles of Mobility Management. The most essential mobility management related protocols, such as Mobile IP. Mobility management technologies using on different protocol layers.
Teaching methods	Lectures 28 h, project presentations 8h, 3rd period. Home assignments, Practical assignment. Exam.
Assessment	0 - 5. Exam 40 %, Home assignments and practical assignment 60 %.
Course Material	Lecture material announced on lectures.
	Supplementary literature: Soliman, Hesham: Mobile IPv6 - Mobility in a Wireless Internet, Addison-Wesley, 2004.
Prerequisites	Recommended CT30A2500 TCP/IP -perusteet, CT30A2600 Langaton tietoliikenne.

CT30A6801	LOCAL AREA NETWORKS, SPECIAL COURSE 8 ECTS cr

	Local Area Networks, Special Course, Lähiverkot -erikoistyökurssi
Year and Period	M.Sc. (Tech.) 1, Period 1-3
Lecturer(s)	Researcher/Teacher, Docent, D.Sc. (Tech.) Jouni Ikonen
Aims	Recognize local area networking technologies. Understand how basic network services operate and be able to implement services independently for common software components. Understand requirements and relationships of network services and common problematics. Can act as member and leader of a large project.
Contents	Local area network standards, components, application interfaces and practice. Study of used communication protocols (e.g. IP and some of upper layer protocols). Network services in Linux environment (e.g. DHCP, firewalls and web-server). Course has practical exercises and a large scale project work.
Teaching methods	Lectures 4 h, exercises 5 h, 1st period.
	Lectures 4 h, seminars 10 h, exercises 21 h, 2nd period.
	Seminars 10 h, exercises 17 h, 3rd period.
	Laboratory works, seminar works and project work, 1st, 2nd and 3rd period.
Assessment	0 - 5. Project work 40 %, laboratory- and seminar works 60 %
Course Material	Stallings, W.: Local and Metropolitan area networks, Prentice-Hall, 1997.
	Stevens, W.R.: TCP/IP Illustrated, Vol. 1: The Protocols, Addison-Wesley, 1994.
	Stevens, W.R.: UNIX Network Programming, Addison-Wesley, 2004.
Prerequisites	Recommended CT20A3000 Unix and System Programming, CT30A5000 Network Programming, CT30A5800 Communications Software and Architecture.

CT30A6900	*PEER-TO-PEER NETWORKING*	*5 ECTS cr*

Peer-to-peer Networking, Vertaisverkot

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2009 - 2010.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Jari Porras
Aims	This course aims to provide the student with the fundamental principles of peer-to-peer networking, its main challenges and possible solutions.
Contents	Principles of peer-to-peer networking, Peer-to-peer systems and applications, Overlay networks, Challenges, Security, fairness and trust concerns, Practical P2P development with a programming language.
Teaching methods	Lectures 21 h, Exercises 14 h, 1st period. Project work 2nd period. Exam.
Assessment	0 – 5. Exam, 50% Project work 50 %.
Course Material	Barkai, D. 2001 Peer-To-Peer Computing: Technologies for Sharing and Collaborating on the Net. Intel Press.
	Steinmetz, R. and Wehrle, K. 2005 Peer-To-Peer Systems and Applications (Lecture Notes in Computer Science). Springer-Verlag
	See more: http://mediaserver.it.lut.fi/kurssiwiki/index.php/Peer-to-Peer_Networking
Prerequisites	CT30A5000 Network Programming

CT30A7001	*CONCURRENT AND PARALLEL COMPUTING*	*8 ECTS cr*

Concurrent and Parallel Computing, Rinnakkaislaskennan perusteet

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2008 - 2009.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Jari Porras
Aims	Student understands the concept of concurrency and the meaning, concepts as well as applications of parallel and distributed computing. He/she also knows different architectures and their usage. Student can implement simple parallel programs and utilize parallel methods on their own work.
Contents	Emerging need for parallel computing, parallel architectures and their classification, performance meters and scalability as well as a general view of programming in a parallel environment.
Teaching methods	Lectures 30 h, exercises12 h, 1st period.
	Seminars 21 h, exercises 14 h, practical assignments, 2nd period. Exam.
Assessment	0 - 5. Exam 50 %, presentation 25 %, practical assignments 25 %.
Course Material	Grama, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003.
	Roscoe, A.W.: The theory and practice of concurrency, Pearson Education, 1998.
Prerequisites	Recommended CT20A2601 Käyttöjärjestelmät, CT20A3000 Unix and System Programming.

CT30A7100	*PARALLEL PROGRAMMING*	*5 ECTS cr*

Parallel Programming, Rinnakkaisohjelmoinnin perusteet

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2009 - 2010.

Year and Period	M.Sc. (Tech.) 1-2, Period 3-4
Lecturer(s)	Assistant, M.Sc. (Tech.) Jani Peusaari
Aims	Student knows the difference between sequential and parallel programming and can implement advanced programs using multiple programming models. Student knows how to utilize essential features, e.g. optimized communication and load balancing, of parallel computing. He/she can also use specific tools that aid in debugging and analyzing parallel programs.
Contents	Principles of parallel programming, differences between processes and threads. Usage of a cluster of workstations as a parallel programming environment. Programming using distributed libraries (PVM, MPI) and shared memory libraries (POSIX threads, OpenMP.) Debugging and analysis of parallel programs.
Teaching methods	Lectures 14 h, exercises 14 h, project work, 3rd period. Exercises 12 h, project presentations 8 h, project work, 4th period. Exam.
Assessment	0 - 5. Project work 100 %.
Course Material	Foster, I.: Designing and building parallel programs, Addison-Wesley, 1995. Andrews, G.: Foundations of Multithreaded, Parallel and Distributed Programming, Addison-Wesley, 2000. Pacheco, P.: Parallel programming with MPI, Morgan Kaufmann Publishers, 1997. Butenhof, D.: Programming with POSIX threads, Addison-Wesley, 1997. Chandra R. et al.: Parallel Programming in OpenMP, Morgan Kaufman Publ., 2001. Lecture hand-outs.
Prerequisites	Recommended CT20A2601 Käyttöjärjestelmät, CT20A3000 Unix and System Programming, CT30A7001 Concurrent and Parallel Computing.

CT30A7400	DISTRIBUTED OBJECT PROGRAMMING	6 ECTS cr
	Distributed Object Programming, Hajautettu objektiohjelmointi	

Year and Period	M.Sc. (Tech.) 2, Period 1-2
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jari Porras
Aims	To introduce the student to the object-oriented design and open distributed processing based digital communication architectures and design methodology.
Contents	Object-oriented systems, application level distribution and architectures in communication, remote procedure calls, service and interface descriptions, application data representation, object discovery services, related design patterns. Some (eg. CORBA, WebServices) distributed programming environment implementation is used to express concepts and practices of the distributed system.
Teaching methods	Lectures 14 h, exercises 14 h, homeworks, 1st period. Lectures 14 h, exercises 14 h, homeworks, project work, 2nd period. Exam.
Assessment	0 - 5. Exam 50 %, project work 36 %, homeworks 14 %.
Course Material	Lecture notes.
Prerequisites	Recommended CT20A2410 Olio-ohjelmointi, CT20A4001 Ohjelmistotuotanto, CT30A2001 Tietoliikennetekniikan perusteet , CT30A5000 Network Programming.

CT30A8001	USER-CENTRIC SERVICE DESIGN	5 ECTS cr
	User-Centric Service Design, Käyttäjäkeskeiset tietoliikennepalvelut	
	The course will be lectured every second year only. The course will be lectured next time during the academic year 2008 - 2009.	

Year and Period	M.Sc. (Tech.) 1-2, Period 3
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Kari Heikkinen
Aims	After the course the student is expected to be able

	- to understand the terminology, fundamentals and characteristics of User-Centric Service design - to understand its role, main methods and processes and effect on designing communication engineering applications and services taking into account both user and technology requirements - to demonstrate the learning with both written assignments and with designed, implemented and presented practical assignment.
Contents	User-Centric Service Design terminology, fundamentals and characteristics. The role, methods, processes and the effect of the UCD in applying it to communication engineering application design, implementation and evaluation. User and Technology requirements based on selected area of interest in communication engineering. Evaluation of UCD designs and prototypes of different fidelities. Flash programming as enabling technology.
Teaching methods	Lectures 14 h, exercises 14 h, exam and home assignments (4), 3. period.
Assessment	0 - 5. Home assignments 40%, continual evaluation 40%, exam 20%.
Course Material	Lecture and Web-material.
Prerequisites	Recommended CT10A9500 Research Methods.

CT30A8100	*INFORMATION NETWORK TECHNOLOGIES 7 ECTS cr*
	Information Network Technologies, Informaatioverkostojen teknologiat **The course will be lectured every second year only.** **The course will be lectured next time during the academic year 2009 - 2010.**
Year and Period	M.Sc. (Tech.) 1-2, Period 2-3
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Kari Heikkinen
Aims	After the course the student is expected to be able • To understand the terminology, principles and the impact of both Information Networks and its technologies • To understand the characteristics and applicability of networked media technologies in the Information Network service creation • To demonstrate the understanding with a written, implemented and presented assignments
Contents	The terminology, basic principles and the impact of the Information Networks and its technologies. The characteristics of the networked media technologies in the Information Network. Networked media service creation design issues, implementation platforms and evaluation methods.
Teaching methods	Lectures 21 h, exercises 14 h, home assignments, 2nd period. Practical assignment, WikiBook and exam, 3rd period.
Assessment	0 – 5. Exam 25 %, Home Assignments, Project work and WikiBook 75 %.
Prerequisites	Recommended CT30A2001 Tietoliikennetekniikan perusteet , CT30A3100 Web-ohjelmointi, CT30A3600 Tietoverkot ja tietoturva.

CT30A8300	*WIRELESS SERVICE ENGINEERING 5 ECTS cr*
	Wireless Service Engineering, Langattomien palveluiden tekniikka **The course will be lectured every second year only.** **The course will be lectured next time during the academic year 2008 - 2009.**
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen
Aims	To understand the challenges that wireless communication technologies and mobile devices provide to service development. To learn methods to improve the use of wireless services.
Contents	Wireless service types: fixed services, mobile Internet services, ad hoc

Teaching methods	services, mobile p2p, ubiquitous services, environment services. The service perspective to mobile devices and wireless network technologies. Service discovery methods. Service enhancing technologies: adaptation and personalisation, context awareness, location. Lectures 21 h, demonstrations 14 h, exercises 14 h, practical assignment, 1st period. Practical assignment, exam, 2nd period.
Assessment	0 - 5. Exam 50 %, practical assignments 50 %.
Course Material	Will be announced on lectures.
Prerequisites	CT30A2600 Langaton tietoliikenne, CT30A5000 Network Programming. Recommended CT30A5201 Symbian Programming, CT30A5800 Communications Software and Architecture.

CT30A8550	WORK COURSE ON CROSSMEDIA	5 ECTS cr

Work Course on Crossmedia, Monimedian työkurssi

Year and Period	M.Sc. (Tech.) 1-2, Period 1-4
Lecturer(s)	Lecturer(s) responsible: Senior Assistant, D.Sc. (Tech.) Kari Heikkinen
Aims	Crossmedia tools and software. Authoring and processing of cross- and multimedia content in creation of WWW portal design and implementation or/and audio/video production from manuscript to a processed video.
Contents	The course can be taken either in fall or in spring. Demolectures (8h) will be given every fall and spring. Guidance and checking points will be agreed individually. Self-learning material. Homework.
Assessment	0 - 5. Practical assignment 100 %.
Prerequisites	Recommended CT20A4001 Ohjelmistotuotanto, CT20A4501 Ihminen ja vuorovaikutteinen teknologia, CT30A3100 Web-ohjelmointi.

CT30A8800	SECURED COMMUNICATIONS	6 ECTS cr

Secured Communications, Suojatut tietoyhteydet

The course will be lectured every second year only.
The course will be lectured next time during the academic year 2009 - 2010.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-2
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen
Aims	To learn how to secure the communication channel between communicating devices.
Contents	Security risks against communication channel. Creation of secure communication channel. Cryptographic methods: Symmetric and asymmetric encryption algorithms, hash functions, key exchange methods. Authentication methods. Digital signatures.
Teaching methods	Lectures 14 h, exercises 14 h, 1st period. Lectures 8 h, seminars 20 h, practical assignment, 2nd period. Exam.
Assessment	0 - 5. Exam 40 %, seminars 30 %, practical assignment 30 %.
Course Material	Trappe W., Washington L.C.: Introduction to Cryptography with Coding Theory. Schneier, B.: Applied Cryptography, Wiley, 1996. Kerttula, E.: Tietoverkkojen tietoturva, 2. painos, Edita, 2000. Lecture hand-outs.
Prerequisites	CT30A3500 Tietoturvan perusteet. Recommended CT30A2500 TCP/IP -perusteet, CT30A5000 Network Programming.

CT30A8901	*SERVICE ORIENTED COMMUNICATIONS* *5 ECTS cr*
	Service Oriented Communications, Palveluperustainen kommunikaatio
Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Professor, Ph.D. Juha Puustjärvi
Aims	Service- and Web oriented architecture terminology, theories, techniques, standards and infrastructures are introduced and studied in the light of application development in www. The course will give fundamentals for application development in www following the fundamentals of service-oriented computing.
Contents	Web Services and its standards, Service Architectures, Information modeling and visualisation. Ontologies and ontology development. Event processing in Web, Composition of Web Services, Business Process requirement processing in Web. Web agents and Service management.
Teaching methods	Lectures 21 h, Exercises 12 h, Practical assignment, 2. periodi. Exam.
Assessment	0 - 5. Exam 100%.
Course Material	Chapters 1-14 from: Singh, M.P., Huhns, M.N.: Service-Oriented Computing: Semantics, Processes, Agents, John Wiley & Sons, 2005.
Prerequisites	CT30A2900 Web-teknologiat

CT30A9300	*CODE CAMP ON COMMUNICATIONS* *4 ECTS cr* *ENGINEERING*
	Code Camp on Communications Engineering, Tietoliikennetekniikan code camp
	The course is arranged intensively 1-2 times /year.
Year and Period	M.Sc. (Tech.) 1-2
Lecturer(s)	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Jari Porras
Aims	Code camp is a short term practically oriented course where students work together on their projects based on the selected topic of the course. After the course students are expected to be able • to use the achieved knowledge on the topic in their work • to implement other projects with the technology.
Contents	Topic varies each time.
Teaching methods	Lectures and demonstrations, project work, presentation 52h.
Assessment	0 – 5. project work 60%, reports 30%, presentation 10%.
Course Material	To be announced in beginning of the course based on the selected topic.
Prerequisites	Based on the topic. To be announced with the final course description.

9 Master's Degree Programme in Mechanical Engineering

The Master's degree programme in Mechanical Engineering corresponds to 120 ECTS credits and leads to the degree of Master of Science in Technology. The students have two years of full-time studies in which all lectures and laboratory work are conducted in English. The first three semesters include 90 ECTS credits of classroom and laboratory instruction. The Master's thesis of 30 ECTS credits is conducted in the fourth semester, after other courses have been completed.

The Aims of the Master's Degree Programme

Particular emphasis is placed on future product design and production technologies. The programme aims to provide in-depth knowledge in design- or production related areas such as machine design, steel structures, welding technology, laser technology as well as production and sheet metal technology. It is aimed at students who wish to pursue a career in mechanical engineering industry using advanced engineering techniques.

Careers for Graduates

The programme provides the foundation for both constructive design as well as production-oriented tasks. The professional tasks may include, for example, product development and design, management of design and production projects, technical sales. The professional scope often includes educational, research and marketing tasks as well as specialist responsibilities in technical inspection and project management. The programme also provides the students with knowledge and skills for scientific doctoral studies in the field of mechanical engineering.

The Degree Structure of the Programme

Degree Structure		
General Studies	13-15	ECTS cr
Major Subject	39	ECTS cr
Minor Subject	20 (min.)	ECTS cr
Elective Studies	16-18	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
Total	*120 (min.)*	*ECTS cr*

General Studies (13-15 ECTS cr):
General studies are common to all the students in the programme. The studies provide a brief introduction to the field of mechanical engineering as well as language skills essential for M.Sc. studies.

Major Subject (39 ECTS cr):
The Department of Mechanical Engineering offers major subjects in Structural and Machine Design and in Production Technologies. The choice of the major is made at the end of the 3rd period of the first year.

Structural and Machine Design
The person responsible for major in Structural and Machine Design is professor, D.Sc. (Tech.) Aki Mikkola
Students study both the theory and practice of developing mechanical engineering systems for performance, strength and durability. They learn to use state-of-the-art computer tools for creating and testing virtual prototypes so that complex mechatronic systems and structures can be designed, tested and optimised before a prototype is fabricated. Major in Structural and Machine Design includes advanced studies of machine automation, steel structures and virtual design.

Production Technologies

The person responsible for major in Production Technologies is professor, D.Sc. (Tech.) Jukka Martikainen

Students learn about modern production systems and production planning that will be integral parts of tomorrow's factories. Special emphasis is given to welding technology, high technology machining operations and sheet metal and plate forming. Moreover, students have the opportunity to develop expertise in laser welding and cutting together with a variety of surface improvement techniques including laser cladding and surface hardening. Major in Production Technologies includes advanced studies of welding technology, production technology and laser technology.

Master's Thesis and Seminar (30 ECTS cr):

The Master's thesis is a research or design project carried out in the field of the student's major subject.

Minor Subject (min. 20 ECTS cr):

Students can choose any minor subject taught in English at LUT.

Elective Studies (16-18 ECTS cr):

To attain the full 120 ECTS credits, the students may need to take some additional courses. Elective studies can include any courses offered by Lappeenranta University of Technology if the required prerequisites are completed. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

General Studies 13-15 ECTS cr

General Studies		year	per.	ECTS cr
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
BK20A0100	Materials Science	M.Sc. (Tech.) 1	1-2	6
FV11A9000	Academic Seminar for International Programs		2–4	6
FV18A9101(*	Finnish 1		1, 3	2

*) Foreign students are required to study at least one course of Finnish language

Major in Structural and Machine Design

Students should select Master's Thesis 30 ECTS credits and a minimum of 39 ECTS credits from the below courses:

Obligatory Studies		year	per.	ECTS cr
BK10A0100(*	Individual Project Work	M.Sc. (Tech.) 1	1-4	6
BK60A0300	Servo Control Engineering	M.Sc. (Tech.) 1	1-2	6
BK70A0400	Introduction to Multibody Dynamics	B.Sc. (Tech.) 3	1	4
BK80A0500(**	Advanced Strength of Materials	M.Sc. (Tech.) 1	1-2	7
BK80A1000	Design of Steel Structures	M.Sc. (Tech.) 1	3-4	6
BK80A1200(*	FE-analysis course	B.Sc. (Tech.) 3	3-4	5
BK80A1400	Fatigue Design	M.Sc. (Tech.) 1	1-2	6
BK80A1600	FE-analysis Seminar in Advanced Topics	B.Sc. (Tech.) 3	1-4	3
Thesis	Master's Thesis and Seminar			30

*) A required course
**) The course will be given in English if required.

Major in Production Technologies

Obligatory Studies (69 ECTS cr)		year	per.	ECTS cr
BK10A0100	Individual Project Work	M.Sc. (Tech.) 1	1-4	6
BK20A0400	Modern Welding Technology	M.Sc. (Tech.) 2	1-2	7
BK20A1100	Virtual Welding	M.Sc. (Tech.) 1	3-4	3
BK30A0100	Laser Processes	M.Sc. (Tech.) 1	1-2	6
BK30A0200	Product Design for Laser Processing	M.Sc. (Tech.) 1	3-4	4
BK50A0700	Advanced Production Engineering	M.Sc. (Tech.) 1	1-2	7
BK90C1300	Wood Processing Machinery	M.Sc. (Tech.) 1	3	6
Thesis	Master's Thesis and Seminar			30

Minor in Structural and Machine Design

Obligatory Studies (21 ECTS cr)		per.	ECTS cr
BK70A0400	Introduction to Multibody Dynamics	1	4
BK80A1000	Design of Steel Structures	3-4	6
BK80A1200	FE-analysis course	3-4	5
BK80A1400	Fatigue Design	1-2	6

Minor in Production Technologies

Obligatory Studies (20 ECTS cr)		per.	ECTS cr
BK20A0400	Modern Welding Technology	1-2	7
BK20A1100	Virtual Welding	3-4	3
BK30A0100	Laser Processes	1-2	6
BK30A0200	Product Design for Laser Processing	3-4	4

Additional Information

Personal Study Plans
At the beginning of their studies, students prepare a personal study plan, in which the student and the Department agree on what studies the student will pursue and in what order. This plan includes detailed information on the major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS cr)
Students with a Finnish degree from the University of Applied Scienes or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska 2 ECTS cr is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further Information
Faculty of Technology, Study Coordinator Jutta Luostarinen
Phone +358 5 621 2268, room 2321, jutta.luostarinen@lut.fi
Study Coordinator Minna Loikkanen
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Courses Offered in English

		ECTS cr
BK10A0100	Individual Project Work	6
BK10A0300	Introduction to M.Sc. Studies	1
BK20A0100	Materials Science	6
BK20A0400	Modern Welding Technology	7
BK20A1100	Virtual Welding	3
BK30A0100	Laser Processes	6
BK30A0200	Product Design for Laser Processing	4
BK50A0700	Advanced Production Engineering	7
BK60A0300	Servo Control Engineering	6
BK60A0601	Process and Product Innovations	10
BK60A0700	Introduction to Mechatronics	4
BK70A0000	Simulation of a Mechatronic Machine	6
BK70A0400	Introduction to Multibody Dynamics	4
BK80A0500	Advanced Strength of Materials	7
BK80A0900	Structural Analysis	6
BK80A1000	Design of Steel Structures	6
BK80A1200	FE-analysis course	5
BK80A1400	Fatigue Design	6
BK80A1600	FE-analysis Seminar in Advanced Topics	3
BK80A2000	Basics of Technical Mechanics	4
BK90C1300	Wood Processing Machinery	6
BK90C1400	Measuring Technology at Mechanical Wood Processes	6

Course Descriptions

BK10A0100	*INDIVIDUAL PROJECT WORK*	*6 ECTS cr*
	Individual Project Work	
	Only for the students of Master's degree programmes of the Department of Mechanical Engineering.	
Year and Period	M.Sc. (Tech.) 1, Period 1-4	
Lecturer(s)	Professors Department of Mechanical Engineering	
Contents	The student will apply methods of engineering and/or research work to a design or production technology related project supervised by a professor, industrial representative or researcher/instructor. The work will be reported and presented.	
Teaching methods	10 h of lectures, 1st-4th period. 150 h of tutorials and independent projects, 1st-4th period.	
Assessment	Pass/Fail, based on written report and oral presentation.	
Prerequisites	Consent of supervising professor.	

BK10A0300	*INTRODUCTION TO M.SC. STUDIES*	*1 ECTS cr*
	Introduction to M.Sc. Studies	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	N. N. Information Specialist, M.Sc. (Tech.) Marja Talikka M.Sc. (Econ. & Bus. Adm.) Jutta Luostarinen	
Contents	This course will help orient international students to the basics of study at LUT. Orientation week activities, information gathering, and essay.	
Teaching methods	Lectures 8 h, 1st period. Exercises 10 h Independent work 8 h	
Assessment	Pass/Fail, grade based on participation, exercises and essay.	
Course Material	LUT Web.	

BK20A0100	*MATERIALS SCIENCE*	*6 ECTS cr*
	Materials Science	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	Senior Assistant, Lic.Sc. (Tech.) Raimo Suoranta	
Aims	The student is capable to select proper material according to functionality and economically.	
Contents	The structure of steel, plastic deformation, restoration, hardening, heat treatment methods. Selecting materials according to strength, toughness, corrosion resistance, wear resistance. Manufacturability. Light metals and non -metallic materials. LCC. Systems for selecting materials.	
Teaching methods	28 h of lectures, 1st-2nd period. 42 h of independent work, 1st-2nd period.	
Assessment	0-5, examination 75%, tutorials 25%.	

BK20A0400	*MODERN WELDING TECHNOLOGY*	*7 ECTS cr*
	Modern Welding Technology	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Senior Assistant, Lic.Sc. (Tech.) Raimo Suoranta Professor, D.Sc. (Tech.) Jukka Martikainen	
Contents	Productivity, economy and quality in welding. Welding costs. Productive and	

	efficient new welding methods. Welding materials. The mechanisation and robotisation of welding. Mechanisation and robotisation equipment and systems. On-line and off-line programming. The design of welded structures. Modulation. Modelling and simulation in welding.
	Methods for preparing roots. Welding FMU and FMS. Lay-out in welding workshop. The quality, environmental and safety in welding workshop. Welding in the future.
	Adaptive welding. Welding in the global welding workshop.
Teaching methods	4 h of lectures, 1st-2nd period.
	14 h of laboratory tutorials.
	28 h of laboratory- and seminar presentations.
Assessment	0-5, examination 80%, laboratory- and seminar presentations 20%.
Course Material	Blackboard material.
	Lecture notes.

BK20A1100	*VIRTUAL WELDING*	*3 ECTS cr*
	Virtual Welding	

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Part-time Untenured Teacher, M.Sc. (Tech.) Esa Hiltunen
Aims	Be able to apply tools of computer technology on workshop operation planning, for example on simulation of robot welding system. Know, what are the opportunities and limitations of these tools.
Contents	Welding production planning of workshops. Modelling and simulation of robot welding system.
	Virtual technology and its applications in mechanical engineering. Basis of virtual modelling. Basis of industrial robots and their construction.
	Planning of productive robotized welding. Definition of welding process parameters.
Teaching methods	2 h of lectures, 3rd period.
	12 h of controlled tutorials, 3rd-4th period.
Assessment	0-5, examination 70%, exercises 30%.
Course Material	Blackboard.

BK30A0100	*LASER PROCESSES*	*6 ECTS cr*
	Laser Processes	

Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Veli Kujanpää
	Docent, D.Sc. (Tech.) Antti Salminen
Aims	Readiness to understand the special features of laser processing in production and product design.
Contents	Basic knowledge on different laser processing systems and processes and the interaction between laser beam and materials. Basic knowledge on laser welding, cutting and surface treatment.
	Optics of laser processing, safety and quality assurance. Practical cases.
	Basics of the interaction between laser beam and materials, absorption, keyhole and its usefulness on laser welding and cutting.
Teaching methods	28 h of lectures, 1st-2nd period.
	16 h of tutorials, 1st-2nd period.
Assessment	0-5, examination 90%, seminar 10%.
Course Material	Steen W., Laser material processing.
	Material presented during lectures.

BK30A0200	*PRODUCT DESIGN FOR LASER PROCESSING*	*4 ECTS cr*
	Product Design for Laser Processing	

Year and Period	M.Sc. (Tech.) 1, Period 3-4

Lecturer(s)	Docent, D.Sc. (Tech.) Antti Salminen
Aims	Readiness to use laser processing possibilities on the tasks of product design.
Contents	Special features of laser processing methods for product design. The effect of laser processing devices, process features, materials and processing results on product design.
	Practical examples on product design and its effects on product properties.
	Special features of laser processing and its usefulness on product design.
Teaching methods	28 h of lectures, 3rd-4th period.
	14 h of tutorials, 3rd-4th period.
Assessment	0-5, examination 50%, seminar 50%.
Course Material	Kujanpää V. et al., Lasertyöstö.
	Steen W., Laser material processing.
Prerequisites	BK30A0000 Sädetyöstö or BK30A0100 Laser Processes

BK50A0700	ADVANCED PRODUCTION ENGINEERING 7 ECTS cr
	Advanced Production Engineering
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Varis
Aims	This course will deepen the student's knowledge of the most advanced design and production methods, equipment, equipment systems and modern product facilities used especially in the manufacture of thin and rough sheet metal products. The student will also learn to understand the role of manufacturing as a part of the company's strategy and to design and use production systems. The course will provide the student with the ability to handle duties in factory management and development as well as in research in the field.
Contents	The manufacturing methods for modern metal cutting and sheet metal production. The advanced production methods for punching, folding and mechanical joining of sheet metal products. The production control systems of flexible automatic (FMS, IMS) production factories. The significance and technologies of product design as well as of production (CAD, CAP, PPS, CAM) especially in the manufacture of thin and rough sheet metal production. DFMA and costs functions of products, production controlling and simulation. The operation of a factory as part of a principal-supplier network. The technology and methods for improving production. The material handling, production and information systems of a workshop.
	The development of the operations of a workshop and quality technology.
Teaching methods	30 h of lectures, 1st-2nd period.
	28 h of exercises, 1st-2nd period.
	56 h of laboratory tutorials, 1st-2nd period.
	Seminar 20 h, 1st-2nd period.
Assessment	0-5, examination 60%, satisfactorily completed tutorials 20%, project work 20%.
Course Material	Materials to be announced during lectures.

BK60A0300	SERVO CONTROL ENGINEERING 6 ECTS cr
	Servo Control Engineering
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Heikki Handroos
Contents	Control of Hydraulic, Pneumatic, and electrical servodrives.
	Structures and properties of basic types of servo-drives. Selection of appropriate control methods for different drive types.
	Fuzzy control of servodrives.
	Ability to design and control of different types of servodrives. Ability to evaluate the achievable properties of different servodrives.
Teaching methods	42 h of lectures, 1st-2nd period.
	42 h of tutorials, 1st-2nd period.
	30 h of exercises, 2nd period.

Assessment	0-5, examination 100%.
Course Material	Lecture notes.
Prerequisites	The student must have completed BK60A0000 Mekatroniikan peruskurssi. Recommended BK60A0100 Hydrauliikkaniikka (not required from International Master's Degree Programme students).

BK60A0601	*PROCESS AND PRODUCT INNOVATIONS*	*10 ECTS cr*

Process and Product Innovations

Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.

Year and Period	M.Sc. (Tech.) 1-2, Period 1-4
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Kimmo Kerkkänen
	Professor, D.Sc. (Tech.) Tuomo Kässi
	Senior Lecturer, D.Sc. (Tech.) Ville Ojanen
	Professor, D.Sc. (Tech.) Riku Pöllänen
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To get acquainted with the generation of innovations and new technology, the typical methods, problems and their solutions. To train project and teamwork in interdisciplinary, international environment. To get acquainted with product and process development. To train and deepen many skills learned in other connections.
Contents	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting.
Teaching methods	Informational lectures, 6 h/period. Project meetings, 6 h/period. Independent project and teamwork in groups of 4-8 students.
Assessment	0-5, project work 100%.

BK60A0700	*INTRODUCTION TO MECHATRONICS*	*4 ECTS cr*

Introduction to Mechatronics

Belongs only to complementary studies of the Master's Degree Programmes New Packaging Solutions and Mechanical Engineering.

Year and Period	M.Sc. (Tech.) 1, Period 2-3
Lecturer(s)	D.Sc. (Tech.) Hassan Yousefi
Aims	To give basic understanding about mechatronic systems, components and power transmission.
Contents	Mechatronic systems, Mechanical Transmission components, Sensors and Transducers, Stepper Motors, DC-and AC-servomotors, Hydraulic Actuators, Digital Logicand Hardware.
Teaching methods	Self-learning by the assigned literature.
Assessment	0-5, written examination 100%
Course Material	deSilva, C., Mechatronics, An Integrated Approach, CRC Press, 2004, 1293p, selected chapters.

BK70A0000	*SIMULATION OF A MECHATRONIC MACHINE*	*6 ECTS cr*

Simulation of a Mechatronic Machine

Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Aki Mikkola
Aims	The student will obtain the theoretical ability for the mathematical modelling and computer simulation of machine systems that are hydraulically,

Contents	pneumatically or electronically actuated. The student will also obtain knowledge to utilize static, kinematic and dynamic analysis in a machine design process. Principles of multibody dynamics, modelling of actuators, coupled simulation. Description of mechanic flexibility. The use of Lagrangian equation. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Modeling of hydraulic components. Numerical integration of the equation of motion. Rotation matrix in spatial cases.
Teaching methods	28 h of lectures, 3rd-4th period. 28 h of supervised tutorials, 3rd-4th period.
Assessment	0-5, examination or mid-course examinations 90%, simulation work 10%.
Course Material	Lecture notes.
Prerequisites	Students are recommended to have completed BK60A0000 Mekatroniikan peruskurssi, BK80A0000 Statiikka, BK80A0100 Dynamiikka I BK80A0200 Dynamiikka II (not required from International Master's Degree Programme students).

BK70A0400	*INTRODUCTION TO MULTIBODY DYNAMICS 4 ECTS cr*
	Introduction to Multibody Dynamics
Year and Period	B.Sc. (Tech.) 3, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Aki Mikkola
Aims	The student will obtain the theoretical ability for the mathematical modelling and computer simulation of machine systems that consists of rigid bodies.
Contents	Principles of multibody dynamics. The use of Lagrangian equation. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Numerical integration of the equation of motion. Rotation matrix in spatial cases.
Teaching methods	Lectures of 14 h, 1st period. Exercises of 14 h, 1st period.
Assessment	0-5, examination 90%, simulation work 10%.
Course Material	Lecture notes.
Prerequisites	Students are recommended to have completed BK80A0000 Statiikka, BK80A0100 Dynamiikka I, BK80A0200 Dynamiikka II (not required from International Master's Degree Programme students).

BK80A0500	*ADVANCED STRENGTH OF MATERIALS 7 ECTS cr*
	Lujuusoppi II
	The course will be lectured in English if required.
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	N. N. Researcher/Teacher, D.Sc. (Tech.) Tapani Halme Senior Assistant, D.Sc. (Tech.) Timo Nykänen
Aims	The course is a continuation of the basic course and is intended to provide students with a more thorough background in solid mechanics and strength of materials.
Contents	Unsymmetric beam bending, states of stress and strain, generalized Hooke's law, behaviour of orthotropic materials and laminates, thick-walled axi-symmetric shells, stress function, experimental methods in strength of materials, deformation energy and failure theories, St. Venant's theory for torsion, Prandtl membrane analogy, restrained warping of thin-walled open sections, stresses in curved bars, deformation of circular members, composite beams, columns and beam-columns, equilibrium solutions for elastic buckling, plastic bending and torsion, plastic limit analysis.
Teaching methods	42 h of lectures, 1st-2nd period. 42 h of tutorials, 1st-2nd period.

	1 h of laboratory work.
	8 h of independent work.
Assessment	0-5, examination or two intermediate examinations 100% (85%), laboratory work (5%), exercises (10%).
Course Material	Lecture notes.
	Ugural A.C. and Fenster S.K., Advanced strength and applied elasticity. -4th ed.
Prerequisites	BK80A0300 Lujuusoppi I tutorials completed or registration in the International Master's Degree Programme.

BK80A0900	**STRUCTURAL ANALYSIS**	**6 ECTS cr**
	Structural Analysis	
Year and Period	B.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	N. N.	
	Part-time Untenured Teacher, M.Sc. (Tech.) Sami Heinilä	
Aims	Drawing shear and moment diagrams, constructing influence lines. Use of STRAN computer program.	
Contents	Application of basic geometry and static principals to the analysis of simple structural components. Structures include frame, beam and truss structures. Indeterminacy and exact and approximate methods for indeterminate structures. Energy methods and force methods.	
Teaching methods	42 h of lectures, 1st-2nd period. 18 h of tutorials, 1st-2nd period. 20 h of laboratory work.	
Assessment	0-5, examination 50%, exercises 50%.	
Course Material	Hibbeler R.C., Structural Analysis - 5th ed., Prentice-Hall, 2002.	
Prerequisites	Static equilibrium, understand shear forces, normal forces and bending moments BK80A0000 Statiikka and BK80A0300 Lujuusoppi I.	

BK80A1000	**DESIGN OF STEEL STRUCTURES**	**6 ECTS cr**
	Design of Steel Structures	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	N. N.	
Aims	Use of AGIFAP computer program.	
Contents	Principals of design for welded mechanical engineering structures. Theory of buckling, fatigue of welded structures, introduction to limit state design, yield line theory, welding residual stresses. Design to avoid buckling of slender members, design to avoid fatigue failure, design of welded joints, optimization of beams.	
Teaching methods	42 h of lectures, 3rd-4th period. 10 h of tutorials 3rd-4th period. 5 h of laboratory work, 3rd-4th period.	
Assessment	0-5, examination 60%, laboratory projects and reports 40%.	
Course Material	Niemi E., Levyrakenteiden suunnittelu, 2003.	
Prerequisites	BK80A1100 FE-analyysin peruskurssi or BK80A1200 FE-analysis course	

BK80A1200	**FE-ANALYSIS COURSE**	**5 ECTS cr**
	FE-analysis course	
Year and Period	B.Sc. (Tech.) 3, Period 3-4	
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Pasi Tanskanen	
Aims	The aim of this course is to ensure that the student has a good knowledge of the theoretic fundamentals of FE analysis as well as a basis for the reliable use of FEM software.	
Contents	The student will be acquainted with the procedure of static linear-elastic FE analysis with the aim of providing the student with a basic knowledge of the	

	derivation of element stiffness matrices of elements, the assembly of a global stiffness matrix, the handling of boundary conditions and loading as well as the problem solving. In the tutorials the student will be acquainted with FE modelling using commercial software.
Teaching methods	28 h of lectures, 3rd-4th period. 28 h of tutorials, 3rd-4th period.
Assessment	0-5, examination 50%, exercises 50%.
Course Material	The material is to be specified during lectures.

BK80A1400	*FATIGUE DESIGN*	*6 ECTS cr*

	Fatigue Design
Year and Period	M.Sc. (Tech.) 1, Period 1-2
Lecturer(s)	N. N.
Contents	Principals of design to avoid fatigue failure of mechanical engineering components and structures. Introduction to fatigue, dynamic loading of structures, deformation of structural materials, stress concentrations, introduction to fracture mechanics. Design of structures based on stress-life approach, strain life approach and linear elastic fracture mechanics.
Teaching methods	42 h of lectures, 1st-2nd period. 40 h of tutorials, 1st-2nd period.
Assessment	0-5, examination 60%, exercises 40%.
Course Material	Dowling N.E., Mechanical Behavior of Materials 2nd ed., Prentice Hall.
Prerequisites	BK80A0500 Lujuusoppi II or BK20A0100 Materials Science.

BK80A1600	*FE-ANALYSIS SEMINAR IN ADVANCED TOPICS*	*3 ECTS cr*

	FE-analysis Seminar in Advanced Topics **Course registrations directly to the lecturer, WebOodi not in use.**
Year and Period	B.Sc. (Tech.) 3, Period 1-4
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Pasi Tanskanen
Aims	To better prepare the student for industrial problem solving or research work by giving more in-depth instruction on numerous advanced topics in finite element analysis.
Contents	The course will cover numerous advanced topics in finite element analysis especially for mechanical engineers, e.g., solution techniques, stability and dynamic eigenvalue problems, sub-modeling and sub-structure techniques, and nonlinear analysis.
Teaching methods	Lectures 14 h, 1st-4th period.
Assessment	0-5, exercises 100%.
Course Material	The material is to be specified during lectures.
Prerequisites	BK80A1200 FE-analysis course.

BK80A2000	*BASICS OF TECHNICAL MECHANICS*	*4 ECTS cr*

	Basics of Technical Mechanics **Belongs only to complementary studies of Master's Degree Programme New Packaging Solutions.**
Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Tapani Halme
Contents	Equilibrium of a particle and a rigid body, concentrated and distributed force systems, problems involving trusses, frames and machines. Internal forces of straight beams, centroid and main axes of a cross-section. Definition of normal

	and shear stress, mechanical properties of materials. Separate treatments of axial load, torsion and bending. State of stress resulting from combined loadings. Theories of failure, design of beams and shafts. Deflections of beams and shafts. Buckling of columns.
Teaching methods	Lectures 24 h Exercises 6 h Independent work 6 h
Assessment	Pass/Fail, based on exercises and exam, exam 50%, exercises 50%.
Course Material	Hibbeler, Statics and Strength of Materials

BK90C1300	*WOOD PROCESSING MACHINERY*	*6 ECTS cr*
	Wood Processing Machinery	

Year and Period	M.Sc. (Tech.) 1, Period 3
Lecturer(s)	Researcher/Teacher, M.Sc. (Tech.) Kimmo Piispa
Aims	Comprehensive insight on machinery and processes used in the primary wood processing industry. Basic knowledge of raw material handling, debarking, chipping, cutting processes, saws, sorting, drying and secondary machinery. Practical knowledge of sawmills including a sawmill visit and a written report. Student makes an individual written report on a selected subject and presents it in a seminar.
Contents	Primary wood processing technologies and machinery. Production planning, wood as raw material, maintenance, environment and labour safety.
Teaching methods	32 h lectures, 3rd period. 16 h mill visits and seminars, 3rd period. 24 h independent projects, 3rd period. Two written reports, final examination.
Assessment	0-5, final examination 80%, written reports and approved seminar attendance 20%.
Course Material	Lecture material.

BK90C1400	*MEASURING TECHNOLOGY AT MECHANICAL WOOD PROCESSES*	*6 ECTS cr*
	Measuring Technology at Mechanical Wood Processes	

Year and Period	M.Sc. (Tech.) 1-2, Period 4
Lecturer(s)	Researcher/Teacher, M.Sc. (Tech.) Kimmo Piispa
Aims	Comprehensive insight on techniques and equipment used in the primary and secondary wood processing industry. Basic knowledge of statistical control, measuring devices, scanners and optimization. Practical knowledge of dimension control including an analysis of a saw process in a sawmill with a written report. Student makes an individual written report on a selected subject and presents it in a seminar.
Contents	Measuring and control techniques and systems in mechanical wood industry. Physics and use of measuring techniques and devices.
Teaching methods	32 h lectures, 4th period. 16 h mill visits and seminars, 4th period. 24 h independent projects, 4th period. Two written reports, final examination.
Assessment	0-5, final examination 60%, written reports and approved seminar attendance 40%.
Course Material	Vuorilehto J., Size Control of Sawn Timber by Optical Means in Breakdown Saw Machines.
Prerequisites	BK90C1300 Wood Processing Machinery

10 Master's Degree Programme "New Packaging Solutions"

The Master's degree programme "New Packaging Solutions" (NPS) is a part-time programme leading to the degree of Master of Science in Technology. Teaching is organized as intensive teaching periods (4-5 days at a time) during the academic year, and distance learning solutions are widely used. Students have two years (90 ECTS credits) of coursework in which all lectures, exercises and laboratory work are conducted in English. The Master's thesis (30 ECTS credits) will be conducted after the other courses have been completed.

The Aims of the Master's Degree Programme

The objective of the programme is to educate experts in packaging materials, converting and packaging technologies who possess the skills to work throughout the whole packaging chain. It is aimed at students already working in packaging related businesses or wishing to pursue a career in the industry dealing with packaging.

Careers for Graduates

The packaging field offers a great diversity of employment opportunities in production, research, development and sales & marketing. The professional tasks may include, for example, production, product development and design, marketing and sales in domestic and international businesses.

The Degree Structure of the Programme

Degree Structure		
General Studies	18	ECTS cr
Major Subject	41	ECTS cr
Minor Subject	20	ECTS cr
Elective Studies	11	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
Total	120 (min.)	ECTS cr

General Studies (18 ECTS cr):
General studies are common to all the students in the programme. The studies provide a brief introduction to the packaging field and packaging materials as well as language & communication skills essential for M.Sc. studies.

Major Subject (41 ECTS cr):
The person responsible for major subject in Packaging Technologies is professor, Ph.D. Henry Lindell.
The main focus of the major subject is on paper and paperboard converting technologies, packaging machinery and packaging technologies, planning and design of packaging solutions and understanding of packaging chain demands.

Master's Thesis and Seminar (30 ECTS cr):
The Master's thesis is a research or design project, which will be written after the other courses have been completed. It is carried out in the field of the student's major subject.

Minor Subject (20 ECTS cr):
Information concerning the courses in the minor subject of the NPS programme can be obtained from the study coordinator. Choices of other minor subjects will be treated on a case-by-case basis.

Elective Studies (11 ECTS cr):
To attain the full 120 ECTS credits, the students may need to take some additional courses. Elective studies can include any courses offered by Lappeenranta University of Technology if the required prerequisites are completed. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise. Foreign students are recommended to study one or more of the following: FV18A9101 Finnish 1, FV18A9201 Finnish 2 and FV18A9301 Finnish 3 courses.

General Studies

General Studies (18 ECTS cr)		year	per.	ECTS cr
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
BK10A0800	Introduction to M.Sc. Studies in Packaging	M.Sc. (Tech.) 1	1	1
BK20A1300	Packaging Materials	M.Sc. (Tech.) 1	1-2	4
FV10A 12EC[*]	Language and Communication Studies			12

[*] The following studies of English language are recommended:

Language and Communication Studies (12 ECTS cr)		per.	ECTS cr
FV11A4200	Writing for Business	1, 2, 3, 4	2
FV11A6200	English for Negotiating	3–4	3
FV11A9300	Scientific and Technical English Writing Course	1–2, 3–4	4
FV11A9750	Aspects of Culture		3

Major Subject in Packaging Technologies

Obligatory Studies (71 ECTS cr)		year	per.	ECTS cr
BK10A0100	Individual Project Work	M.Sc. (Tech.) 1	1-4	6
BK20A1200	Interaction of the Package and the Content	M.Sc. (Tech.) 1	3-4	3
BK20A1400	Coating and Lamination of Fibre Based Packaging Materials	M.Sc. (Tech.) 1	1-3	5
BK30A0400	Laser in Converting and Packaging	M.Sc. (Tech.) 2	1-2	2
BK50A1200	Machine Design for Packaging Technology	M.Sc. (Tech.) 1	3-4	2
BK50A1300	Converting and Forming of Fibre Based Packaging	M.Sc. (Tech.) 2	1-2	5
BK50A1400	Packaging Lines and Machinery	M.Sc. (Tech.) 2	3-4	8
BK50A1500	Printing and Varnishing	M.Sc. (Tech.) 1	2-3	2
BK50A1600	Functions of Package and Packaging Formats	M.Sc. (Tech.) 2	1-2	4
BK50A1700	Legislation on Packaging and Environmental Issues Related to Packaging	M.Sc. (Tech.) 2	1-3	4
Thesis	Master's Thesis and Seminar			30

Additional Information

Personal Study Plans
At the beginning of their studies, students prepare a personal study plan, in which the student and the Department agree on what studies the student will pursue and in what order. This plan includes detailed information on the major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS cr)
Students with a Finnish degree from the University of Applied Scienes or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska 2 op is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further Information
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Study Coordinator Minna Loikkanen
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Courses Offered in English

		ECTS cr
BK10A0100	Individual Project Work	6
BK10A0300	Introduction to M.Sc. Studies	1
BK10A0800	Introduction to M.Sc. Studies in Packaging	1
BK20A1200	Interaction of the Package and the Content	3
BK20A1300	Packaging Materials	4
BK20A1400	Coating and Lamination of Fibre Based Packaging Materials	5
BK20A1500	Principles of Chemistry, Paper Technology and Food Technology	5
BK30A0400	Laser in Converting and Packaging	2
BK50A1200	Machine Design for Packaging Technology	2
BK50A1300	Converting and Forming of Fibre Based Packaging	5
BK50A1400	Packaging Lines and Machinery	8
BK50A1500	Printing and Varnishing	2
BK50A1600	Functions of Package and Packaging Formats	4
BK50A1700	Legislation on Packaging and Environmental Issues Related to Packaging	4
BK60A0601	Process and Product Innovations	10
BK60A0700	Introduction to Mechatronics	4
BK80A2000	Basics of Technical Mechanics	4

Course Descriptions

BK10A0100	*INDIVIDUAL PROJECT WORK*	*6 ECTS cr*
	Individual Project Work	
	Only for the students of Master's degree programmes of the Department of Mechanical Engineering.	
Year and Period	M.Sc. (Tech.) 1, Period 1-4	
Lecturer(s)	Professors Department of Mechanical Engineering	
Contents	The student will apply methods of engineering and/or research work to a design or production technology related project supervised by a professor, industrial representative or researcher/instructor. The work will be reported and presented.	
Teaching methods	10 h of lectures, 1st-4th period. 150 h of tutorials and independent projects, 1st-4th period.	
Assessment	Pass/Fail, based on written report and oral presentation.	
Prerequisites	Consent of supervising professor.	

BK10A0300	*INTRODUCTION TO M.SC. STUDIES*	*1 ECTS cr*
	Introduction to M.Sc. Studies	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	N. N. Information Specialist, M.Sc. (Tech.) Marja Talikka M.Sc. (Econ. & Bus. Adm.) Jutta Luostarinen	
Contents	This course will help orient international students to the basics of study at LUT. Orientation week activities, information gathering, and essay.	
Teaching	Lectures 8 h, 1st period.	

methods	Exercises 10 h
	Independent work 8 h
Assessment	Pass/Fail, grade based on participation, exercises and essay.
Course Material	LUT Web.

BK10A0800	*INTRODUCTION TO M.SC. STUDIES IN PACKAGING*	*1 ECTS cr*
	Introduction to M.Sc. Studies in Packaging	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	Professor, D.Sc. (Tech.) Juha Varis	
	M.Sc. (Econ. & Bus. Adm.) Jutta Luostarinen	
Aims	To provide understanding of packaging branch and the degree programme.	
Contents	The course will introduce the packaging branch and packaging businesses and the main features of the degree programme. Students will make personal study plans.	
Teaching methods	8 h lectures, 1st period.	
	10 h exercises, 1st period.	
	8 h independent work, 1st period.	
Assessment	Pass/Fail	
Course Material	Orientation days, Study guide	
	Handouts.	

BK20A1200	*INTERACTION OF THE PACKAGE AND THE CONTENT*	*3 ECTS cr*
	Interaction of the Package and the Content	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Visiting lecturers, Professor, Ph.D. Atte von Wright, Docent, Ph.D. Henry Lindell	
Aims	Understanding of the main mechanisms about the interaction of package and the content especially in food packaging.	
Contents	Fundamentals of microbiology and toxicology relevant to packaging materials, packages, machinery and the packed products. Fundamentals of the interaction of the packaging and the content. The main analyzing methods of packages and packaging materials.	
Teaching methods	Lectures total 24 h, 3rd-4th period.	
	Exercises total 12 h, 3rd-4th period.	
Assessment	0-5, examination 70%, exercises 30%.	
Course Material	Handouts.	

BK20A1300	*PACKAGING MATERIALS*	*4 ECTS cr*
	Packaging Materials	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	Visiting lecturer, Professor, Jurkka Kuusipalo	
Aims	To provide understanding of the packaging related properties of various packaging materials.	
Contents	The manufacture, physical and chemical properties (relevant for packaging) of the major packaging materials: paper, paperboard, corrugated board, wood, glass, metals, polymers including biopolymers and adhesives. Foreseeable future development of each material.	
	Material composite possibilities and their use.	
	Capability to select material alternatives or combinations for specific packaging solutions based on their possible performance characteristics.	
Teaching methods	Lectures total 16 h, 1st-2nd period.	
	Exercises total 7 h, 1st-2nd period.	

Assessment	0-5, examination 70%, exercises 30%.
Course Material	Course material.
	Lecturers' comments.
	Kuusipalo, J. ed., Paper and paperboard converting. In series of books: Papermaking science and technology, osa 12, 2nd edition, Fapet, Helsinki.

BK20A1400	COATING AND LAMINATION OF FIBRE BASED PACKAGING MATERIALS 5 ECTS cr

	Coating and Lamination of Fibre Based Packaging Materials
Year and Period	M.Sc. (Tech.) 1, Period 1-3
Lecturer(s)	Visiting lecturer, Professor, Jurkka Kuusipalo
Aims	To provide understanding of various ways to combine materials with paper and board and of their properties in packaging applications.
Contents	Raw materials, for main coating and laminating methods. Main properties (including pronting) of the finished products. Focus in extrusion coating process.
	The main applications of paper based packaging materials in packaging sector.
	Combined packaging structures and their manufacturing techniques.
	Capability to run extrusion coating line and utilize fibre materials on the packaging solutions.
Teaching methods	Lectures total 18 h, 1st-3rd period.
	Exercises total 8 h, 1st-3rd period.
	Seminar 1st-3rd period.
Assessment	0-5, examination 70%, exercises 30%.
Course Material	Course material.
	Lecturers' comments.
	Kuusipalo, J. ed., Paper and paperboard converting. In series of books: Papermaking science and technology, osa 12, 2nd edition, Fapet, Helsinki.

BK20A1500	PRINCIPLES OF CHEMISTRY, PAPER TECHNOLOGY AND FOOD TECHNOLOGY 5 ECTS cr

	Principles of Chemistry, Paper Technology and Food Technology
	Belongs only to complementary studies of New Packaging Solutions. Course registrations during 1st period.
Year and Period	M.Sc. (Tech.) 1, Period 1-4
Lecturer(s)	Visiting lecturer, M.Sc. (Tech) Matti Salste
Aims	Understanding basic general, organic and biochemical phenomena.
	Understanding basics of paper technology and products.
	Understanding packaging related features of processed food.
Contents	Basic phenomena of general, organic and biochemistry.
	Main fibre grades and other raw materials and their role in paper products, the main part processes of paper production, typical properties of the main paper and board grades.
	The basic principles of foods and processing theory, the main food processes and their effect on foods considering packaging.
Teaching methods	Essays with specific instruction.
Assessment	Pass/Fail.
Course Material	Smook G.A., Handbook for Pulp & Paper Technologists, 2nd edition, p 1-7, 36-44,194-324 or
	Smook G.A., Handbook for Pulp & Paper Technologists, 3rd edition, p 1-9, 37-45, 190-324 or
	Herbert Holik, Handbook of Paper and Board, Wiley-VCH Verlag GmbH & Co. KgaA, Wennheim, Germany.
	Bettelheim & March, Introduction to General, Organic and Biochemistry

Saunders College Publishing
Fellows P., Food processing technology - Principles and Practice, Second edition, Part I p 7-62, III and IV, p 229-452.

BK30A0400	*LASER IN CONVERTING AND PACKAGING*	*2 ECTS cr*
	Laser in Converting and Packaging	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Professor, D.Sc. (Tech.) Veli Kujanpää	
	Lecturer, N. N.	
Aims	To provide understanding for laser based processing in converting technology, paper and cardboard material, multimaterials, pigment and plastic coated, packaging lines.	
Contents	The use of laser in converting of fibre based packaging materials and packaging line solutions. Laser processes like laser cutting, laser scoring, laser joining, and laser marking.	
	Laser machines, optics and work stations in other applications.	
	Product design for laser processing. Other special laser technologies.	
	Capability to utilize laser technologies in converting and packaging.	
Assessment	0-5, examination 90%, tutorials 10%.	
Course Material	Material prepared for the course, in Blackboard.	

BK50A1200	*MACHINE DESIGN FOR PACKAGING TECHNOLOGY*	*2 ECTS cr*
	Machine Design for Packaging Technology	
Year and Period	M.Sc. (Tech.) 1, Period 3-4	
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Harri Eskelinen	
Aims	To provide understanding of most important mechanisms and their machine parts for packaging solutions by utilizing the basic theories of DFM(A).	
Contents	Basic mechanisms types, mechanisms analysis and synthesis, reliability-based machine design, wear and lifetime analysis of selected machine parts and elements.	
	Different methodologies of DFM(A) and means to apply them in packaging technology.	
	Knowledge about how to design a simple machine or mechanisms for packaging operations and means to estimate functional aspects of applied technology.	
Teaching methods	Lectures total 14 h, 2nd-3rd period.	
	Exercises total 26 h, 2nd-3rd period.	
	Seminar 2nd-3rd period.	
Assessment	0-5, examination 70%, exercises and seminar 30%	
Course Material	Erdman A.G., Mechanism Design.	
	Norton R.L., Design of Machinery.	

BK50A1300	*CONVERTING AND FORMING OF FIBRE BASED PACKAGING*	*5 ECTS cr*
	Converting and Forming of Fibre Based Packaging	
Year and Period	M.Sc. (Tech.) 2, Period 1-2	
Lecturer(s)	Visiting lecturers	
Aims	To provide understanding of various paper and board converting technologies and their developments in package production.	
Contents	The main technologies of carton forming: die cutting, scoring, folding of blanks and other forming technologies. Tool design (3D-systems) and tool manufacturing technologies in modern workshops. Machines and equipment for listed converting processes, and their integration into effective production systems.	

	Sealing, gluing and closing technologies of fibre based packaging materials. The special requirements various paper based materials for converting processes. Features to be considered in multimaterial converting. Knowledge of the main paper package forming technologies. The requirements of various paper and board grades set for the processes.
Teaching methods	Lectures, seminar work and an independent work.
Assessment	Written examination 60%, seminar 40%. Laboratory works; pass/fail.
Course Material	Lecture handouts.

BK50A1400	*PACKAGING LINES AND MACHINERY* *8 ECTS cr*
	Packaging Lines and Machinery
Year and Period	M.Sc. (Tech.) 2, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Jukka Martikainen Lecturers N.N.
Aims	To provide understanding for operations and functions of packaging lines and their development aspects.
Contents	The unit processes in packaging line, the main components of packaging line. The main filling technologies in food packaging, for example liquid packaging, aseptic packaging, MAP packaging, autoclave packaging. The main filling technologies in non-food packaging like pharma, electronics, industrial packaging. Technologies used in carton packaging and flexible packaging: pouch, wrapping, form-fill-seal. The focus in fibre based packaging. Instrumentation, automation, robotics in packaging lines.
Teaching methods	Will be announced later.
Assessment	0-5, examination 100%.
Course Material	Will be announced at lectures.

BK50A1500	*PRINTING AND VARNISHING* *2 ECTS cr*
	Printing and Varnishing
Year and Period	M.Sc. (Tech.) 1, Period 2-3
Lecturer(s)	Guest Lecturer, D.Sc. (Tech.) Johanna Lahti
Aims	To provide understanding of printing methods used in packaging industry. Capability to select a proper printing method for a certain packaging solution. Capability to solve printing problems and to control print quality.
Contents	Pre-press operations. The main printing technologies and their use in packaging industry. Printing of various substrates. Composition of printing inks. Print quality and defects. Print quality measurements. Emerging printing technologies and their potential use in packaging industry. Future trends of printing technologies.
Teaching methods	Lectures total 12 h, 2nd-3rd period. Exercises total 6 h, 2nd-3rd period.
Assessment	0-5, examination 70%, exercises 30%.
Course Material	Course material. Lecturers' comments. Saarelma, H., Oittinen P., Printing. In series of books: Papermaking Science and Technology, Book 13, Fapet, Helsinki 1999.

BK50A1600	*FUNCTIONS OF PACKAGE AND PACKAGING FORMATS* *4 ECTS cr*
	Functions of Package and Packaging Formats

Year and Period	M.Sc. (Tech.) 2, Period 1-2
Lecturer(s)	N.N.
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Juha Varis
Aims	To provide understanding of various functions of packaging and packages and their future trends. To provide understanding of various formats of packages, their merits and shortfalls in logistic chain and end-use. To provide understanding of challenges of packages in specific end uses.
Contents	Aspects of the role of packaging throughout the value chain. The main categories packages and their use.
	Aspects for understanding of the main opportunities of various packaging formats in specific end uses when developing new solutions.
Teaching methods	Lectures 24 h.
	Exercises/seminars 16 h.
Assessment	0-5, assignments.

BK50A1700	*LEGISLATION ON PACKAGING AND ENVIRONMENTAL ISSUES RELATED TO PACKAGING*	*4 ECTS cr*
	Legislation on Packaging and Environmental Issues Related to Packaging	
Year and Period	M.Sc. (Tech.) 2, Period 1-3	
Lecturer(s)	Visiting lecturers, Professor, Ph.D. Atte von Wright	
	M.Sc. Päivi Harju-Eloranta	
Aims	To provide understanding of packaging related legislation and sustainability aspects and their impact on the packaging business.	
Contents	The main content of the EU legislation of chemical, biological and microbiological hygienic and purity aspects in the packaging. Environmental issues of packaging and packaging waste and the relevant legislation. The environmental standardization of packages in EU. Sustainability aspects concerning packaging legislation on product safety aspects and traceability.	
Teaching methods	Lectures total 18 h, 1st-3rd period.	
	Exercises total 14 h, 1st-3rd period.	
	Seminar 1st-3rd period.	
Assessment	0-5, assignments.	
Course Material	Handouts.	

BK60A0601	*PROCESS AND PRODUCT INNOVATIONS*	*10 ECTS cr*
	Process and Product Innovations	
	Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.	
Year and Period	M.Sc. (Tech.) 1-2, Period 1-4	
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Kimmo Kerkkänen	
	Professor, D.Sc. (Tech.) Tuomo Kässi	
	Senior Lecturer, D.Sc. (Tech.) Ville Ojanen	
	Professor, D.Sc. (Tech.) Riku Pöllänen	
	Lecturer(s) responsible: Professor, D.Sc. (Tech.) Ilkka Turunen	
Aims	To get acquainted with the generation of innovations and new technology, the typical methods, problems and their solutions. To train project and teamwork in interdisciplinary, international environment. To get acquainted with product and process development. To train and deepen many skills learned in other connections.	
Contents	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting.	
Teaching	Informational lectures, 6 h/period.	

methods	Project meetings, 6 h/period.
	Independent project and teamwork in groups of 4-8 students.
Assessment	0-5, project work 100%.

BK60A0700	*INTRODUCTION TO MECHATRONICS*	*4 ECTS cr*

Introduction to Mechatronics

Belongs only to complementary studies of the Master's Degree Programmes New Packaging Solutions and Mechanical Engineering.

Year and Period	M.Sc. (Tech.) 1, Period 2-3
Lecturer(s)	D.Sc. (Tech.) Hassan Yousefi
Aims	To give basic understanding about mechatronic systems, components and power transmission.
Contents	Mechatronic systems, Mechanical Transmission components, Sensors and Transducers, Stepper Motors, DC-and AC-servomotors, Hydraulic Actuators, Digital Logicand Hardware.
Teaching methods	Self-learning by the assigned literature.
Assessment	0-5, written examination 100%
Course Material	deSilva, C., Mechatronics, An Integrated Approach, CRC Press, 2004, 1293p, selected chapters.

BK80A2000	*BASICS OF TECHNICAL MECHANICS*	*4 ECTS cr*

Basics of Technical Mechanics

Belongs only to complementary studies of Master's Degree Programme New Packaging Solutions.

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Researcher/Teacher, D.Sc. (Tech.) Tapani Halme
Contents	Equilibrium of a particle and a rigid body, concentrated and distributed force systems, problems involving trusses, frames and machines. Internal forces of straight beams, centroid and main axes of a cross-section. Definition of normal and shear stress, mechanical properties of materials. Separate treatments of axial load, torsion and bending. State of stress resulting from combined loadings. Theories of failure, design of beams and shafts. Deflections of beams and shafts. Buckling of columns.
Teaching methods	Lectures 24 h
	Exercises 6 h
	Independent work 6 h
Assessment	Pass/Fail, based on exercises and exam, exam 50%, exercises 50%.
Course Material	Hibbeler, Statics and Strength of Materials

11 Master's Degree Programme in Technomathematics and Technical Physics

Master's Degree programme in Technomathematics and Technical Physics has two alternative major subjects. This two-year programme is for both Finnish and international students. The programme is worth 120 credits and includes coursework of 90 credits and a Master's Thesis of 30 credits, leading to a Master of Science in Technology degree. Lectures and tutoring are given in English. The application period for the programme is in January-February annually.

Technomathematics

Students majoring in Technomathematics should have a Bachelor's degree in engineering, applied mathematics, computer science or equivalent discipline. The aim is to develop the student's mathematical and computational skills for industry and other research and development tasks. The professional scope is wide-ranging and growing rapidly. Technomathematics is the art and science of applying mathematics and computational models into real life problems in industrial research and applied science, such as

- measurements, experiments and intelligent data-analysis
- modelling and simulation of systems and processes
- production management and process monitoring/control
- financial models, risk analysis and decision support systems

We train our graduates to combine modeling, computational skills, advanced theory and data analysis in innovative ways. We provide solutions to questions of industrial R&D. Some examples of applications and research areas: inverse problems, stochastic methods, Bayesian methods with MCMC, fuzzy logic and systems, fuzzy methods in knowledge engineering, data assimilation techniques, computational fluid dynamics, wavelets and image/signal analysis, data intensive methods in weather models, forest inventory and environmental monitoring.

Education in Applied Mathematics at LUT is international. One of our goals is the development of university pedagogy in applied mathematics education. We also provide the student with a capability for doctoral studies and independent research.

Requirements for Basic Studies

Students who apply to the Master's Degree programme and major in Technomathematics are assumed to have a B.Sc. in applied mathematics, computer science or information technology. The students should have basic knowledge in computing including data structures and some programming skills. Furthermore, the students must have familiarity with PC work stations and basic data manipulation tools.

Regarding mathematics the student should master calculus, also in functions of several variables. He/she is assumed to know basics of matrices, linear algebra, differential equations and optimization, numerical algorithms, statistics and probability. Knowledge of discrete models, fuzzy models and methods is of great advantage. It is assumed that student has knowledge in physics covering basic phenomena in mechanics, electricity, thermal and wave phenomena. Independence, team work and communication skills are important. The education is given in English, thus good communication skills in English are necessary both orally and in writing.

Contact Information
Programme Coordinator/Technomathematics:
Lecturer, Ph.D. Matti Heiliö (room 1343, firstname.lastname@lut.fi)

The Degree Structure of the Programme

Degree Structure		
General Studies	9	ECTS cr
Major Subject, obligatory studies	17	ECTS cr
Major Subject, elective modules	30	ECTS cr
Minor Subject	20	ECTS cr
Elective Studies	14	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
Total	*120 (min.)*	*ECTS cr*

General Studies 9 ECTS cr

Obligatory Studies (9 ECTS cr)		*year*	*per.*	*ECTS cr*
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV11A9000	Academic Seminar for International Programs		2–4	6
FV18A9101	Finnish 1		1, 3	2

Major Subject, obligatory studies 17 + 30 ECTS cr

Obligatory Studies (47 ECTS cr)		*year*	*per.*	*ECTS cr*
BM20A2101	Differential Equations	M.Sc. (Tech.) 1-2	3	5
BM20A2200	Logic and Discrete Methods	M.Sc. (Tech.) 1	4	4
BM20A2500	Linear Algebra and Normed Spaces	M.Sc. (Tech.) 1-2	1	3
BM20A4000	Case Study Seminar	M.Sc. (Tech.) 1	1-4	5
Thesis	Master's Thesis and Seminar			30

Major Subject, elective modules 30 ECTS cr
Choose two modules from a-d. The extent of each module should be at least 15 ECTS cr.

a) Computational Modelling of Technical Systems

Obligatory Studies (7 ECTS cr)		*year*	*per.*	*ECTS cr*
BM20A2700	Numerical Analysis II	M.Sc. (Tech.) 1	4	3
BM20A2800	Nonlinear Optimization	M.Sc. (Tech.) 1-2	4	4

Elective Studies		*year*	*per.*	*ECTS cr*
BM20A2000	Simulation	M.Sc. (Tech.) 1	1	4
BM20A2600	Integral Transforms	B.Sc. (Tech.) 3	4	3
BM20A3201	Fuzzy Engineering	M.Sc. (Tech.) 1-2	4	5
BM20A3800	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6
BM20A4200	Applied Functional Analysis	M.Sc. (Tech.) 1-2	2-3	5
BM20A4500	Evolutionary Computation	M.Sc. (Tech.) 1-2	2	5

b) Data Analysis and Stochastics

Obligatory Studies (8 ECTS cr)		*year*	*per.*	*ECTS cr*
BM20A1900	Statistics II	M.Sc. (Tech.) 1-2	2	3
BM20A3001	Statistical Analysis in Modelling	M.Sc. (Tech.) 1	2	5

Elective Studies		year	per.	ECTS cr
BM20A2000	Simulation	M.Sc. (Tech.) 1	1	4
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-2	4	5
BM20A3301	Stochastic Theory and Models	M.Sc. (Tech.) 1	4	3-5
BM20A3401	Design of Experiments	M.Sc. (Tech.) 1-2	3	4
BM20A3601	Fuzzy Data Analysis	M.Sc. (Tech.) 1-2	3	5
BM20A3800	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6
BM20A4500	Evolutionary Computation	M.Sc. (Tech.) 1-2	2	5

c) Discrete and Fuzzy Models and Methods

Obligatory Studies (6 ECTS cr)		year	per.	ECTS cr
BM20A3101	Fuzzy Sets and Fuzzy Logic	M.Sc. (Tech.) 1-2	1-2	6

Elective Studies		year	per.	ECTS cr
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-2	4	5
BM20A3201	Fuzzy Engineering	M.Sc. (Tech.) 1-2	4	5
BM20A3601	Fuzzy Data Analysis	M.Sc. (Tech.) 1-2	3	5
BM20A3800	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6

d) Theory of Applied Analysis

Obligatory Studies (8 ECTS cr)		year	per.	ECTS cr
BM20A2600	Integral Transforms	B.Sc. (Tech.) 3	4	3
BM20A4200	Applied Functional Analysis	M.Sc. (Tech.) 1-2	2-3	5

Elective Studies		year	per.	ECTS cr
BM20A1300	Complex Analysis	M.Sc. (Tech.) 1-2	1	3
BM20A1900	Statistics II	M.Sc. (Tech.) 1-2	2	3
BM20A2700	Numerical Analysis II	M.Sc. (Tech.) 1	4	3
BM20A2800	Nonlinear Optimization	M.Sc. (Tech.) 1-2	4	4
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-2	4	5
BM20A3101	Fuzzy Sets and Fuzzy Logic	M.Sc. (Tech.) 1-2	1-2	6
BM20A3301	Stochastic Theory and Models	M.Sc. (Tech.) 1	4	3-5
BM20A3800	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6

Minor Subject 20 ECTS cr
The minor subject will be selected from the minor subject modules available at LUT in English. There might be limitations regarding studies available in English. The minor subject selection should be discussed with the supervising professor or the Master's Degree programme coordinator in Technomathematics.

Elective Studies 14 ECTS cr
Elective courses may be chosen from various subjects. Also studies passed at other universities during exchange programmes can be accepted. The student should discuss the choice of elective

courses with his/her supervisor. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

Master's Thesis and Seminar 30 ECTS cr
Thesis topics arise from various application areas, research projects and contacts with industry. Typically, the thesis contains a theoretical study, as well as the use of up-to-date mathematical and computational methods for solving an application practical problem.

Minor in Technomathematics 20 ECTS cr
Minor in Technomathematics can be studied by students of other Master's Degree programmes. Courses for minor studies can be freely chosen from the courses that laboratory of Applied Mathematics offers in English. However, suitable background knowledge is needed. This means basic knowledge about matrix calculation, optimization, statistics, numerical analysis and especially mathematical programming with some procedural language (preferably Matlab/Octave). These topics are included in courses **BM20A1601 Matrix Calculus, BM20A1700 Optimization, BM20A1400 Statistics I, BM20A1500 Numerical Analysis I and BM20A4300 Introduction to Technical Computation.**

Minimum 20 ECTS credits should be selected

Elective Studies		per.	ECTS cr
BM20A1300	Complex Analysis	1	3
BM20A1900	Statistics II	2	3
BM20A2000	Simulation	1	4
BM20A2101	Differential Equations	3	5
BM20A2200	Logic and Discrete Methods	4	4
BM20A2500	Linear Algebra and Normed Spaces	1	3
BM20A2600	Integral Transforms	4	3
BM20A2700	Numerical Analysis II	4	3
BM20A2800	Nonlinear Optimization	4	4
BM20A2901	Discrete Optimization	4	5
BM20A3001	Statistical Analysis in Modelling	2	5
BM20A3101	Fuzzy Sets and Fuzzy Logic	1-2	6
BM20A3201	Fuzzy Engineering	4	5
BM20A3301	Stochastic Theory and Models	4	3-5
BM20A3401	Design of Experiments	3	4
BM20A3601	Fuzzy Data Analysis	3	5
BM20A3900	Modelling Methodology in Process Engineering	1-2	6
BM20A4000	Case Study Seminar	1-4	5
BM20A4200	Applied Functional Analysis	2-3	5
BM20A4500	Evolutionary Computation	2	5

Complementary Studies (20-60 ECTS cr)
Students with a Finnish polytechnic degree or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska 2 ECTS cr is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further Information
Faculty of Technology, Study Coordinator Jutta Luostarinen
Phone +358 5 621 2268, room 2321, jutta.luostarinen@lut.fi
Study Coordinator Minna Loikkanen
Phone +358 5 621 2268, room 2321, minna.loikkanen@lut.fi

Technical Physics

Students majoring in Technical Physics should have a Bachelor's degree. The aim of the major subject Technical Physics is to prepare the student professionally and academically in physics and other technical science skills in industry and other research and development tasks. The programme also provides the student with readiness for doctoral studies and independent research.

Contact Information
Programme Coordinator, Programme Content/Technical Physics:
Professor, Ph.D. Erkki Lähderanta (room 1372, firstname.lastname@lut.fi)

The Degree Structure of the Programme

Degree Structure		
General Studies	9	ECTS cr
Major Subject	40	ECTS cr
Minor Subject	20	ECTS cr
Elective Studies	21	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
Total	*120 (min.)*	*ECTS cr*

General Studies 9 ECTS cr

Obligatory Studies (9 ECTS cr)		*year*	*per.*	*ECTS cr*
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV11A9000	Academic Seminar for International Programs		2–4	6
FV18A9101	Finnish 1		1, 3	2

Major Subject 70 ECTS cr

Obligatory Studies (65 ECTS cr)		*year*	*per.*	*ECTS cr*
BL50A0600	Electromagnetic compatibility in power electronics	M.Sc. (Tech.) 1	1	2
BM30A0500	Applied Optics	M.Sc. (Tech.) 1	2	6
BM30A1000	Semiconductor Physics	M.Sc. (Tech.) 1	1	6
BM30A1100	Superconductor Physics	M.Sc. (Tech.) 1	2	6
BM30A1500	Advanced Topics in Material Science	M.Sc. (Tech.) 2	2	6
BM30A1600	Microelectronics	M.Sc. (Tech.) 1	1	6
BM30A1700	Physics of Semiconductor Devices	M.Sc. (Tech.) 1-2		3-6
Thesis	Master's Thesis and Seminar			30

Elective Studies		*year*	*per.*	*ECTS cr*
AB30A0300	International Finance and Emerging Markets	M.Sc. (Econ. & Bus. Adm.) 1	2	5
BL30A0600	Power Electronics	M.Sc. (Tech.) 1	1-2	6
BL30A1200	Numerical Methods in Electromagnetism	M.Sc. (Tech.) 2	3	4
BL50A1300	Advanced Course in Electronics	M.Sc. (Tech.) 1	3-4	6
CS10A0050[*]	Introduction to International Business	B.Sc. (Tech.) 2	4	4
CS10A0300	Business Forecasting	M.Sc. (Tech.) 1	1	4
CS10A0850	Transitional Countries Integration with the European Union - Trade, Manufacturing and Labour Perspective	M.Sc. (Tech.) 1	4	5

[*] The course will be studied in the 4th year (M.Sc. (Tech.) 1).

Minor Subject 20 ECTS cr
The minor subject will be selected from the minor subject modules available at LUT in English. There might be limitations regarding studies available in English. The minor subject selection should be discussed with the supervising professor or the Master's Degree programme coordinator in Technical Physics.

Elective studies 21 ECTS cr
The student should discuss the choice of elective courses with his/her supervisor**.** Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

Master's Thesis and Seminar 30 ECTS cr
Thesis topics arise from various application areas, research projects and contacts with different universities. Typically, the thesis contains a theoretical study, experimental part and analyzis of the experimental results.

Minor in Technical Physics 20 ECTS cr
Minor in Technical Physics can be studied by students of other Master's Degree programmes. Minimum 20 ECTS credits should be selected.

Elective Studies		per.	ECTS cr
BM30A0500	Applied Optics	2	6
BM30A1000	Semiconductor Physics	1	6
BM30A1100	Superconductor Physics	2	6
BM30A1500	Advanced Topics in Material Science	2	6
BM30A1600	Microelectronics	1	6

Complementary Studies (20-60 ECTS cr)
Students with a Finnish polytechnic degree or equivalent will have to study complementary studies. The extent of these studies depends on the content of the previous degree. The course FV13A1200 Teknisk svenska 2 ECTS cr is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

Further Information:
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Courses Offered in English

		ECTS cr
BM20A1300	Complex Analysis	3
BM20A1900	Statistics II	3
BM20A2000	Simulation	4
BM20A2101	Differential Equations	5
BM20A2200	Logic and Discrete Methods	4
BM20A2500	Linear Algebra and Normed Spaces	3
BM20A2600	Integral Transforms	3
BM20A2700	Numerical Analysis II	3
BM20A2800	Nonlinear Optimization	4
BM20A2901	Discrete Optimization	5
BM20A3001	Statistical Analysis in Modelling	5
BM20A3101	Fuzzy Sets and Fuzzy Logic	6
BM20A3201	Fuzzy Engineering	5
BM20A3301	Stochastic Theory and Models	3 - 5
BM20A3401	Design of Experiments	4
BM20A3601	Fuzzy Data Analysis	5
BM20A3800	Advanced Mathematical Methods	3 - 6
BM20A3900	Modelling Methodology in Process Engineering	6
BM20A4000	Case Study Seminar	5
BM20A4200	Applied Functional Analysis	5

BM20A4500	Evolutionary Computation	5
BM30A0500	Applied Optics	6
BM30A1000	Semiconductor Physics	6
BM30A1100	Superconductor Physics	6
BM30A1500	Advanced Topics in Material Science	6
BM30A1600	Microelectronics	6
BM30A1700	Physics of Semiconductor Devices	3 - 6
BM30A2000	Magnetism and Magnetic Materials	4

Course Descriptions

BM20A1300	*COMPLEX ANALYSIS*	*3 ECTS cr*
	Complex Analysis	
	The course will be lectured next time during the academic year 2008 - 2009.	
Year and Period	M.Sc. (Tech.) 1-2, Period 1	
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
Aims	Give the students the necessary knowledge of complex analysis needed in technical applications.	
Contents	Complex number arithmetics and roots. Complex functions, also as mappings of complex plane. Derivative of a complex function and analytical functions. Complex integration, Cauchy's theorem and Residue theorem.	
Teaching methods	Lectures 28 h, exercises 14 h, 1st period. Exam.	
Assessment	0-5, examination 100%.	
Course Material	Kreyszig, E.: Advanced Engineering Mathematics, 8th Ed., Part D.	
Prerequisites	Recommended Mathematics A and B.	

BM20A1900	*STATISTICS II*	*3 ECTS cr*
	Statistics II	
Year and Period	M.Sc. (Tech.) 1-2, Period 2	
Lecturer(s)	Lecturer, Ph.D. Matti Heiliö	
Aims	To give the students deeper understanding about statistical hypothesis testing, introduction to distributions of several variables, and multiple regression analysis.	
Contents	Basic data analysis. Statistical inference: hypothesis testing. Nonparametric tests. Distributions of several variables. Correlation. Curve fitting and nonlinear regression. Multiple regression analysis. Elements of time series analysis and decision theory. Introduction to multivariate methods.	
Teaching methods	Lectures 28 h, exercises 14 h, home assignments, 2nd period. Exam.	
Assessment	0-5, examination 70%, home assignments 30%.	
Course Material	Will be announced on lectures.	
Prerequisites	Recommended BM20A1400 Tilastomatematiikka I.	

BM20A2000	*SIMULATION*	*4 ECTS cr*
	Simulation	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	Professor, Ph.D. Heikki Haario	
Aims	The course gives an introduction to the concepts of discrete simulation models and methods together with numerical examples.	
Contents	Basic concepts, discrete and continuous systems. Random numbers, discrete event generation by random numbers. Statistical and empirical distributions for event generation. Application examples: queuing systems, storage size	

Teaching methods	optimization. Building numerical simulation examples with Matlab. Suitable also for postgraduate studies. Lectures 28 h, exercises 14 h, practical assignment, 1st period. Exam.
Assessment	0-5, examination 100%. Practical assignment.
Prerequisites	Recommended BM20A1400 Tilastomatematiikka I.

BM20A2101	*DIFFERENTIAL EQUATIONS*	*5 ECTS cr*

	Differential Equations **Replaces the course BM20A2100 Differential Equations.** **The course will be lectured next time during the academic year 2009 - 2010.**
Year and Period	M.Sc. (Tech.) 1-2, Period 3
Lecturer(s)	Professor, Ph.D. Heikki Haario
Aims	The course introduces the basic concepts of ordinary and partial differential equations together with numerical solution methods.
Contents	Linear and nonlinear ordinary differential equations. Initial and boundary value problems. Stability and phase space presentation of solutions. Numerical solutions for ordinary differential equations with Matlab solvers. Basic types of partial differential equations: advection, diffusion/heat, wave equations. Numerical solutions with semidiscretization methods. Modelling examples from different engineering fields.
Teaching methods	Lectures 28 h, exercises 28 h, 3rd period. Exam.
Assessment	0-5, examination 100%.
Prerequisites	Mathematics A and B.

BM20A2200	*LOGIC AND DISCRETE METHODS*	*4 ECTS cr*

	Logic and Discrete Methods
Year and Period	M.Sc. (Tech.) 1, Period 4
Lecturer(s)	Professor, Ph.D. Jorma K. Mattila
Aims	To introduce essential methods of logic and discrete mathematics for computer science. A student can use these methods in formal environments of computer science and related topics.
Contents	The course consists of classical logic and resolution method, some basic things of non-classical logics, inductive, recursional and relational methods for computer science. An algebraic approach to discrete methods is considered. Suitable also for postgraduate studies.
Teaching methods	Lectures 28 h, exercises 14 h, 4th period. Exam.
Assessment	0-5, examination 100%.
Course Material	Grassmann, W.K., Tremblay J-P.: Logic and Discrete Mathematics. A Computer Science Perspective, Prentice Hall, 1996.

BM20A2500	*LINEAR ALGEBRA AND NORMED SPACES*	*3 ECTS cr*

	Linear Algebra and Normed Spaces
Year and Period	M.Sc. (Tech.) 1-2, Period 1
Lecturer(s)	Lecturer, Ph.D. Matti Heiliö
Aims	Essentials of linear analysis in normed spaces and principles which are needed to understand methods of applied mathematics.
Contents	Vector spaces and linear operators. Linear subspaces and projection. Norms, metric and convergence. Function spaces. Banach spaces, Lp-spaces. Inner product and orthogonality. Hilbert spaces. Theory of matrices, eigenvalues and spectral decomposition. Applications in systems and signal analysis, numerical

Teaching methods	methods, optimization. Suitable also for postgraduate studies. Lectures 21 h, exercises 14 h, 1st period. Exam.
Assessment	0-5, examination 100%.
Course Material	Lay, D.: Linear Algebra and its Applications, Addison-Wesley, 2000. Kreyszig, E.: Introductory Functional Analysis with Applications, Wiley, 1989. Reddy, B.D.: Introductory Functional Analysis, with applications to Boundary Value Problems and Finite Elements, Springer, 1998.
Prerequisites	Recommended BM20A1601 Matriisilaskenta.

BM20A2600   *INTEGRAL TRANSFORMS*   *3 ECTS cr*

Integral Transforms

Year and Period	B.Sc. (Tech.) 3, Period 4
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pasi Luukka
Aims	To show how different transform techniques are used in order to solve certain engineering problems.
Contents	Laplace transform, Fourier transform, z-transform. Examples of applications of transforms in engineering problem solving.
Teaching methods	Lectures 28 h, exercises 14 h, 4th period. Exam.
Assessment	0-5, examination 100%.
Course Material	Kreyszig, E.: Advanced Engineering Mathematics, Wiley, 1999. James, G.: Advanced Modern Engineering Mathematics, Addison-Wesley, 2003.
Prerequisites	Recommended Mathematics A and B.

BM20A2700   *NUMERICAL ANALYSIS II*   *3 ECTS cr*

Numerical Analysis II

Year and Period	M.Sc. (Tech.) 1, Period 4
Lecturer(s)	Professor, Ph.D. Heikki Haario
Aims	An introduction to methods of numerical integration and to solving ordinary and partial differential equations on a computer.
Contents	Numerical differentiation, Numerical integration, Gaussian quadrature, Romberg integration. Numerical solution of ordinary differential equations, Runge-Kutta methods, stiffness and how to deal with it. Numerical solution of simple partial differential equations. Laplace equation, finite difference methods, finite element methods and related matrix computations.
Teaching methods	Lectures 21 h, exercises 14 h, 4th period. Exam.
Assessment	0-5, examination 100%.
Course Material	Will be announced at lectures.
Prerequisites	Mathematics A and B. Recommended BM20A1500 Numeerinen analyysi I.

BM20A2800   *NONLINEAR OPTIMIZATION*   *4 ECTS cr*

Nonlinear Optimization

The course will be lectured next time during the academic year 2009 - 2010.

Year and Period	M.Sc. (Tech.) 1-2, Period 4
Lecturer(s)	Lecturer, Lic.Phil. Sirkku Parviainen
Aims	The course introduces the concepts of nonlinear optimization and provides the basic skills for formulating and solving nonlinear optimization tasks.
Contents	Formulation of optimization models. Classification of optimization problems. Optimization of a function of one variable. Optimality criteria in unconstrained

and constrained optimization. Line search methods, unconstrained multivariate optimization methods. Methods for constrained optimization. Methods for global optimization. Principles of evolutionary algorithms. Introduction to stochastic optimization. Optimization software tools, examples with Matlab. Suitable also for postgraduate studies.

Teaching methods	Lectures 28 h, exercises 14 h, 4th period. Practical assignment. Exam.
Assessment	0-5, examination 100%. Practical assignment.
Course Material	Nocedal, J. and Wright, S. J.: Numerical Optimization, Springer, 2006.
Prerequisites	Mathematics A and B, BM20A1500 Numeerinen analyysi I. Experience in programming or using mathematical software required.

BM20A2901	*DISCRETE OPTIMIZATION*	*5 ECTS cr*

Discrete Optimization

The course will be lectured next time during the academic year 2008 - 2009.

Year and Period	M.Sc. (Tech.) 1-2, Period 4
Lecturer(s)	Lecturer, Lic.Phil. Sirkku Parviainen
Aims	To introduce the student to discrete or combinatorial optimization methods and problems.
Contents	Discrete optimization problems. Algorithms and computational complexity. Polynomial-time problems and NP-complete problems. Integer linear programming. Assignment problem. Traveling salesman problem: solution with branch&bound and heuristic methods. Routing and packing problems: solution with heuristics and dynamic programming. Principles of genetic algorithms and simulated annealing methods in discrete optimization. Suitable also for postgraduate studies.
Teaching methods	Lectures 28 h, exercises 28 h, 4th period. Project work. Exam.
Assessment	0-5, examination 100%. Project work.
Course Material	Will be announced on lectures.
Prerequisites	Experience in programming or using mathematical software required. Recommended BM20A1801 Lineaarinen optimointi.

BM20A3001	*STATISTICAL ANALYSIS IN MODELLING*	*5 ECTS cr*

Statistical Analysis in Modelling

Replaces the course BM20A3000 Statistical Analysis in Modelling.

Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Professor, Ph.D. Heikki Haario
Aims	Introduction to the methods of estimating reliability of modelling.
Contents	Errors and uncertainty in experimental data. Uncertainty in model parameters and prediction results. Bayesian approach for parameter estimation and inverse problems, various Monte Carlo (MCMC) methods for nonlinear models. Suitable also for postgraduate studies.
Teaching methods	Lectures 28 h, exercises 28 h, 2nd period. Practical assignment. Exam.
Assessment	0-5, examination 100%. Practical assignment.
Prerequisites	Mathematics A and B, BM20A1400 Tilastomatematiikka I. Recommended BM20A2000 Simulation.

BM20A3101	*FUZZY SETS AND FUZZY LOGIC*	*6 ECTS cr*
	Fuzzy Sets and Fuzzy Logic	
	Replaces the course BM20A3100 Fuzzy Sets and Fuzzy Logic.	
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2	
Lecturer(s)	Professor, Ph.D. Jorma K. Mattila	
Aims	To introduce mathematics of fuzzy systems. The student will learn the relations between crisp and fuzzy sets and those between algebras of crisp and fuzzy sets, some function algebras, lattices of membership functions and the basic things of L-sets. The student will learn also non-classical logics and some basic things of mathematical fuzzy logic.	
Contents	The course consists of concept of fuzziness, some algebras of fuzzy sets, fuzzy quantities, logical aspects of fuzzy sets, operations of fuzzy sets, relations, universal approximation, fuzzy compositional calculus, fuzzy ranking, aggregation operators, fuzzy screening systems, averaging operators and modifier operations. Suitable also for postgraduate studies.	
Teaching methods	Lectures 56 h, exercises 28 h, 1st-2nd period. Exam.	
Assessment	0-5, examination 100%.	
Course Material	Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000. Klir, G., Yuan, B.:Fuzzy Sets and Fuzzy Logic. Theory and Applications, Prentice Hall, 1995. Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000. Carlsson C. and Fullér, R.: Fuzzy Reasoning in Decision Making and Optimization, Physica-Verlag, 2002.	
Prerequisites	Bachelor level basic math courses.	

BM20A3201	*FUZZY ENGINEERING*	*5 ECTS cr*
	Fuzzy Engineering	
	Replaces the course BM20A3200 Fuzzy Engineering. **The course will be lectured next time during the academic year 2009 - 2010.**	
Year and Period	M.Sc. (Tech.) 1-2, Period 4	
Lecturer(s)	Professor, Ph.D. Jorma K. Mattila	
Aims	To introduce fuzzy systems in engineering environment. The student will learn function approximation methods with fuzzy systems and how to model and solve control problems and neuro-Fuzzy systems.	
Contents	Fuzzy sets and relations, fuzzy functions and rule-based systems, mamdani fuzzy system and Sugeno-Tagaki fuzzy system, universal approximators, fuzzy modelling, fuzzy control, fuzzy controllers in applications. Some image processing techniques. Neuro-Fuzzy systems. Suitable also for postgraduate studies.	
Teaching methods	Lectures 28 h, exercises 14 h, 4th period. Practical assignment. Exam.	
Assessment	0-5, examination 100%. Practical assignment.	
Course Material	Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000. Kosko, B.: Fuzzy Engineering, Prentice-Hall, 1996. Passino, K.M., Yurkovich, S.: Fuzzy Control, Addison-Wesley, 1998.	
Prerequisites	Recommended BM20A2300 Sumeat menetelmät, BM20A3101 Fuzzy Sets and Fuzzy Logic.	

BM20A3301	*STOCHASTIC THEORY AND MODELS*	*3 - 5 ECTS cr*
	Stochastic Theory and Models	
	Replaces the course BM20A3300 Stochastic Theory and Models.	
Year and Period	M.Sc. (Tech.) 1, Period 4	
Lecturer(s)	Lecturer, Ph.D. Matti Heiliö	
Aims	To present theory of stochastics and advanced statistical methods for understanding systems and phenomena containing randomness and uncertainty.	
Contents	Theory of stochastics applicable to modelling and analysing systems where randomness is inherent in a non-trivial way. Stochastic processes, conditional expectations and martingales. Brownian motion, introduction to Ito-integral and stochastic differential equations. Time series and ARMA-models. Regression and linear statistical models. Analysis and identification of nonlinear statistical models. Bayesian and MCMC methods. Suitable also for postgraduate studies.	
Teaching methods	Lectures 14 h, exercises 14 h, project assignment, self-study material, 4th period. The course is also available as virtual web-course (in Finnish). Exam.	
Assessment	0-5, examination 50%, project assignment 50%.	
Course Material	Will be announced at lectures.	
Prerequisites	BM20A1400 Tilastomatematiikka I. Recommended BM20A1900 Statistics II, BM20A2500 Linear Algebra and Normed Spaces.	

BM20A3401	*DESIGN OF EXPERIMENTS*	*4 ECTS cr*
	Design of Experiments	
	Replaces the course BM20A3400 Design of Experiments. **The course will be lectured next time during the academic year 2009 - 2010.**	
Year and Period	M.Sc. (Tech.) 1-2, Period 3	
Lecturer(s)	Professor, Ph.D. Heikki Haario	
Aims	Introduction to the basic concepts for efficient planning of experiments.	
Contents	Importance of experimental design, minimization of prediction uncertainty. Basic factorial designs: 2N, Central Composite designs for regression analysis. Variance analysis for qualitative factors. The Taguchi principles. Experimental optimisation of engineering processes. Suitable also for postgraduate studies.	
Teaching methods	Lectures 28 h, exercises 14 h, project work, 3rd period. Exam.	
Assessment	0-5, examination 100%. Project work.	
Prerequisites	Mathematics A and B, BM20A1400 Tilastomatematiikka I.	

BM20A3601	*FUZZY DATA ANALYSIS*	*5 ECTS cr*
	Fuzzy Data Analysis	
	The course will be lectured next time during the academic year 2008 - 2009.	
Year and Period	M.Sc. (Tech.) 1-2, Period 3	
Lecturer(s)	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
Aims	To introduce theoretical aspects of data analysis. The student will learn how to model and analyze uncertainty in different problem settings.	
Contents	Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Principles of individual multiperson, multicriteria and	

	multidecision making, fuzzy interpolation, fuzzy principle component analysis, fuzzy clustering and classification, fuzzy regression analysis. Evaluation of methods. Suitable also for postgraduate studies.
Teaching methods	Lectures 28 h, exercises 28 h, 3rd period. Practical assignment. Exam.
Assessment	0-5, examination 100%. Practical assignment.
Course Material	Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.
Prerequisites	Recommended BM20A2300 Sumeat menetelmät and BM20A3101 Fuzzy Sets and Fuzzy Logic.

BM20A3800	ADVANCED MATHEMATICAL METHODS	3 - 6 ECTS cr
	Advanced Mathematical Methods	
Year and Period	M.Sc. (Tech.) 1, Period 1-4	
Lecturer(s)	Lecturer, Ph.D. Matti Heiliö	
Aims	Student will obtain theoretical and operational skills in some specific area of applied mathematics.	
Contents	The course will demand reading literature, working on exercises and practical projects. Material will be individually chosen according to the focus of the study module, students' interests and research task. The topic may be for example optimization, numerical methods, PDE:s, stochastics, theory of algorithms, wavelets, filtering, systems analysis etc. The course with the same title can be included in the study programme twice when two distinct areas are covered. Suitable also for postgraduate studies.	
Teaching methods	Self study material, exam and/or report.	
Assessment	0-5, examination and/or report 100%.	
Prerequisites	Recommended BM20A1500 Numeerinen analyysi I, BM20A1601 Matriisilaskenta.	

BM20A3900	MODELLING METHODOLOGY IN PROCESS ENGINEERING	6 ECTS cr
	Modelling Methodology in Process Engineering	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	Researcher/Teacher, Ph.D. Tuomo Kauranne	
Aims	The course provides an overview to the concepts and techniques of mathematical modelling in process engineering.	
Contents	Types of modelling: empirical and physicochemical models and the use of them. Measurement of uncertainty in experimental data. Basic concepts of regression methods for empirical models. Building physicochemical models for engineering processes from first principles. How to employ various mathematical tools to formulate and numerically solve models. Least squares methods, curve fitting and parameter estimation. Examples from data analysis, process modelling, pulp and paper technology, chemical engineering, and signal processing among others. Examples and exercises with Matlab.	
Teaching methods	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Assessment	0-5, examination 100%. Practical assignment.	
Course Material	Giordano, Frank R. - Weir, Maurice D. - Fox, William P.: A first course in mathematical modeling, Brooks/Cole, 1997. Borrelli, R., Coleman, C.: Differential Equations: A Modeling Perspective, John Wiley & Sons, 2003. Svobodny, T.: Mathematical Modeling for Industry and Engineering, Prentice Hall, 1998.	
Prerequisites	Mathematics A and B. Recommended BM20A1400 Tilastomatematiikka I, BM20A1500 Numeerinen analyysi I, BM20A1601 Matriisilaskenta, BM20A2101 Differential Equations.	

BM20A4000	CASE STUDY SEMINAR	5 ECTS cr
	Case Study Seminar	
Year and Period	M.Sc. (Tech.) 1, Period 1-4	
Lecturer(s)	Professor, Ph.D. Heikki Haario	
Aims	The course gives an introduction to independent scientific work by presenting seminar works from different fields of applied mathematics.	
Contents	The course works in a seminar form. Each student receives a project work topic and presents the problem as well as the work plan in the beginning. Typically, the topics cover modelling problems from different engineering fields, together with numerical solutions. Solution methods for the project work problems are discussed during the course. At conclusion, the participants present their project works. Suitable also for postgraduate studies.	
Teaching methods	Exercises 14 h, 1st period. Exercises 14 h, 2nd period. Exercises 14 h, 3rd period. Exercises 14 h, 4th period. Extended project work. Seminar is held in each period.	
Assessment	Pass/fail. To pass the course student must attend 7 weeks and present his/her project work.	
Prerequisites	Mathematics A and B. Recommended BM20A1500 Numeerinen analyysi I, BM20A1601 Matriisilaskenta, BM20A3900 Modelling Methodology in Process Engineering.	

BM20A4200	APPLIED FUNCTIONAL ANALYSIS	5 ECTS cr
	Applied Functional Analysis	
	Replaces the course BM20A3500 Functional Analysis. **The course will be lectured next time during the academic year 2008 - 2009.**	
Year and Period	M.Sc. (Tech.) 1-2, Period 2-3	
Lecturer(s)	M.Sc. (Tech.) Jouni Sampo	
Aims	To introduce some specific area of applied functional analysis. Topic may change every year. Academic year 2008-2009 subject is "Wavelet and multiscale transforms with applications".	
Contents	Academic year 2008-2009: Elementaries of orthogonal and bi-orthogonal bases and frames, continuous and discrete wavelet transforms, properties of wavelet basis, multiresolution analysis, filter banks, implementation of wavelet transform in 1-D and 2-D, geometric multiscale transforms, applications (especially compression and denoising of signals and images). Suitable also for postgraduate studies.	
Teaching methods	Lectures 28 h, exercises 14 h, 2nd period. Seminars 7 h and project work and seminar presentation, 3rd period. Exam.	
Assessment	0-5, examination 100%. Project work and seminar presentation.	
Course Material	Will be announced at lectures.	
Prerequisites	Recommended BM20A2500 Linear Algebra and Normed Spaces.	

BM20A4500	EVOLUTIONARY COMPUTATION	5 ECTS cr
	Evolutionary Computation	
	The course will be lectured next time during the academic year 2008 - 2009.	
Year and Period	M.Sc. (Tech.) 1-2, Period 2	
Lecturer(s)	Saku Kukkonen	
Aims	Familiarize with the basics and applications of evolutionary computation (EC).	

Contents	Learn to apply, implement, and modify evolutionary algorithms. Learn their application areas and restrictions. Learn to apply evolutionary algorithms to complex problems and to solve practical problems in the student's own specialization. Introduction to evolutionary computation and its applications. Structure, components, and characteristics of evolutionary algorithms. Evolutionary problem solving, searching, and optimization. Different evolutionary algorithms, especially Differential Evolution (DE). Practical problem solving and multiobjective optimization using evolutionary algorithms. Suitable also for postgraduate studies.
Teaching methods	Lectures 28 h, exercises 14 h, project work and seminars (about 7 h), 2nd period. Exam.
Assessment	0-5, examination 100%. Project work.
Course Material	Haupt, R. L., Haupt, S. E.: Practical Genetic Algorithms, Wiley, 1998. Eiben, A. E., Smith, J. E.: Introduction to Evolutionary Computing, Springer-Verlag, 2003. Price, K. S., Storn, R. M., Lampinen, J. A.: Differential Evolution, A Practical Approach to Global Optimization, Springer, 2005. Other material given in lectures.
Prerequisites	Programming skill using some programming language is needed. Also, following courses might be helpful: BM20A1700 Optimoinnin perusteet, CT20A0200 Ohjelmoinnin perusteet, CT20A0210 Käytännön ohjelmointi and CT20A2310 Tietorakenteet ja algoritmit.

BM30A0500	APPLIED OPTICS	6 ECTS cr
	Applied Optics	

Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Lecturer, Ph.D. Pertti Silfsten
Aims	The aims of the course are to describe basic optical phenomena and their applications particularly in the field of optical measurement technology and to provide the students with the skills to understand the operation of optical measurement instruments.
Contents	Ocular optics. Optical measurement instruments. Interferometry. Polarisation. Diffraction. Fourier optics. The optical properties of materials.
Teaching methods	Lectures 42 h, tutorials 28 h, 2nd period. Written examination.
Assessment	0-5, examination 100%.
Course Material	Pertti Silfsten: Sovellettu optiikka.
Prerequisites	Students are recommended to have completed Physics or Physics L.

BM30A1000	SEMICONDUCTOR PHYSICS	6 ECTS cr
	Semiconductor Physics	

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, Ph.D. Erkki Lähderanta
Aims	The course gives the student the skills to understand the behaviour of semiconductors. This understanding is based on the comprehension of the electron dynamics and the energy band.
Contents	A basic knowledge of the phenomena governing the operation of semiconductors, starting from the basis of material physics.
Teaching methods	Lectures 42 h, tutorials 28 h, 1st period. Written examination.
Assessment	0-5, examination 100%.
Course Material	Juha Sinkkonen: Puolijohdeteknologian perusteet.
Prerequisites	A knowledge of the fundamentals of material physics, a knowledge of the electric and physical properties of materials.

BM30A1100	*SUPERCONDUCTOR PHYSICS*	*6 ECTS cr*
	Superconductor Physics	
Year and Period	M.Sc. (Tech.) 1, Period 2	
Lecturer(s)	Professor, Ph.D. Erkki Lähderanta	
Aims	The course gives the student the skills to understand the behaviour of superconductors. The student is acquainted with different properties of superconductors.	
Contents	A basic knowledge of the physical behaviour of superconductors, starting from the basis of material physics.	
Teaching methods	Lectures 42 h, tutorials 28 h, 2nd period. Written examination.	
Assessment	0-5, examination 100%.	
Course Material	A.C. Rose-Innes and E.H. Rhoderick: Introduction to Superconductivity, second edition (Pergamon).	
Prerequisites	A knowledge of the fundamentals of material physics, a knowledge of the electric and physical properties of materials.	

BM30A1500	*ADVANCED TOPICS IN MATERIAL SCIENCE*	*6 ECTS cr*
	Advanced Topics in Material Science	
Year and Period	M.Sc. (Tech.) 2, Period 2	
Lecturer(s)	Visiting lecturers	
	Lecturer(s) responsible: Professor, Ph.D. Erkki Lähderanta	
Aims	The aim of the course is to introduce students to selected topics of advanced physics, especially in the area of nanophysics.	
Contents	Nanophysics, applied superconductivity, ferroelectrics, other advanced topics in material science connected to nanophysics. Suitable also for postgraduate studies.	
Teaching methods	Lectures and exercises 24 h, 2nd period.	
Assessment	Written examination, 100%.	
Course Material	To be given in the lectures.	
Prerequisites	BM30A1000 Semiconductor Physics	
	BM30A1100 Superconductor Physics	

BM30A1600	*MICROELECTRONICS*	*6 ECTS cr*
	Microelectronics	
Year and Period	M.Sc. (Tech.) 1, Period 1	
Lecturer(s)	Part-time Untenured Teacher, N. N.	
	Lecturer(s) responsible: Professor, Ph.D. Erkki Lähderanta	
Aims	To acquaint students with integrated circuit technology and provide them with skills for analog IC design. Students will learn the most important variables and functions related to the components of integrated circuits. Components will be modelled with simulation programs. The assignment of IC design will be carried out with a suitable design program.	
Contents	Semiconductor physics for the analysis of the operation of components. The geometry and design rules of IC components. PN junctions, MOS, BJT, and passive components in IC.	
Teaching methods	Lectures 28 h, tutorials 28 h, 1st period. Assignment and its presentation. Written examination.	
Assessment	0-5, examination 100%. Satisfactorily completed assignment required.	
Course Material	Roger T. Howe, Charles G. Sodini: Microelectronics An Integrated Approach.	
Prerequisites	Students are recommended to have completed the courses BL40A1710 Digitaalielektroniikka A and BL50A1400 Analogiaelektroniikka.	

BM30A1700	*PHYSICS OF SEMICONDUCTOR DEVICES*	*3 - 6 ECTS cr*
	Physics of Semiconductor Devices	
Year and Period	M.Sc. (Tech.) 1-2	
Lecturer(s)	Part-time Untenured Teacher, N. N.	
	Lecturer(s) responsible: Professor, Ph.D. Erkki Lähderanta	
Aims	To provide the student with an in-depth knowledge of semiconductor devices and their operation.	
Contents	Structure, operation and physics of semiconductor devices.	
Teaching methods	Special assignment.	
Assessment	Pass/fail, special assignment 100%.	
Course Material	Sze, Physics of Semiconductor Devices.	

BM30A2000	*MAGNETISM AND MAGNETIC MATERIALS*	*4 ECTS cr*
	Magnetism and Magnetic Materials	
	The course will be lectured every second year, the first time during the academic year 2008-2009.	
Year and Period	M.Sc. (Tech.) 1, Period 4	
Lecturer(s)	Lecturer(s) responsible: Professor, Ph.D. Erkki Lähderanta	
Aims	Microscopic basics for magnetism and interactions in magnetism. Because magnetism is a quantum mechanical phenomena, knowledge of quantum mechanics is upgraded first. Purpose is to have deep understanding of magnetic phenomena.	
Contents	Basics of quantum mechanics. Diamagnetism and paramagnetism. Magnetic interactions. Ferromagnetism and antiferromagnetism. Other classes of magnetic ordering. Magnetic materials. Suitable also for postgraduate studies.	
Teaching methods	Lectures 21 h, exercises 14 h, 4th period.	
Assessment	0-5, exam 100%.	
Prerequisites	Recommended BM30A0910 Materiaalifysiikka A and BM30A0920 Materiaalifysiikka B.	

12 Degrees in Business Administration

The following lower and higher university degrees can be obtained at the LUT, School of Business:

- Bachelor of Science (Economics and Business Administration) (B.Sc. (Econ. & Bus. Admin.)), workload 180 ECTS credits, duration approximately 3 years (=lower university degree)
- Master of Science (Economics and Business Administration) (M.Sc. (Econ. & Bus. Admin.)), workload 120 ECTS credits, duration approximately 2 years (=higher university degree)

Students complete the Bachelor's degree first and continue then to Master's degree studies.

In Master's degree programmes only the degree of Master of Science (Economics and Business Administration) is completed. Students admitted into Master's degree programmes are selected through a special application system.

Degree studies are completed in accordance with the Government Decree on University Degrees (794/2004) and the LUT Administrative Regulations on Teaching and Studying. The degree entered into force on 1 August 2005 and the LUT Administrative Regulations entered into force on 1st January 2007.

General information

Study Modules
The B.Sc. (Econ. & Bus. Admin.) degree consists of the following study modules: general studies obligatory for all, basic and intermediate studies in the student's major subject, minor studies, language and communication studies and elective studies. Each study module has its own objectives, which determine the different forms of teaching applied.

The M.Sc. (Econ. & Bus. Admin.) degree consists of advanced studies, minor studies, language and communication studies and elective studies.

General Studies
General studies provide basic, general information regarding the field. They aim at providing an extensive basis for the degree, and the knowledge and skills required for other study modules. General studies are obligatory and required of all students.

Basic and Intermediate Studies
Basic and intermediate studies develop the student's scientific and professional knowledge and skills and concentrate on disciplines important for the major subject. Intermediate studies in the student's major subject include a Bachelor's thesis (10 ECTS credits) and a related maturity test.

Advanced Studies
Advanced studies develop previously acquired problem recognition and solving skills by integrating and applying knowledge. The student continues his or her specialisation in selected areas. Advanced studies in the student's major subject include a Master's thesis (30 ECTS credits) and a related maturity test.

Elective Studies
The degree also includes elective studies. The amount of elective studies depends on the student's individual study plan. Elective studies are included in the Bachelor's and Master's degrees in order to obtain the required 180 and 120 ECTS credits, respectively. Elective studies may include any

university-level courses, e.g. any courses given at LUT, including those in the field of technology or languages. (Notice: this does not concern the MITIM-program)

Course

A course is the basic unit of studies. It is an independent entity with specific learning outcomes. Courses included in the student's major subject are determined on the basis of the objectives and contents of the major subject. A course may include different forms of teaching and studying, such as literature, lectures, assignments, tutorials, independent research and combinations of the above. Courses can be obligatory, optional or elective in accordance with the curriculum.

Study Module

Major or minor subject study modules are composed of courses from one discipline or more. Each study module is on a specific, coherent topic or field.

Measurement of Studies

Studies are measured in credits, which indicate the input required for each course. The average annual workload of a student is 1600 hours of work, which is worth 60 ECTS credits. One credit refers to an average input of 26 hours of work by a student.

Major Subjects and Learning Outcomes

At Lappeenranta University of Technology there are nine major subjects that lead to a Master's degree in Economics and Business Administration:

- Supply Management
- Management and Organizations
- International Marketing
- Accounting
- Finance
- Strategy Research
- Knowledge Management
- Business Law
- International Technology and Innovation Management (an international master's degree program)

Supply Management

When modern businesses focus on their core know-how, they acquire more goods from outside and increasingly outsource services. Therefore, the importance of the management of supplies and external resources is emphasized as a success factor.

The aim of Supply Management is to provide students with the basic knowledge and skills required in supply planning and management in companies. The learning outcomes include the ability to manage challenges related to acquisitions in the corporate world. A supply management professional should understand the escalating internationalization and its demands with regard to international trade, and the possibilities opened up by electronic commerce. Flexible businesses that operate in the network economy require a new approach to supply relations. Supply management training provides a basis for logistics and supply management and professional tasks in different businesses in trade and industry and for teaching and research in the field.

Management and Organizations

Management and Organizations provides professional expertise in the management and development of a corporate organization from the human resources viewpoint. The subject especially focuses on human resource management and SME management. Entrepreneurship is

also emphasized throughout the studies. In addition, the subject underlines knowledge of organizational culture and values and its application as well as organizational psychology. Another objective is to give students theoretical and methodological knowledge and skills for research and postgraduate studies and for applying research results to the development of a company's activity.

Students of Management and Organizations find employment in various management tasks, e.g. consulting, which requires an understanding of the overall dynamics of business activity and administration, or management tasks in SMEs. The studies provide information on launching a business and developing internal entrepreneurship in large-scale business organizations. Due to the contents of the studies, employment in tasks requiring expertise in human resources and education is also possible.

International Marketing

The learning outcomes of International Marketing include the ability to work in tasks related to international business. The studies emphasise the marketing of high technology products and industrial products, international experience and extensive language skills. Some of the courses are in English and are sometimes given by international visiting lecturers.

A degree in International Marketing can include minor studies in not only business administration but also e.g. Industrial Engineering and Management or technology. The studies contain a great deal of practical assignments, case work and projects for companies. The curriculum also includes an obligatory student exchange period in one of the university's many cooperation universities abroad. The number of optional courses is rather high, which along with studies abroad contributes to a flexible and diverse study programme.

International Marketing graduates have extensive marketing know-how combined with technological expertise and international experience. Consequently, graduates have good possibilities to find employment in demanding tasks related to marketing and international business. Graduates have traditionally found positions in their own field of expertise.

Accounting

Major studies in Accounting provide students with the skills and knowledge to produce, analyse and utilise financial information needed in decision-making. In their studies, students may focus on management accounting (e.g. cost accounting, investment accounting, budgeting and financial management) or financial reporting (e.g. accounting, financial statement planning and analysis, taxation and auditing). Accounting studies are organized in cooperation with the Department of Industrial Engineering and Management. Minor studies in especially Business Law and Finance support major studies in Accounting. In addition to professional skills, major studies in Accounting provide skills and knowledge required in research and postgraduate studies.

Accounting graduates are usually employed in management positions and tasks requiring expertise in businesses and public organizations. They are often employed as accounting officers, financial directors, controllers, financial managers, management consultants, internal auditors and independent auditors. Those who have carried out their major studies in Accounting may also find work in various educational positions and as independent entrepreneurs in the field.

Finance

Major studies in Finance are a well coordinated combination of courses on corporate finance and investments. Courses on corporate finance include the following issues: corporate finance planning, investment accounting and decision-making, decision-making concerning capital structure and dividends and related effects. Courses on investments deal with e.g. financial markets and their activity, valuation models and processes of securities, management of an investment portfolio, pricing of derivative instruments and risk management.

The learning outcomes of the studies in Finance include sufficient, extensive and practical basic knowledge on all of the areas of finance and the competence for demanding professional tasks in the field in both Finland and abroad. The most potential employers are investment and commercial banks, brokerages, consulting and industrial companies, investment funds and insurance companies

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The MITIM program is designed to give future managers the analytical and managerial skills necessary to succeed in the international business field of technology and innovations. Graduates are trained to understand the specifics of international business environments, cross-border movement of goods, people and technology, and the management of technologically oriented organizations in the global markets.

The MITIM program focuses on close cooperation between business education and the business community, integrating knowledge and best practices. All students will receive the unique opportunity to complete their summer internships in leading international technology oriented companies in Russia and Finland.

The program leads to the degree of Master of Science in Economics and Business Administration at Lappeenranta University of Technology, School of Business (LUT) and the degree of Master of Management at St. Petersburg State University, School of Management (GSOM).

Internship

Both the Bachelor's and Master's degree in Economics and Business Administration may include an optional or an obligatory internship worth a maximum of 10 ECTS credits. Two consecutive weeks of internship are worth one credit. Before the internship begins, students must contact the professor in charge of the major subject to find out what kind of internship can be included in the degree. Priority is given to Erasmus internship. After the internship students prepare a report on the internship, what it was like and how it was connected with the studies. The report, an informal application for including the internship in the studies and a work certificate is submitted to the professor in charge of the subject or someone assigned by the professor, who will then decide on the inclusion.

Business Administration Degree Structure

Bachelor of Science (Economics and Business Administration) 180 ECTS credits

- Compulsory general studies (min. 60 ECTS cr)
- Language and communication studies (16-25 ECTS cr)
- Basic and intermediate studies in the major subject, including a Bachelor's thesis and a related maturity test (min. 60 ECTS cr)
- Minor studies (min. 25 ECTS cr)
- Elective studies (10-19 ECTS cr)

Master of Science (Economics and Business Administration) 120 ECTS credits

- Advanced studies in the major subject, including a Master's thesis and a related maturity test (min. 60 ECTS cr)
- Language and communication studies (11 ECTS cr)
- Minor studies (min. 25 ECTS cr)
- Elective studies (24 ECTS cr)

Important Information on Preparing a Personal Study Plan

- **<u>Important!</u> Either the B.Sc. or M.Sc. (Econ. & Bus.Adm.) degree must include one university-level minor subject in economics (= Accounting, Finance, Supply Management, Int. Marketing, Business Law, Management and Organizations, Knowledge Management, Economics, SME Development).**

- **In a minor subject students must first carry out basic studies before they can take intermediate studies.**

- In the B.Sc. (Econ. & Bus.Adm.) degree, part of the general studies will be transferred to the major studies where they will be included in the total number of credits. One course in general studies can only be included in one part of the study plan (e.g. Introduction to Accounting and Finance is transferred to the Accounting study module) This applies also to other studies.

- If you can not otherwise obtain the required number of credits (180/120), you need to include elective studies into your degree (any courses at LUT are acceptable, including language courses). The amount of elective studies depends on your individual study plan.

- **Further information on the degree structure is available in Finnish at http://www.lut.fi/kati/opiskelu_ohjeita.php**

- **Postgraduate degrees (Licentiate and Doctor of Science (Economics and Business Administration)) can only include courses that have not yet been included in the person's undergraduate degree.**

13 Master's Degree Program (CBU) in Business and Administration - *International Technology and Innovation Management (MITIM)*

The Master's Degree Program in International Technology and Innovation Management is the result of cooperation between two universities in Finland and Russia: the Graduate School of Management (GSOM) of St. Petersburg State University and Lappeenranta University of Technology's School of Business.

The Master's degree program titled as "International Technology and Innovation Management", takes two years, corresponds to 120 ECTS credits and leads to the degrees of Master of Science in Economics and Business Administration at LUT, School of Business and Master of Management at GSOM. Thus students admitted into the program receive a degree certificate from both universities. Three semesters include obligatory lectures and exercises, as well as a summer internship and essay and elective courses. The fourth semester is devoted to the Master's thesis. The language of tuition in the program is English. In the autumn of 2008 students will study at GSOM in St. Petersburg.

Master of Science in Economics and Business Administration

The Degree Structure

General Studies	6	*ECTS cr*
Major Subject	66	*ECTS cr*
Minor Subject	30	*ECTS cr*
Elective Studies	18	*ECTS cr*
Credits	*120 (min.)*	*ECTS cr*

Major Subject (66 ECTS cr)

International Technology and Innovation Management

All the courses are obligatory		*year*	*per.*	*ECTS cr*
AC60A0000	Cross-Cultural Management and Corporate Social Responsibility in the Information Age	M.Sc. 1	1-2	6
AC60A0050	Knowledge Management as a Theory and Practice	M.Sc. 1	1-2	6
AC60A0200	Supply and Innovation Management	M.Sc. 1	3-4	6
AC60A0250	International High Technology Marketing	M.Sc. 1	4	6
AC60A0300	Economics of Innovation and Intellectual Capital	M.Sc. 1	4	6
CS30A6100	Technology Management	M.Sc. 1	1-2	6
AC60A9000	Research Seminar for Master's Thesis	M.Sc. 2	3-4	30

Minor Subject (30 ECTS cr)

Business Administration in CBU

All the courses are obligatory		*year*	*per.*	*ECTS cr*
AB30A0550	International Financial Management	M.Sc. 1	3	6
AC60A0150	Strategic Management of Growth	M.Sc. 1	3	6
AC60A5000	Managerial Economics	M.Sc. 1	1-2	6
AC60A5100	Consulting Project	M.Sc. 1	1-2	6
	Summer Internship + Essay	M.Sc. 2		6

General Studies (6 ECTS cr)

AC60A0100	Qualitative and Quantitative Methods for Business Research	M.Sc. 1	1-2	6

Elective Studies (18 ECTS cr)

Min. 18 ECTS credits should be selected from GSOM or LUT School of Business or from other co-operation universities

Electives from GSOM	year	per.	ECTS cr
European Union – Russia Relations	M.Sc. 2		5
Business-Government Relations	M.Sc. 2		5
Economics of Information Technology and Telecommunications Network	M.Sc. 2		5
Emerging Markets	M.Sc. 2		5
Business in Arab World	M.Sc. 2		5
Relationship Marketing and Network Approach in Marketing	M.Sc. 2		5
Marketing Communications	M.Sc. 2		5
Knowledge Engineering	M.Sc. 2		5
International Retail Management	M.Sc. 2		5
Business Process Modelling	M.Sc. 2		5
Knowledge Management Technologies	M.Sc. 2		5
E-Business and Web-Technologies	M.Sc. 2		5
Enterprise Information Systems	M.Sc. 2		5

Electives from LUT School of Business		year	per.	ECTS cr
AB30A0600	Empirical Research in Accounting and Finance	M.Sc. 2	3-4	7
AC40A0100	Cross-Cultural Marketing Strategies	M.Sc. 2	2	5
AC40A0150	Integrated Marketing Communication	M.Sc. 2	4	5
AC40A0200	Internationalization of the Firm	M.Sc. 2	2	5
AC40A0650	International Business Strategies	M.Sc. 2	1-2	5
AC50AJ200	Collaborative Innovation and Innovativeness	M.Sc. 2	3	7
AC60A0350	Multivariate and Econometric Analysis Methods	M.Sc. 2	1-2	6
AC60A0400	International Accounting and Analysis	M.Sc. 2	1 / 2	6
CS10A0600	Doing Business in Transitional Economies	M.Sc. 2	3-4	7

Additional Information

Master's Thesis
The Master's thesis is a demanding research project carried out in the field of the student's major subject.

Language Studies
Students of LUT School of Business will have to take complementary language studies of a minimum of 9 ECTS credits of one language. These studies are not included in the Master's degree, but are an addition to it.

Contact Information
Program Coordinator:
Professor, Ph. D. Minna Martikainen (**minna.martikainen@lut.fi**), program content

International Officer:
Essi Reponen (room 7385.1, **essi.reponen@lut.fi**), practical issues

Program web pages: **http://www.lut.fi/kati/lsb/**

Courses Offered in English

		ECTS cr
AB30A0550	International Financial Management	6
AB30A0600	Empirical Research in Accounting and Finance	7
AC40A0100	Cross-Cultural Marketing Strategies	5
AC40A0150	Integrated Marketing Communication	5
AC40A0200	Internationalization of the Firm	5
AC40A0650	International Business Strategies	5
AC60A0000	Cross-Cultural Management and Corporate Social Responsibility in the Information Age	6
AC60A0050	Knowledge Management as a Theory and Practice	6
AC60A0100	Qualitative and Quantitative Methods for Business Research	6
AC60A0150	Strategic Management of Growth	6
AC60A0200	Supply and Innovation Management	6
AC60A0250	International High Technology Marketing	6
AC60A0300	Economics of Innovation and Intellectual Capital	6
AC60A0350	Multivariate and Econometric Analysis Methods	6
AC60A0400	International Accounting and Analysis	6
AC60A5000	Managerial Economics	6
AC60A5100	Consulting Project	6
AC60A9000	Research Seminar for Master's Thesis	30
CS10A0600	Doing Business in Transitional Economies	7
CS30A6100	Technology Management	6

Course Descriptions

AB30A0550	*INTERNATIONAL FINANCIAL MANAGEMENT 6 ECTS cr*
	International Financial Management
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen
Aims	The aim of the course is to provide an analytic framework for understanding how cross-border financing, valuation, risk management, and investment decisions are influenced by a variety of factors including exchange rates, legal rules, international tax considerations and country risks. The course provides the understanding how firms can create, measure, and sustain value across borders.
Contents	The course consists of the four different areas in international financial management. The part including currencies and asset prices concentrates in the mechanisms of exchange rates. The area of multinational financial decision making considers several of the central financial decisions multinational firms must make. The part of cross-border valuation and financing considers how the valuation and financing decisions must be modified in a cross-border setting. Institutions and Finance part includes the topics of investors' behavior and risk management.
Teaching methods	Lectures 24 h, 3rd period. Course work (Assignment on a topic of mutual agreement, which can be written individually or in groups of up to three members). Exam.
Assessment	Graded 0–5 based 80% on an exam and 20% on course work.
Course Material	Madura, J., International Financial Management, 8th edition, or later version Handouts in the class and all additional material required by the lecturer.
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)

AB30A0600	EMPIRICAL RESEARCH IN ACCOUNTING AND FINANCE	7 ECTS cr
	Empirical Research in Accounting and Finance	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3-4	
Lecturer(s)	Docent, D.Sc. (Econ. & Bus. Adm.) Jussi Nikkinen Lecturer(s) responsible: Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen	
Aims	The course has the following three objectives. First, the course provides an overview of recent relevant research issues in accounting and finance, thereby extending and deepening students' knowledge in the area of accounting and finance. Second, the course in intended to prepare students to do empirical research in accounting and finance.	
Contents	Relevant research issues related to financial reporting; corporate governance; agency relationships; managerial incentive plans; market efficiency; information content of asset prices; accounting, capital markets and financial institutions; international financial markets.	
Teaching methods	Lectures/seminar 21 h. Over the course of the term there will be two to three assignments, such as an article analysis. The aim of these assignments is to get students to understand the principles of deductive empirical research. The main course requirement is to write a term paper from the area of accounting or finance containing at minimum a detailed well-developed research proposal.	
Assessment	Graded 0–5 on the basis of the term paper.	
Course Material	There is no textbook. Issues covered in class will be based on research papers and articles.	
Prerequisites	Compulsory B.Sc. courses in Accounting or in Finance (except Bachelor's thesis). AC40A0010 Tilastollisen analyysin perusteet (Basic Course in Statistical Analysis Method) and AB40A0100 Monimuuttujamenetelmät (Multivariate Analysis Methods or Ka6710100 Quantitative Research Methods I)	

AC40A0100	CROSS-CULTURAL MARKETING STRATEGIES	5 ECTS cr
	Cross-Cultural Marketing Strategies	
	All instruction will be in English.	
Year and Period	B.Sc. (Econ. & Bus. Adm.) 2, Period 2	
Lecturer(s)	Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio	
Aims	To familiarize the students with the factors in the cultural environment of business and to help them understand how these factors affect international marketing strategies.	
Contents	Central concepts in understanding culture and its role in business: dimensions and categorizations of culture, sense of time and space, communication and negotiation styles. Understanding the effects of globalization on culture. Using cultural concepts to analyze how firms adapt their marketing strategies to foreign cultures.	
Teaching methods	14 hours of lectures, assignments, written exam.	
Assessment	0-5, written exam 60%, assignments 40%.	
Course Material	1. Selected chapters of Usunier (2000): Marketing Across Cultures, Prentice Hall. 2. Assigned reading.	
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet or Ka6720000 Markkinoinnin ja hankintatoimen perusteet	

AC40A0150	*INTEGRATED MARKETING COMMUNICATION 5 ECTS cr*
	Integrated Marketing Communication
	All instruction will be in English.
Year and Period	B.Sc. (Econ. & Bus. Adm.) 3, Period 4
Lecturer(s)	Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
Aims	To familiarize the student with the concept and process of marketing communication. To give the students basic skills in the design, implementation and management of communication as part of the marketing process.
Contents	The role of marketing communication in the marketing strategy of an enterprise. The concept and implementation of integrated marketing communication. The design, implementation and management of advertising, sales promotion and public relations. The introduction of electronic and print media, media choice, the creative process and execution of a promotion campaign. The services in campaign planning, the advertising business and the advertiser-agency relationship. Legal and ethical issues in advertising. The course focuses especially on mass communication because there is a separate course available in personal selling and sales management.
Teaching methods	28 hours of lectures, 14 hours of exercises, groupwork and an individual ad analysis report, 4th period. Written exam.
Assessment	0-5, written exam 50%, individual ad analysis 30%, groupwork 20%.
Course Material	1. Percy, Rossiter & Elliott (2001): Strategic Advertising Management, Oxford University Press. 2. Assigned reading.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet, CS10A0000 Markkinoinnin peruskurssi or Ka6720000 Markkinoinnin ja hankintatoimen perusteet

AC40A0200	*INTERNATIONALIZATION OF THE FIRM 5 ECTS cr*
	Internationalization of the Firm
	All instruction will be in English.
Year and Period	B.Sc. (Econ. & Bus. Adm.) 3, Period 2
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo, N. N.
Aims	To familiarize the students with the characteristics of the international market environment and theories of internationalization. To provide strategic views on international market selection and market entry.
Contents	Internationalization theories: e.g. the Uppsala model. Network Model and Born Globals. The fundamental management decisions connected with the internationalization processes: (1) Whether to internationalize, (2) Deciding which markets to enter, (3) Deciding how to enter the foreign market, (4) Designing the global marketing programme and (5) implementing and coordinating the global marketing programme.
Teaching methods	21 hours of lectures and 14 hours of practical exercises.
Assessment	0-5 Active class participation. Exercises: oral and written project reports (30% of final grade). A written final examination (70% of final grade).
Course Material	1. Hollensen, S.: Global Marketing – A Decision-oriented approach, 2004. 2. Assigned reading.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet or Ka6720000 Markkinoinnin ja hankintatoimen perusteet. AC40A0050 Vienti- ja tuontitoiminta is recommended.

AC40A0650	*INTERNATIONAL BUSINESS STRATEGIES* *5 ECTS cr*
	International Business Strategies
	Replaces AC40A0600 Services Marketing and Management. All instruction will be in English.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen, Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen
Aims	The aim of the course is to familiarize the students with strategic planning for international business in general and the management and execution of international business strategies within the context of multinational corporations in particular. To help the students to develop an understanding of various international or global strategies and their advantages and disadvantages. The assignment aims to expose the students to actual management challenges in an international context.
Contents	International business planning. International and global business strategies. Strategic tools for analyzing the internal and external environment, for example resource and product positions. Organization of resources and capabilities within a multinational corporation. Implementation of an international business strategy.
Teaching methods	14 h of interactive lectures, 1st period. 14 h of interactive lectures, 2nd period. Group assignment/project work. Exam.
Assessment	0-5. Active class participation. Assignment: oral and written project work, 80%. Exam (has to be passed), 20%.
Course Material	Assigned reading.
Prerequisites	Basic understanding of international business.

AC60A0000	*CROSS-CULTURAL MANAGEMENT AND* *6 ECTS cr* *CORPORATE SOCIAL RESPONSIBILITY IN* *THE INFORMATION AGE*
	Cross-Cultural Management and Corporate Social Responsibility in the Information Age
	Only for the students of the Master's Degree Program (CBU) in Business and Administration. The course will be lectured at GSOM.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Janne Tienari Associate Professor, Dr. Yuri E. Blagov
Aims	The objective of the course is to present students with a theoretically and practically grounded understanding of how multinational firms operate. The course pays particular attention to questions related to managing and organizing a cross-cultural workforce. Course themes also include presentation skills, ethics and social responsibility, image building, and the use of management consultants in international business.
Contents	Session (1) Introductions, overview and organization of course work. Working across borders: presentation skills. How multinational firms function. Instructions for teamwork assignment 1. Session (2) Ethics and social responsibility in global business. Teamwork assignment presentations 1. Managing the cross-cultural firm: Image building. Instructions for teamwork assignment 2.

	Session (3) Ethical and responsible decision-making. Teamwork assignment presentations 2. Managing the cross-cultural firm: When cultures meet. Instructions for reading assignment. Instructions for case assignment. Session (4) Reading assignment seminar. Managing the cross-cultural firm: Using consultants. Session (5) Managing the cross-cultural firm: Focus on Russia and Finland. Session (6) Case assignment presentations. Course summary and preparation for the exam. Exam.
Teaching methods	Lectures 6 X 3 hours. Teamwork assignments. Exam.
Assessment	0–5; exam 50% and assignments 50% of course grade.
Course Material	Available in the first course session.
Prerequisites	Basic knowledge of management and organizations.

AC60A0050	*KNOWLEDGE MANAGEMENT AS A THEORY AND PRACTICE* *6 ECTS cr*
	Knowledge Management as a Theory and Practice **Only for students of the Master's Degree Program (CBU) in Business and Administration. The course will be lectured at GSOM.**
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Kirsimarja Blomqvist Professor, D.Sc. (Econ. & Bus. Adm.) Aino Pöyhönen Assistant Professor, Dr. Tatiana Andreeva Lecturer(s) responsible: Tatiana Andreeva
Aims	In modern times, both managers and management theorists are increasingly challenged by the changing circumstances and contexts where the competitive advantage of firms greatly depends on their ability to create and use knowledge. The aim of the course is to provide students with the understanding of knowledge as an organizational phenomenon and source of competitive advantages for contemporary organizations and to introduce them to key issues of managing knowledge in an organization. The course covers current conceptual frameworks in the field of knowledge management, including notions of knowledge, knowledge economy, the knowledge organization and the knowledge worker, and problems of knowledge creation, sharing and measurement (intellectual capital). Discussing these issues, the course aims to answer the key question: how the company should be organized and managed to be competitive in this knowledge-intensive era.
Contents	Part I. Introduction to knowledge management (10 h). Topic 1. Introduction. Basic definitions and concepts (4 h). The role of knowledge in organizations and society. Knowledge economy, knowledge society, knowledge organizations. Data, information, knowledge and wisdom. Tacit and explicit knowledge. Personal and organizational, internal and external knowledge. Various attributes of knowledge. Controversies and myths about knowledge management. Topic 2. Knowledge management as a scientific discipline (6 h) (visiting lecturers). Evolution of KM as a scientific discipline. Theoretical roots and generations of KM. Paradigms and perspectives of KM. Emerging future topics in KM. Knowledge-based view of the firm, its underlying assumptions and implications for management. The role of knowledge and knowledge-based interaction in a firm's competitiveness. Part II. Managing knowledge in organizations: key challenges (24 h). Topic 3. Key knowledge-related processes: key concepts and key problems (8

	h).
	Knowledge creation: stages and tools. SECI model. Improvization as a process of knowledge creation. Knowledge sharing: key barriers and solutions. Knowledge hoarding and motivation for knowledge sharing. Organizational learning and a learning organization. External knowledge acquisition and absorptive capacity. Topic 4. The human factor in KM (6 h). Knowledge workers: a new type of employee or just a prestigious title? Specific issues of managing knowledge workers: attraction, motivation, development, retention. Managing knowledge teams. Communities of practice. Topic 5. Organizational infrastructure for KM (6 h). Creating a knowledge organization: key tasks. New requirements for organizational leaders. Influence of the organizational structure, communications and culture on knowledge processes. Best practices and failures around the world. Knowledge management and strategy. Topic 6. Cross-cultural issues in KM (4 h). Cultural influences on key knowledge-related processes. Revising the SECI model from a cross-cultural point of view. KM in MNCs. Part III. Finale. Current KM problems in organizations and future research questions (10 h) (visiting lecturers). Student group project presentations of knowledge management practices in different companies: problem analysis and development of recommendations. Future research questions and course review.
Teaching methods	Lectures 36 h. Student project 50 h. Student project presentations 8 h. Independent work (reading course material) 60 h. Exam 3 h.
Assessment	Students' work for the course will be assessed on 2 key aspects: group research paper and knowledge of the course topics (exam). The group project will be dedicated to the analysis of knowledge management practices in a particular company. Details of the group project assignment will be provided at the beginning of the course. The exam is a written test. It is based on all course issues and material. The final assessment is composed as follows: • Final exam – 60% • Student group project – 40%
Course Material	Compulsory reading: • A selection of up-to-date articles will be provided at the beginning of the course. Basic textbooks (these books are recommended solely as additional basic reading). • Davenport, T. and Prusak, L. Working Knowledge: How Corporations Manage What They Know. Boston: Harvard Business School Press. 1998. • Nonaka, I. and Takeuchi, H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford: Oxford University Press. 1995.
Prerequisites	None.

AC60A0100	*QUALITATIVE AND QUANTITATIVE METHODS FOR BUSINESS RESEARCH* *6 ECTS cr*
	Qualitative and Quantitative Methods for Business Research **Only for the students of the Master's Degree Program (CBU) in Business and Administration. Course will be lectured at GSOM.**
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2
Lecturer(s)	Senior Lecturer, PhD Ludmila Bogolomova

Aims	Professor, D.Sc. (Tech.) Kaisu Puumalainen The objective of the course is to give the students an understanding of research process and methodology, especially in the context of international business research. The course provides the students with skills in the practical research design, analysis and reporting issues, especially in the context of cross-cultural studies. After the course the students should be able to: - understand the meaning of scientific research - write a research proposal - use databases to search for existing publications and empirical data - critically evaluate the research design and results of empirical studies - design an empirical study - evaluate the validity and reliability - recognize the main problems in cross-cultural studies - understand the applicability of the most typical qualitative and quantitative analysis methods
Contents	1) What is scientific research? Basic issues of the philosophy of science, research process, requirements for a Master's thesis 2) Using databases: finding research publications, introduction of secondary data sources available for SOM and LUT students 3) Qualitative methods 4) Quantitative methods: sampling, collecting secondary data, designing surveys (soliciting responses, analyzing non-response bias, survey data collection methods, questionnaire design, pre-testing, typical problems with survey data), reliability and validity, observational and experimental research designs, overview to the methods of analysis 5) Special challenges and issues in international business research: typical methods applied, main problems, role of culture in research design 6) Reporting: Research proposal, conducting a literature review, reporting the methodology, presenting the results
Teaching methods	Participation in lectures, 30 hours Evaluation of a research proposal and a Master's thesis Written exam based on the lectures and course books
Assessment	Evaluation of research proposal and master's thesis accepted vs. not accepted Written exam is graded from 0-5. The maximum points in the exam will be 50, and 25 points (50%) are required for passing the exam.
Course Material	1. Cooper, D.R. & Schindler, P.S. (2001) Business Research Methods. New York: McGraw-Hill. Parts I – III (Chapters 1-14) 2. A book on qualitative research methods
Prerequisites	None

AC60A0150	*STRATEGIC MANAGEMENT OF GROWTH*	*6 ECTS cr*

	Strategic Management of Growth **Only for the students of the Master's Degree Program (CBU) in Business and Administration.**
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala Lecturer(s) responsible: Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala
Aims	The objective of the course is to provide students with up-to-date insights into business growth strategies and their implications on management and on research. The course deals with the concept of strategy, the models of business growth, the relationship between growth and strategy, the barriers to growth, traditional routes of growth, external growth models and business growth analysis.
Contents	Objectives of firms. The connection between business growth and strategy. Dimension and directions of growth and development. External growth.
Teaching methods	Lectures and assignments 20 h. Exam.
Assessment	0-5. Assignment 50%, exam 50%.

Course Material	Articles, lecture notes and material announced during lectures.
Prerequisites	Introduction to Management

AC60A0200	*SUPPLY AND INNOVATION MANAGEMENT* *6 ECTS cr*
	Supply and Innovation Management
	Only for the students of the Master's Degree Program (CBU) in Business and Administration.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Tech.) Veli-Matti Virolainen Senior Lecturer, D.Sc. (Tech.) Jukka Hallikas Dr. Konstantin V. Krotov (GSOM)
Aims	The objective of the course is to address the methods and frameworks for analyzing changing business models as a part of enterprise-wide supply and value networks. The aim is to deepen the understanding about the strategic role of supply management. It is designed to meet the requirements for using purchasing and supply management as a source of competitive advantage in organizations.
Contents	The course examines the structure and role of innovation management in complex supply/demand business systems. The course covers the following topics: inter-firm learning and change management, the principles of systems thinking, methods for assessing customer value, mapping of business processes and value streams, systematic innovation of business models, the role of technology in supply networks, and risk management of supply/demand processes. Purchasing and supply strategy as a part of a business strategy and issues of external resource management are covered during the course.
Teaching methods	28 h of lectures and exercises in the 3-4 periods.
Assessment	Exam 0-5. Approved exercise reports.
Course Material	1. Hughes, J., Ralf, M., and Michels, B.: Transform Your Supply Chain. International Thomson Business Press, 240 p., 1998. 2. Cox, A.: Business Success. Earlsgate Press, 325 p., 1997. 3. Journal articles. Assigned reading (will be announced later).

AC60A0250	*INTERNATIONAL HIGH TECHNOLOGY MARKETING* *6 ECTS cr*
	International High Technology Marketing
	Only for the students of the Master's Degree Program (CBU) in Business and Administration.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4
Lecturer(s)	Visiting Professor, PhD Sanjit Sengupta (San Francisco State University) Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen Associate Professor, Dr. Sergey P. Kouchtch Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo Visiting lecturers
Aims	The aim of the course is to provide students an understanding of high–technology marketing challenges and opportunities. To help the participants to understand the advantages and limitations of traditional marketing thinking and tools in emergent, international high technology markets. After the course, students will have skills to analyze the market environment and plan and organize marketing activities in international high-technology markets.
Contents	The course will include lectures, guest lectures, presentations, assignments and discussions on selected topics and practical problems. Current insights

	into challenges and opportunities in international high technology markets. The concepts of technology and "high-tech". Innovations and new products in high-tech markets. Industry structure, industry changes and marketing implications. Marketing research in international high-tech markets. Partnering. Entry timing. Strategic planning and marketing strategies in international high technology markets. Organizing marketing activities in international high-tech markets.
Teaching methods	28 h of interactive lectures, intensive course May 2009 Active participation. Independent and class assignments, project work. Exam.
Assessment	0-5. Active class participation and assignments, including project work (40% of the final grade). Written exam (60% of the final grade). All assignments have to be passed.
Course Material	1. Mohr, Jakki, Sanjit Sengupta, and Stanley Slater (2005). Marketing of High-Technology Products and Innovations. Second Edition. Pearson Prentice Hall. 2. Assigned reading.

AC60A0300	*ECONOMICS OF INNOVATION AND INTELLECTUAL CAPITAL*	*6 ECTS cr*

	Economics of Innovation and Intellectual Capital
	Only for the students of the Master's Degree Program (CBU) in Business and Administration.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Kalevi Kyläheiko Associate Professor, Dr. Vasiliy K. Dermanov Professor, D.Sc. (Econ. & Bus. Adm.) Ari Jantunen Visiting lecturers
Aims	To familiarize students with basic concepts of the economics of innovation and intellectual capital, and provide an overview of theoretical perspectives on the economics of information goods, knowledge and innovation.
Contents	Knowledge-based economy, technological development and productivity, theoretical foundations and contemporary challenges of science and technology policies, innovation and competition, competitiveness of firms, profiting from innovation, pricing information goods, network externalities, economics of intellectual property rights, economics of innovation.
Teaching methods	Lectures 28 h, 4. period. Exam.
Assessment	0-5
Course Material	Assigned literature to be announced later.

AC60A0350	*MULTIVARIATE AND ECONOMETRIC ANALYSIS METHODS*	*6 ECTS cr*

	Multivariate and Econometric Analysis Methods
	Only for the students of the Master's Degree Program (CBU) in Business and Administration.
Year and Period	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-2
Lecturer(s)	Professor, D.Sc. (Tech.) Kaisu Puumalainen
Aims	The course will familiarize students with basic multivariate and econometric methods of analysis. Empirical cross-sectional, time series and panel data from various fields of economics and business is used, and the students should be able to conduct both descriptive, predictive and explanatory research, and present the results of the analyses.

Contents	Multiple linear regression analysis, factor analysis, cluster analysis, general linear models. Special issues in regression modeling: dummy variables, non-linear models, simultaneous equations, probit/logit-models, limited dependent variables, instrumental variables. SAS, SPSS and/or E-Views software will be used.
Teaching methods	Lectures 21 h, excercises 21 h, 1st–2nd period. Seminars 8 h, 2nd period. Written seminar report and presentation.
Assessment	0-5 based on seminar work, written report 75%, presentation 25%.
Course Material	Hair, Joseph Jr. et al.: Multivariate data analysis. Prentice Hall, 1998. Hill, R. Carter – Griffiths, William E. – Judge, George G.: Undergraduate Econometrics, 2nd edition. 2001.
Prerequisites	Basic courses in statistics and economics.

AC60A0400	INTERNATIONAL ACCOUNTING AND ANALYSIS	6 ECTS cr
	International Accounting and Analysis	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-2	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Sanna Tilli Visiting lecturer	
Aims	The objective of the course is to enrich students' understanding of international accounting and financial reporting. Particular emphasis is on comparative and international aspects of accounting together with financial analysis. The objective of the course is also to instruct students how to interpret financial information and assess the performance and prospects of the firm and how to use financial statement information to prepare a valuation.	
Contents	The course provides students knowledge of the main international differences in financial accounting, harmonization, financial reporting by individual companies, international financial analysis, financial statement analysis, valuation, assessment of accounting quality and the link between accounting and finance.	
Teaching methods	Lectures 28 h. Term paper, exam.	
Assessment	Graded 0-5 on the basis of the exam (60%) and the term paper (40%).	
Course Material	1. Nobes and Parker: Comparative International Accounting, 2006 2. Penman: Financial Statement Analysis and Security Valuation, 2007	

AC60A5000	MANAGERIAL ECONOMICS	6 ECTS cr
	Managerial Economics	
	Only for the students of the Master's Degree Program (CBU) in Business and Administration. The course will be lectured at GSOM.	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2	
Lecturer(s)	Senior Lecturer Ekaterina V. Sokolova Lecturer(s) responsible: Senior Lecturer Ekaterina V. Sokolova	
Aims	The course aims to introduce a practical approach to economics theory. It attempts to bridge the gap between purely analytical problems that intrigue many economic theorists and the day-to-day decisions that managers face. It includes analysis of different tools and approaches for managerial policy-making.	
Contents	The course covers the economic analysis for such concepts as cost, demand, profit, and competition. Students will also examine some theoretical points of industrial innovation and technological change, oligopoly and strategic behaviour, and international competitiveness.	

Teaching methods	Lectures, discussions, presentations, case studies. Lectures 34 h. Seminars 17 h.
Assessment	Home and in-class assignments – 30% Mid-term exam – 10% Final exam – 60%
Course Material	Nick Wilkinson: Managerial Economics, Cambridge University Press, 2005. E. Mansfield: Managerial Economics; W.W. Norton & Company, 1990.
Prerequisites	Introductory microeconomics

AC60A5100	*CONSULTING PROJECT*	*6 ECTS cr*

Consulting Project

Only for the students of the Master's Degree Programmes in Management. The course will be lectured at GSOM.

Year and Period Lecturer(s)	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2 Academic Advisors – GSOM faculty members Lecturer(s) responsible: Elena Kornyshkova, Master Programs Executive Director
Aims	To develop a hands-on consulting experience. To analyze a real life business problem, to do and apply relevant research, to find a sound solution to the problem and professionally present the results both to the Client Company and to a Commission at GSOM To develop team-working, project management, business communication and consulting skills.
Contents	Teams of 4-6 Master students with Academic Advisors (GSOM faculty) act as consulting teams to tackle real-life business problems stated by leading international companies in St. Petersburg. The course (business communication, presentations, the final report etc) are in English. The client companies are located by the GSOM Career Center.
Teaching methods	Academic Advisors: 20 contact hours. Workload: 136 hours (meetings with Client Company, group meetings, research, preparation of the midterm report, the final report and 2 presentations).
Assessment	20% Academic Advisor 30% Client Company 50% GSOM Commission All members of a team get the same final grade (unless there is a written complaint of a free-rider from the group). The final grade is given on a competitive basis among the groups.
Course Material	Depends on the topic and Academic Advisor's recommendations GSOM Consulting Project Guidelines

AC60A9000	*RESEARCH SEMINAR FOR MASTER'S THESIS 30 ECTS cr*

Research Seminar for Master's Thesis

Year and Period Lecturer(s)	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-4 Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen
Aims	The aim of the research seminar is to guide students thru out the process to prepare the master thesis. The research seminar consists of three different parts. 1) Introductory lectures 4 hours 2) Research seminar I: to present the research plan 2) Research seminar II: to present almost final version of the master thesis. The seminar is giving the basis knowledge, how to conduct a research project.
Contents	To present the analysis of the research subject in written format. To write research plan. To conduct the analysis of the theoretical basis of the research area, conduct the research and write draft of the master thesis. To present both research plan and nearly final version of the master thesis. Final examination

Assessment	after the master thesis is finished. The analysis of the research topic needs to be accepted by the supervising professor. Both research seminars I and II has to be conducted and accepted. Master thesis and final examination has to be accepted. Master thesis graded 0 – 5 (improbatur – laudatur)

CS10A0600	*DOING BUSINESS IN TRANSITIONAL ECONOMIES*	*7 op*

	Doing Business in Transitional Economies, Liiketoiminta siirtymätalouksissa
Year and Period **Lecturer(s)**	DI 1, periodi 3-4 Professori, FT Tauno Tiusanen Assistentti, DI Anna Karhu
Aims	Students are able to evaluate the emerging markets and choose the right modes of operations in TEs.
Contents	Must know: Country profiles of European transitional economies (TEs). The communist legacy in TEs. Macro-economic framework of the transitional process. Post-communist region in the global economy. Risks and opportunities in the TE markets. Investment climate and foreign direct investment in the TEs. Should know: EU's enlargement process.
Teaching methods **Assessment** **Course Material**	Lectures 42 h 3. period, exercises 14 h 3. period and 14 h 4. period. Web-based learning environment platform Blackboard is used in this course. 0-5, examination 50 %, exercises 25 %, research report 25 %. Lecture handouts. Tiusanen, Tauno: Foreign Investors in Transitional Economies: Cases in manufacturing and Services, Northern Dimension Research Centre, Publication n:o 27, Lappeenranta University of Technology 2006. Tiusanen, Tauno, Kinnunen, Jatta: EU's Eastern enlargement and the future expansion of the eurozone, Northern Dimension Research Centre, Publication n:o 23, Lappeenranta University of Technology 2005. Tiusanen Tauno: Development of rouble exchange rate in Russia, Northern Dimension Research Centre, Publication n:o 45, Lappeenranta University of Technology 2007. Tiusanen Tauno: Poland, the Largest New EU Country., Northern Dimension Research Centre, Publication n:o 4, Lappeenranta University of Technology 2004.
Prerequisites	CS10A0550 International Business Methods.

CS30A6100	*TECHNOLOGY MANAGEMENT*	*6 ECTS cr*

	Technology Management **Only for the students of the Master's Degree Program (CBU) in Business and Administration. Course will be lectured in the autumn semester 2008 at GSOM.**
Year and Period **Lecturer(s)**	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2 Professor, D.Sc. (Tech.) Marko Torkkeli Professor N.N., GSOM Lecturer(s) responsible: Professor, D.Sc. (Tech.) Marko Torkkeli
Aims	Europe is waking up to the challenge of technology and innovation. We see EU commitment to spend 3% of GDP on R&D, but who is thinking about how to spend? Who is thinking about technology management? Does the corporate board have the means to manage this spend? Should some percentage of the R&D be spent on improving technology and innovation management? This is where this course makes a contribution. It brings together the latest practice, research findings and thinking, presented in a way that addresses top

	management requirements. The goal is to secure the economic future of the firm, in the context of a sustainable industry and society. Using the ideas and methods, the board can assess and improve its own ability to deal with the challenge of technology and innovation.
Contents	The course examines the significant issues related to managing technology from both strategic and tactical perspectives. It is designed to meet the needs of students who must understand the use of technology as a powerful tool of competitive advantage and growth. Open innovation, technology management and evaluation methods, and strategic innovation management issues are covered during the course.
Teaching methods	Lectures 42 h, 1-2 period. Exam.
Assessment	Exam
Course Material	George S. Day, Paul J. H. Schoemaker (Eds.): Wharton on Managing Emerging Technologies, John Wiley & Sons, 2000
	European Institute for Technology and Innovation and European Institute for Technology Management: Bringing Technology and Innovation into the Boardroom, 2003
	Rita Gunther McGrath, Ian MacMillan: The Entrepreneurial Mindset, Harvard Business School Press, 2000
	Other assigned literature to be announced later.

14 The International Business and Technology Management Programme IBTM

IBTM programme is intended for international exchange and Finnish students. All the courses are taught in English and offered on several aspects of international business, technology management and transitional economies. Students can select the most desirable courses from a total selection of approximately 20 different courses per semester. About 30 ECTS credits represent the workload of a semester. The curriculum is managed by the School of Business, the Department of Industrial Management and the International Services.

The duration of the IBTM programme is one academic year, but a student can choose whether to come for one semester or two semesters.

The deadline for application for the autumn semester / academic year is 1 June and 1 November for the spring semester.

More information on schedule and courses can be found at the following web site:
www.lut.fi/exchange

Inquiries should be addressed to the following e-mail address:
incomingexchange@lut.fi

Autumn Semester 2008

August 27 – December 19
1st period/September 1 - October 24
2nd period/October 27 - December 19

Orientation Day, August 27

Subject to alterations

Course number, Course		ECTS cr
AB30A0200	Asset Pricing Theory and Portfolio Management	7
AB30A0500	Financial Econometrics	5
AC30A6000	Organizational Culture and Gender Aspects in Management	5
AC40A0100	Cross-Cultural Marketing Strategies	5
AC40A0200	Internationalization of the Firm	5
AC40A6000	Introduction to International Business and Planning	3
CS10A0300	Business Forecasting	4
CS10A0550	International Business Methods	7
CS10A0650	Management of High-tech Enterprises and Innovations in Russia	5
CS10A0800	The Basics of Doing Business in Russia	5
CS10A7000	The Economies of the Baltic States	3
CS30A1551	System Dynamics and Industrial Management	5
CS30A7000	Technology Management in Japan	3
CS30A7100	Management of Technology	5
CS30A7200	Global Innovation Networks	3
CS34A0400	Strategic Entrepreneurship in Age of Uncertainty	5
FV18A9900	Finnish Society and Culture	2

AB30A0200	*ASSET PRICING THEORY AND PORTFOLIO MANAGEMENT*	*7 ECTS cr*
	Asset Pricing Theory and Portfolio Management	
	Language of teaching is English	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 2	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Mika Vaihekoski	
Aims	This course represents advanced course on asset pricing and portfolio management. The aim is to deepen students' skills and knowledge of the modern portfolio theory, asset pricing models, and recent empirical results and studies.	
Contents	Theoretical and empirical research on modern portfolio theory, asset pricing models, interest rates, bonds, term structure, portfolio management, and behavioral finance.	
Teaching methods	Lectures/seminar 24 h, 2. period. Exercises 14 h, 2. period. Term paper (In written form, paper is presented by students in the seminar). Home assignments. Exam. Blackboard.	
Assessment	Graded 0–5 on the based on 70% exam, 15% term paper, and 15% home assignments.	
Course Material	1. Elton, Edwin J. et. al.: Modern Portfolio Theory and Investment Analysis, 2003 or newer. Selected parts. 2. Copeland, T., Weston, J. F. - Shastri, K.: Financial Theory and Corporate Policy, 2003 or newer. Selected parts. 3. Handouts in the class and all additional material required by the lecturer.	
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	

AB30A0500	*FINANCIAL ECONOMETRICS*	*5 ECTS cr*
	Financial Econometrics	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
Lecturer(s)	Docent, Ph.D. (Psych) Tomi Seppälä Lecturer(s) responsible: Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen	
Aims	This course deepens students' knowledge on empirical research methods in financial econometrics. The focus is on the empirical techniques used most often in the analysis of financial markets and how they are applied to actual market data.	
Contents	Empirical tests of market efficiency, tests of asset pricing models, event studies, time series models, modeling volatility and correlation, co-integration analysis, maximum likelihood estimation.	
Teaching methods	Lectures and exercises 24 h, 3. period. Introduction to Eviews and other statistical programs 2 h, 3. period. Exam.	
Assessment	Grade 0–5 based on exam 80% and home assignments 20%.	
Course Material	1. Brooks, Chris: Introductory econometrics for finance. Cambridge, 2002 or newer. Selected parts. 2. Tsay, Ruey S.: Analysis of Financial Time Series. Wiley, 2002 or newer. Selected parts. 3. Other material required by the lecturer.	
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis).	

AC30A6000	*ORGANIZATIONAL CULTURE AND GENDER ASPECTS IN MANAGEMENT*	*5 ECTS cr*
	Organizational Culture and Gender Aspects in Management	
	Language of instruction is English	

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 2
Lecturer(s)	Professor, Ph.D. Albert J. Mills, Saint Mary's University, Halifax
Aims	Managers and other experts working in organizations need nowadays skills to work with the multiple questions related to gender equality. The course will provide students with understanding the interrelationships between organizational culture, management, and gendered practices at the workplace. The focus is in the question, how the managers will be able to identify, assess and address the organizational processes that lead to discriminatory outcomes for women and men at work. Organizational cultures with multiple values and practices that both women and men find comfortable to work with are crucial for every modern organization.
Contents	1. Understanding organizational culture. Its definition, discussion and methods of analysis. 2. Gender and organizational culture. An overview of an organizational culture approach to understanding the development of discriminatory practices of men and women in the corporation. 3. Examination of selected issues to be drawn from corporate image-making, communication, structure, organizational rules, discourse analysis, group dynamics and interpersonal relations, studied in relation to the questions about gendered practices in the organization. 4. Equality practices in Finland. 5. Managing gender at work - issues and debates.
Teaching methods	Intensive course (November 24 - 28). 24 hours of lectures, case exercises and group work. An important element of the course will involve small groups of 3-4 students analyzing and discussing assigned cases.
Assessment	Graded 0-5 on the basis of active class participation and group reports
Course Material	Articles, book chapters and cases to be specified by the lecturers and read before the course
Prerequisites	Basic courses in Human Resource Management advisable

AC40A0100	CROSS-CULTURAL MARKETING STRATEGIES 5 ECTS cr
	Cross-Cultural Marketing Strategies
	All instruction will be in English.
Year and Period	B.Sc. (Econ. & Bus. Adm.) 2, Period 2
Lecturer(s)	Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
Aims	To familiarize the students with the factors in the cultural environment of business and to help them understand how these factors affect international marketing strategies.
Contents	Central concepts in understanding culture and its role in business: dimensions and categorizations of culture, sense of time and space, communication and negotiation styles. Understanding the effects of globalization on culture. Using cultural concepts to analyze how firms adapt their marketing strategies to foreign cultures.
Teaching methods	14 hours of lectures, assignments, written exam.
Assessment	0-5, written exam 60%, assignments 40%.
Course Material	1. Selected chapters of Usunier (2000): Marketing Across Cultures, Prentice Hall. 2. Assigned reading.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet or Ka6720000 Markkinoinnin ja hankintatoimen perusteet

AC40A0200	*INTERNATIONALIZATION OF THE FIRM*	*5 ECTS cr*

Internationalization of the Firm

All instruction will be in English.

Year and Period	B.Sc. (Econ. & Bus. Adm.) 3, Period 2
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo, N. N.
Aims	To familiarize the students with the characteristics of the international market environment and theories of internationalization. To provide strategic views on international market selection and market entry.
Contents	Internationalization theories: e.g. the Uppsala model. Network Model and Born Globals. The fundamental management decisions connected with the internationalization processes: (1) Whether to internationalize, (2) Deciding which markets to enter, (3) Deciding how to enter the foreign market, (4) Designing the global marketing programme and (5) implementing and coordinating the global marketing programme.
Teaching methods	21 hours of lectures and 14 hours of practical exercises.
Assessment	0-5 Active class participation. Exercises: oral and written project reports (30% of final grade). A written final examination (70% of final grade).
Course Material	1. Hollensen, S.: Global Marketing – A Decision-oriented approach, 2004. 2. Assigned reading.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet or Ka6720000 Markkinoinnin ja hankintatoimen perusteet. AC40A0050 Vienti- ja tuontitoiminta is recommended.

AC40A6000	*INTRODUCTION TO INTERNATIONAL BUSINESS AND PLANNING*	*3 ECTS cr*

Introduction to International Business and Planning

Language of instruction is English

Year and Period	B.Sc. (Econ. & Bus. Adm.) 2-3, Period 1
Lecturer(s)	D.Sc. (Econ.) Toivo S. Äijö, Top Trainers Group
Aims	To familiarize the students with the fundamentals of international business in general and strategic planning for international business in particular, as well as to provide the students with the analytical skills required for critical evaluation of actual international business strategies.
Contents	The global environment and its effects on international business and strategies. Latest challenges and ideas in international business. The role and importance of competitive advantage and core competence in strategy formulation. The strategic planning system for international business: the scope, time frame and organization. The contents of the strategic plan for international marketing.
Teaching methods	Intensive course (September 3-5 & 11-12). 25 hours of lectures and case exercises.
Assessment	Graded 0-5 on the basis of case studies and a written examination
Course Material	1. James Taggart – Michael McDermott: The Essence of International Business, Prentice-Hall 1993 2. Other material will be announced during lectures
Prerequisites	Basic course in marketing

CS10A0300	*BUSINESS FORECASTING*	*4 ECTS cr*

Business Forecasting, Ennustetoiminnot johdon päätöksenteossa

Year and Period	M.Sc. (Tech.) 1, Period 1
Lecturer(s)	Professor, Lic.Sc. (Econ. & Bus. Adm.) Seppo Pitkänen Assistant, N. N.

Aims	Ability to predict by conventional quantitative methods, and knowing the possibilities of the other approaches.
Contents	Must know: Forecasts´ role in business planning and decision making. The foundations of statistico-empirical, intuitive, qualitative-structural and simulation forecasting methods at the practical level. Should know: Special issues on cross-impact analysis. Nice to know: Combination of quantitative and qualitative methods.
Teaching methods	Lectures 28 h, exercises 14 h 1. period.
Assessment	0-5, examination 80 - 100 %, exercise report 0 - 20 %.
Course Material	Will be distributed to the participants.
Prerequisites	Basic skills in statistics (hypotesis testing, etc.), matrix algebra and elementary differential calculus. Recommended: A course dealing with economis/business decision making, or marketing research.

CS10A0650	*MANAGEMENT OF HIGH-TECH ENTERPRISES 5 ECTS cr AND INNOVATIONS IN RUSSIA*
	Management of High-tech Enterprises and Innovations in Russia , Teknologiayritysten ja innovaatioiden johtaminen Venäjällä
Year and Period	M.Sc. (Tech.) 1-2
Lecturer(s)	Professor, M.Sc. (Tech.) Juha Väätänen
Aims	To know the state of high-tech sectors and innovations management in Russia.
Contents	Must know: Key issues of technology and innovation management in Russia. Russian high-tech sectors. Should know: Russian innovation environment. Decision making in Russia, cultural characteristics. Management transformation in state owned and private companies. Nice to know: Managerial comparison between Russia and western countries in high-tech sectors. Transition of leadership and management in different business sectors.
Teaching methods	Literature exam. Introductionary lectures.
Assessment	0-5, examination.
Course Material	Nevens, Michael T., Summe, Gregory L., and Uttal, Bro (1990). "Commercializing Technology: What the Best Companies Do." Harvard Business Review May-June 1990: 154-163. Easingwood, Chris, Moxey, Steven, and Capleton, Henry (2006). "Bringing High Technology to Market: Successful Strategies Employed in the Worldwide Software Industry." The Journal of Product Innovation Management 23:498-511 Bingham, Peter (2003). "Pursuing Innovation in a Big Organization." Research Technology Management 46(4): 52-58. OECD (2005). Fostering Public-Private Partnership for innovation in Russia. OECD. ISBN 92-64-00965-5. Gianella, C., and W. Tompson (2007). "Stimulating Innovation in Russia: The Role of Institutions and Policies", OECD Economics Department Working Papers, No. 539, OECD Publishing. Fey, Carl F., Adaeva, Margarita, and Vitkovskaia, Anastasia (2001). "Developing a Model of Leadership Styles: What Works Best in Russia?" International Business Review 10: 615-643. Ivanova, Oksana, Kyrki, Anna, Selioukova, Yana, and Väätänen, Juha (2005). Case Study on Software Development Company –Opportunities and Challenges of Russian High-Tech Start-Up. Northern Dimension Research Centre, Publication 15, Lappeenranta University of Technology. Chesbrough, Henry (2003). "The Era of Open Innovation." MIT Sloan Management Review 44(3): 35-41.
Prerequisites	CS10A0800 The Basics of Doing Business in Russia.

CS10A0800	*THE BASICS OF DOING BUSINESS IN RUSSIA 5 ECTS cr*
	The Basics of Doing Business in Russia, Venäjän kaupan perusteet
Year and Period	B.Sc. (Tech.) 3, Period 2
Lecturer(s)	Professor, M.Sc. (Tech.) Juha Väätänen
Aims	To understand the special characteristics of Russian economy and society.
Contents	Must know: Transition of Russian society and business environment. Should know: Living standard analysis, competitive advantages, industrial sectors, foreign direct investment and Russian business culture. Nice to know: Russia's economic and political integration with the world economy.
Teaching methods	Lectures 35 h, presentation 10 h, seminar work 40 h, 2nd period.
Assessment	0-5, examination.
Course Material	Tiusanen, Tauno and Keim, Martin: Russian Transition and Oil Price Boom. Northern Dimension Research Centre, Publication n:o 35, Lappeenranta University of Technology 2006. Lecture materials.
Prerequisites	No prerequisites.

CS10A7000	*THE ECONOMIES OF THE BALTIC STATES 3 ECTS cr*
	The Economies of the Baltic States **Language of instruction is English**
Year and Period	M.Sc. (Tech.) 1, Period 2
Lecturer(s)	Professor, D.Sc. (Econ.) Alari Purju Tallinn University of Technology and Estonian Business School
Aims	To familiarize the students with the Baltic economies including historical background, present characteristics and future trends.
Contents	Economic development and structural changes in Estonia, Latvia and Lithuania. Transition to market economy. Comparison of developments with other East European countries. Framework for business (tax system, other regulations). Structure of foreign trade. Trade with the EU and the CIS. Export impediments of enterprises. Introduction to economic problems of enterprises. Case studies. Role of foreign direct investments (FDI). The cycle theory of FDI. Real and monetary integration with the EU. What are the main factors determining future development of the Baltic states?
Teaching methods	Intensive course (October 27-31). 20 hours of lectures and case studies.
Assessment	Graded 0-5 on the basis of active class participation, group case studies and an essay
Course Material	1. Nielsen, Jorgen Ulff-Moller, Erik Strojer Madsen, Kurt Pedersen, International Economics. The wealth of open nations. Berkshire: McGraw-Hill Book Company, First print 1994. 2. Lumiste, Rünno, Robert Pefferly and Alari Purju, 2007, "Estonia's Economic Development: Trends, Practices and Sources"; The World Bank Working Paper. 3. Purju, Alari, 2004, "The institutional framework and trade pattern of the Baltic states after EU membership in trade with the CIS ", Turku School of Economics and Business Administration, Series C Discussion, ISSN 1456-4793, 20 p. 4. Case studies of enterprises, material http://www.hex.com/tallinn/riga/vilnius
Prerequisites	Basic courses in international economy and marketing

CS30A1551	*SYSTEM DYNAMICS AND INDUSTRIAL MANAGEMENT*	*5 ECTS cr*
	System Dynamics and Industrial Management, Systeemidynamiikka tuotantotaloudessa	
Year and Period	M.Sc. (Tech.) 1-2, Period 1-2 int.	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola	
Aims	After completing this course student is able to model complex logistics systems and product development processes using system dynamics, and is able to report results for further managerial decision making.	
Contents	In this course system dynamics is used in the modelling of logistics systems (distribution and supply chains) and product development processes. Objective of the course is to give an understanding for a student how to analyze systems through relationships of different modeling elements (delay, feedback/feed forward, flow and stock), which often create complex interactions. Implications of system behavior on company level as well as country level issues of decision making in logistics as well as innovation management are discussed. During the course we also use and analyze practical problem solving tasks, using simulation models from the previous research.	
Teaching methods	Lectures 12 h, and exercises as well as final seminar 14 h. 1.-2. period in intensive form.	
Assessment	0-5, exam (50 %) and seminar work (50 %).	
Course Material	1. John D. Sterman (2000). Business Dynamics - Systems Thinking and Modeling for a Complex World, McGraw-Hill/Irwin. 2. Senge, Peter (1994). The Fifth Discipline. Currency Doubleday. 3. Article collection provided by the lecturer.	
Prerequisites	Recommended: At least introductory courses taken from logistics/supply chain management as well as technology/innovation management.	

CS30A7000	*TECHNOLOGY MANAGEMENT IN JAPAN*	*3 ECTS cr*
	Technology Management in Japan, Teknologian johtaminen Japanissa	
Year and Period	M.Sc. (Tech.) 1, Period 1 int.	
Lecturer(s)	Professor, D.Sc. (Tech.) Ichimura Takaya	
Aims	The course will provide students with the background information needed to understand how the Japanese system of technology management operates. It will also inform students about the characteristics of Japanese management and how technology management has contributed to the development of Japanese industry. The course will also give an outline of the Japanese production system and how it is based on Japanese culture.	
Contents	1. Technology management as an innovation process 2. Management technology and the effectiveness 3. The cultural and historical background of Japan 4. Industrial development of Japan and their causes 5. The approach to establish an technology management system 6. Cases of Technology Management System in Japan 6.1 Toyota production system 6.2 Product development and improvement system 6.3 New Work design for Quality of Working Life(QWL) 6.4 Quality management system in Japan 6.5 The process and tools of problem solving 6.6 Establishment of an environmental management system 7. Technology management in the global world	
Teaching methods	16 hours of lectures and class discussions in English.	
Assessment	0-5, active participation in classes and a written assignment.	
Course Material	Written material will be distributed during lectures.	
Prerequisites	Basic knowledge of production management.	

CS30A7100	*MANAGEMENT OF TECHNOLOGY*	*5 ECTS cr*
	Management of Technology	
	Language of instruction is English	
Year and Period	M.Sc. (Tech.) 1, Period 1-2	
Lecturer(s)	D.Sc. (Tech.) Tuomo Kässi, Professor	
	LUT/Department of Industrial Management	
Aims	The course develops a basic understanding of the issues and methods for managing technology as a strategic resource. The major issues in R&D Management and the process of technological innovation are included.	
Contents	The course reviews basic ideas and concepts of strategic and operational technology management including:	
	- The concept of strategy	
	- Strategy alternatives	
	- Management product systems	
	- Management of innovation	
	- The process of technology strategy formulation, implementation and management at company level, and of integration of technology strategy with business strategy	
	- Management of innovative organizations	
Teaching methods	28 hours of lectures in English	
Assessment	Graded 0-5 on the basis of classes, assignments and a written examination	
Course Material	1. Tidd, Joe - Bessant, John - Pavitt, Keith: Managing Innovation, Integrating Technological, Market and Organizational Change, John Wiley & Sons, England, 2001	
	2. Other assigned materials	
	3. Case material to be assigned	
Prerequisites	Basic knowledge of strategic management	

CS30A7200	*GLOBAL INNOVATION NETWORKS*	*3 ECTS cr*
	Global Innovation Networks	
Year and Period	B.Sc. (Tech.) 3, Period 1	
Lecturer(s)	Karol Pelc, Ph.D., Professor	
	Michigan Technological University	
Aims	The students will gain knowledge of innovation network structures and their evolution under conditions	
	of business globalization. They will become familiar with management issues within global innovation networks.	
Contents	The course presents conceptual models and empirical data on innovation networks in the context of global scale projects and organizations. It includes the following topics:	
	- Schumpeterian perspective on innovation networks and basic concepts related to technological innovation	
	- Global networks for knowledge generation, and collaborative practices in global product development, production, marketing and distribution	
	- Strategic roadmapping and knowledge management in a global organization	
	- Issues of intellectual property in the global networking environment	
Teaching methods	Intensive course (October 6-10). 20 hours of lectures, case study workshop, reporting and examination.	
Assessment	Case study assignment, active participation, and a written examination	
Course Material	The students will have access to lecture materials prior to each class and will receive case descriptions for study.	
	1. Carayannis, E.G., Assimakopulos, D., Kondo, M. (eds.), Innovation Networks and Knowledge Clusters: Findings and Insights from the U.S., E.U., and Japan, Palgrave Macmillan, Basingstoke, Hampshire, U.K., 2008.	
	2. Deresky, H., Global Management: Strategic and Interpersonal, Prentice Hall, 2002.	

Prerequisites	Basic knowledge of management and economics.

CS34A0400	**STRATEGIC ENTREPRENEURSHIP IN AGE OF UNCERTAINTY**	**5 ECTS cr**

	Strategic Entrepreneurship in Age of Uncertainty, Strateginen yrittäjyys ja epävarmuuden hallinta
Year and Period	M.Sc. (Tech.) 2, Period 1
Lecturer(s)	Professor, D.Sc. (Tech.) Marko Torkkeli
Contents	Must know: This course examines issues related entrepreneurship and entrepreneurial mindset. Entrepreneurial mindset. Identifying opportunities. Management of market and technology uncertainty.
Teaching methods	Lectures 28 h, 1. period.
Assessment	0-5, a written report.
Course Material	Lectures. McGrath Rita and MacMillan Ian, (2000). The Entrepreneurial Mindset. Harvard Business School Pr.

FV18A9900	**FINNISH SOCIETY AND CULTURE**	**2 ECTS cr**

	Finnish Society and Culture
	Language of instruction is English
Year and Period	Period 1-2 and 3-4
Lecturer(s)	Dr. Kalle Michelsen, Professor (Finnish History, Political Culture, Social and Economic System)
	M.A. Kristiina Korjonen-Kuusipuro, Researcher (Finnish Culture)
	Ph.D. Tuija Mikkonen (Architecture and Built Environment)
	Dr. Mika Tonder, Senior Lecturer (Landscapes, mentalities)
Aims	The aim of this course is to introduce Finland and South Karelia to foreign students. The course provides basic information of Finnish history (focusing on Karelia and Karelian issues) from 1809 to the present, culture (arts, architecture and landscape), political system and international issues as well as social and economic systems (demography, ethnic, regional, gender and equality issues, trade, industry, science and technology).
Teaching methods	22 h lectures in English. The course is divided in following parts:
	A) History (4 lectures)
	B) Culture (4 lectures)
	C) Lifestyle (4 lectures)
	D) Architecture and Built Environment (2 lectures)
	E) Society (2 lectures)
	F) Economic Systems (2 lectures)
	F) Nature and Landscape (4 lectures)
	G) Exam (2 lectures)
Assessment	Pass/fail on the basis of participation 60% and a written examination 40%.
Course Material	Portraying Finland. Facts and Insights. Otava 2005. (Available in the library)

Spring Semester 2009

January 8 - May 15
3rd period/January 12 – March 6
4th period/March 9 – May 15

Orientation Day, January 8

Subject to alterations

		ECTS cr
AB30A0250	Theory of Corporate Finance	7
AB30A0450	Financial Modeling using Excel	5
AB30A0550	International Financial Management	6
AB30A0600	Empirical Research in Accounting and Finance	7
AB40A0500	Innovation and Competitiveness	5
AC30A6050	Small and Medium Size Enterprise Management and Business Development	3
AC40A0150	Integrated Marketing Communication	5
AC40A0250	Sales Management and Personal Selling	5
AC40A0450	High Technology Marketing	5
AC40A0500	Customer Relationship Management	5
AC40A0550	International Entrepreneurship	5
AC40A6050	Cross-Cultural Encounters	3
AC50A0300	Organizational Learning and Competence Management	6
CS10A0050	Introduction to International Business	4
CS10A0600	Doing Business in Transitional Economies	7
CS10A0650	Management of High-tech Enterprises and Innovations in Russia	5
CS10A0750	Enterprises and Competition in Russia	5
CS10A0850	Transitional Countries Integration with the European Union - Trade, Manufacturing and Labour Perspective	5
CS30A1500	Transportation Systems	5
CS34A0500	Technology Commercialization and Corporate Venturing	5
FV18A9900	Finnish Society and Culture	2

AB30A0250	*THEORY OF CORPORATE FINANCE*	*7 ECTS cr*
	Theory of Corporate Finance	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen	
Aims	The course is providing advanced knowledge in the area of corporate finance. Latest relevant research in the area is incorporated taking to account the practical aspects of combining theoretical aspects to practice. Moreover, the focus is also to learn how to deepen the knowledge in some specific area with the help of research articles.	
Contents	Specific issues of corporate finance include dividends, valuation, mergers and acquisitions, listings, IPOs, ownership structures, corporate governance, asymmetric information and international finance.	
Teaching methods	Lectures/seminar 21 h, 4. period. Term paper (In written form, paper is presented by students in the seminar). Exam.	
Assessment	Graded 0–5 on the based on 80% exam and 20% term paper	
Course Material	1. Ross, S.A., Westerfield, R.W. – Jaffe, J.: Corporate Finance, 7th edition, selected parts	
	2. Copeland, T., Weston, J.F. - Shastri, K.: Financial Theory and Corporate Policy, 2003, selected parts.	
	3. Handouts in the class and all additional material required by the lecturer.	
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	

AB30A0450	*FINANCIAL MODELING USING EXCEL*	*5 ECTS cr*

Financial Modeling using Excel

Language of teaching is English. Lectured every other year.
The course will be lectured next time during the academic year 2008 - 2009.

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Mika Vaihekoski
Aims	The aim is to teach students how to model and solve financial problems independently using spreadheet programs (mainly Excel).
Contents	Advanced Excel use; building models in corporate finance, investment analysis, bond and stock pricing, portfolio management, and derivatives. Basics of Excel's Visual Basic for Applications macro language.
Teaching methods	Lectures 21 h. Home assignments. Blackboard.
Assessment	Graded 0-5 on the basis of home assignments (weight 60%) and final project (weight 40%). Students are required to achieve 50 percent of the maximum in both.
Course Material	1. Vaihekoski, Mika: Rahoitusalan sovellukset ja Excel, WSOY, 2004 or Benninga, Simon: Financial Modeling, MIT Press, 2002 or newer. 2. Handouts in the class and all additional material required by the lecturer.
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis).

AB30A0550	*INTERNATIONAL FINANCIAL MANAGEMENT*	*6 ECTS cr*

International Financial Management

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen
Aims	The aim of the course is to provide an analytic framework for understanding how cross-border financing, valuation, risk management, and investment decisions are influenced by a variety of factors including exchange rates, legal rules, international tax considerations and country risks. The course provides the understanding how firms can create, measure, and sustain value across borders.
Contents	The course consists of the four different areas in international financial management. The part including currencies and asset prices concentrates in the mechanisms of exchange rates. The area of multinational financial decision making considers several of the central financial decisions multinational firms must make. The part of cross-border valuation and financing considers how the valuation and financing decisions must be modified in a cross-border setting. Institutions and Finance part includes the topics of investors' behavior and risk management.
Teaching methods	Lectures 24 h, 3rd period. Course work (Assignment on a topic of mutual agreement, which can be written individually or in groups of up to three members). Exam.
Assessment	Graded 0–5 based 80% on an exam and 20% on course work.
Course Material	1. Madura, J., International Financial Management, 8th edition, or later version 2. Handouts in the class and all additional material required by the lecturer.
Prerequisites	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)

AB30A0600	*EMPIRICAL RESEARCH IN ACCOUNTING AND FINANCE*	*7 ECTS cr*

Empirical Research in Accounting and Finance

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3-4
Lecturer(s)	Docent, D.Sc. (Econ. & Bus. Adm.) Jussi Nikkinen

	Lecturer(s) responsible: Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen
Aims	The course has the following three objectives. First, the course provides an overview of recent relevant research issues in accounting and finance, thereby extending and deepening students' knowledge in the area of accounting and finance. Second, the course in intended to prepare students to do empirical research in accounting and finance.
Contents	Relevant research issues related to financial reporting; corporate governance; agency relationships; managerial incentive plans; market efficiency; information content of asset prices; accounting, capital markets and financial institutions; international financial markets.
Teaching methods	Lectures/seminar 21 h. Over the course of the term there will be two to three assignments, such as an article analysis. The aim of these assignments is to get students to understand the principles of deductive empirical research. The main course requirement is to write a term paper from the area of accounting or finance containing at minimum a detailed well-developed research proposal.
Assessment	Graded 0–5 on the basis of the term paper.
Course Material	There is no textbook. Issues covered in class will be based on research papers and articles.
Prerequisites	Compulsory B.Sc. courses in Accounting or in Finance (except Bachelor's thesis). AC40A0010 Tilastollisen analyysin perusteet (Basic Course in Statistical Analysis Method) and AB40A0100 Monimuuttujamenetelmät (Multivariate Analysis Methods or Ka6710100 Quantitative Research Methods I)

AB40A0500	*INNOVATION AND COMPETITIVENESS*	*5 ECTS cr*
	Innovation and Competitiveness	
Year and Period	B.Sc. (Econ. & Bus. Adm.) 1, Period 3	
Lecturer(s)	Ph.D. Hannes Toivanen	
	Lecturer(s) responsible: Professor, D.Sc. (Econ. & Bus. Adm.) Ari Jantunen	
Aims	This course explores the relationship between innovation and competitiveness of firms, industries, and nations. Assigned literature, lectures, and class work consider critical issues in competitive strategy and public policy. The course provides an accessible overview of major theoretical perspectives on innovation and key methods employed to measure and assess the impact of innovation.	
Contents	What is innovation, the innovation process and firm, industrial organization and innovation, national systems of innovation, measurement of innovation, special aspects of innovation, contemporary challenges of innovation.	
Teaching methods	21 h of lectures. Exam.	
Assessment	0-5	
Course Material	Will be announced later, see web-pages.	

AC30A6050	*SMALL AND MEDIUM SIZE ENTERPRISE MANAGEMENT AND BUSINESS DEVELOPMENT*	*3 ECTS cr*
	Small and Medium Size Enterprise Management and Business Development	
	Language of instruction is English	
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala	
Aims	To provide students with a multi-perspective of concepts, frameworks, and models for understanding and analysing growth situations in SMEs.	
Contents	The course focuses on the decisions owners/managers have to make in:	

	- identifying and choosing opportunities for business growth - setting realistic growth strategies - identifying and allocating resources (technological, financial, human etc.) - organising, mobilising, motivating, empowering and rewarding staff - exercising control over all aspects of the business during the growth process - developing an organisational climate compatible with the internal and external factors necessary for growth.
Teaching methods	20 hours of lectures and class discussions in English. The teaching method is student-centred. Students are expected to come thoroughly prepared for vigorous discussions on the readings and case studies issued in advance.
Assessment	Graded 0-5 on the basis of classes, case studies and an essay
Course Material	Compendium of articles and cases
Prerequisites	Basic knowledge of management

AC40A0150	INTEGRATED MARKETING COMMUNICATION 5 ECTS cr
	Integrated Marketing Communication **All instruction will be in English.**
Year and Period	B.Sc. (Econ. & Bus. Adm.) 3, Period 4
Lecturer(s)	Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
Aims	To familiarize the student with the concept and process of marketing communication. To give the students basic skills in the design, implementation and management of communication as part of the marketing process.
Contents	The role of marketing communication in the marketing strategy of an enterprise. The concept and implementation of integrated marketing communication. The design, implementation and management of advertising, sales promotion and public relations. The introduction of electronic and print media, media choice, the creative process and execution of a promotion campaign. The services in campaign planning, the advertising business and the advertiser-agency relationship. Legal and ethical issues in advertising. The course focuses especially on mass communication because there is a separate course available in personal selling and sales management.
Teaching methods	28 hours of lectures, 14 hours of exercises, groupwork and an individual ad analysis report, 4th period. Written exam.
Assessment	0-5, written exam 50%, individual ad analysis 30%, groupwork 20%.
Course Material	1. Percy, Rossiter & Elliott (2001): Strategic Advertising Management, Oxford University Press. 2. Assigned reading.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet, CS10A0000 Markkinoinnin peruskurssi or Ka6720000 Markkinoinnin ja hankintatoimen perusteet

AC40A0250	SALES MANAGEMENT AND PERSONAL SELLING 5 ECTS cr
	Sales Management and Personal Selling **All instruction will be in English.**
Year and Period	B.Sc. (Econ. & Bus. Adm.) 3, Period 3-4
Lecturer(s)	Senior Lecturer, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen
Aims	To familiarize the students with the fundamentals of sales management and personal selling including negotiation skills as well as general issues in business to business and organizational selling.
Contents	Special characteristics of business-to-business, industrial and organizational selling. Fundamentals of personal selling, negotiations and sales management.
Teaching	24 h of lectures in 3rd period. 14 h of exercises in 4th period. Written exam.

methods	
Assessment	0-5, written examination 60% of the final grade, Exercises 40% of the final grade
Course Material	1. Johnston, Mark W. and Greg Marshall, 2006. Churchill/Ford/Walker's Sales Force Management. McGraw-Hill/Irwin, New York. 2. Manning, Gerald L., and Barry Reece, 2004. Selling Today, Creating Customer Value. 9th edition. Pearson Prentice hall, New Jersey. 3. Other material distributed during the course.
Prerequisites	Ka6720000 Markkinoinnin ja hankintatoimen perusteet or AC40A0000 Kansainvälisen markkinoinnin perusteet (AC40A0050 Vienti- ja tuontitoiminta recommended).

AC40A0450 HIGH TECHNOLOGY MARKETING 5 ECTS cr

High Technology Marketing

The number of students attending the course may have to be limited based on pre-exam if the number of students exceeds 30. In registration priority is given to LUT master's students. All instruction will be in English.

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4
Lecturer(s)	Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen
Aims	The aim is to understand whether marketing for firms operating in high technology markets is different from traditional marketing? And, if so, why and how? To provide a deep understanding of the functions of marketing regarding challenges and opportunities in high technology products and markets. To assist the participants to understand the virtue and limitations of traditional marketing thinking and tools in emergent, high technology markets.
Contents	The course will be offered as a blend of lectures, guest lectures, presentations and discussions of selected topics and practical problems. Updated insights regarding challenges and opportunities in high technology markets; The concepts of technology and "high-tech"; Innovations and new products in high-tech markets; Industry structure, industry changes and marketing implications; Marketing research in high-tech markets; Partnering; Entry timing; Marketing strategies in high technology markets, Organizing marketing activities in high-tech markets.
Teaching methods	28 h of interactive lectures in the 4th period. Active participation. In- and out-class assignments. Exam.
Assessment	0-5 Active class participation and assignments (40% of the final grade). Written exam (60% of the final grade). All assignments have to be passed.
Course Material	1. Mohr, Jakki, Sanjit Sengupta, and Stanley Slater (2005) Marketing of High-Technology Products and Innovations. Second Edition. Pearson Prentice Hall. 2. Assigned reading.
Prerequisites	Basic knowledge of international marketing.

AC40A0500 CUSTOMER RELATIONSHIP MANAGEMENT 5 ECTS cr

Customer Relationship Management

The course will be lectured for the first time during the academic year 2009-2010. Substituting literature exams during the academic year 2008-2009.

Year and Period	B.Sc. (Econ. & Bus. Adm.) 2, Period 1-4

Lecturer(s)	Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Hanna Salojärvi
Aims	The aim of the course is to familiarize the students with relationship marketing theory and strategic management of customer relationships.
Contents	Basic issues in relationship marketing theory. Development of customer relationships and customer life-cycle. Large customer management. The role of customer knowledge in the management of customer relationships. Characteristics of customer relationship oriented organization.
Teaching methods	Independent literature exam during academic year 2008-2009.
Assessment	0-5, written exam 100%.
Course Material	1. Payne, Adrian (2005), Handbook of CRM: Achieving Excellence through Customer Management, Butterworth- Heinemann 2. Gupta, Sunil & Lehmann, Donald (2005), Managing Customers as Investments: The Strategic Value of Customers in the Long Run, Wharton School Publishing.
Prerequisites	AC40A0000 Kansainvälisen markkinoinnin perusteet

AC40A0550	*INTERNATIONAL ENTREPRENEURSHIP*	*5 ECTS cr*

International Entrepreneurship

All instruction will be in English. The number of students attending the course may have to be limited based on pre-exam if the number of students exceeds 30.

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 3-4
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo, Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen
Aims	To provide the students with both theoretical and practical insight into the processes of international entrepreneurship. To help the students develop an understanding of the nature and benefits of an international expansion strategy. The field project will expose the students to actual challenges that entrepreneurs have to deal with when internationalizing their businesses.
Contents	Evolution of International entrepreneurship, development of internationalization plan, competitive strategies and international business operations for small and medium-sized firms: e.g. marketing, human resources, R&D and financing, managing entrepreneurial ventures in the global marketplace. In the field project the students apply tools and frameworks related to international entrepreneurship to analyze a particular opportunity and create a business plan.
Teaching methods	12 h of lectures including guest entrepreneurs as lecturers, 3.-4. period. 12 h of field project presentations, 3.-4. period. Group tutorials.
Assessment	0-5 Active class and tutorial participation Assignment 1: Case narrative of chosen firm/ entrepreneur (10% of final grade) Assignment 2: Field project & Presentation (40% of final grade) (Peer evaluation in the group work has an effect on the grade) Exam (50% of final grade)
Course Material	1) Äijö Toivo, Kuivalainen Olli, Saarenketo Sami, Lindqvist Jani & Hanninen Hanna (2005) Internationalization Handbook for the Software Business, Centre of Expertise for Software Product Business, Espoo 2005. 2) Assigned reading
Prerequisites	Basic understanding of international business. Entrepreneurship studies are recommended.

AC40A6050	*CROSS-CULTURAL ENCOUNTERS*	*3 ECTS cr*

Cross-Cultural Encounters

Language of instruction is English

Year and Period	B.Sc. (Econ. & Bus. Adm.) 2, Period 3
Lecturer(s)	M.A. Tanja Karppinen, Coordinator
	M.A. Kristiina Korjonen-Kuusipuro, Researcher
	M.A. Aino Harinen, Planning Officer
Aims	The purpose of the course is to develop students' abilities to understand and appreciate cultural differences both in business and private life.
Contents	Cultures and communication, verbal and nonverbal communication, national stereotypes, intercultural sensitivity, cross-cultural interaction, culture shock, adaptation, intercultural effectiveness, cultures and organisations, expatriate assignments.
Teaching methods	24 hours of lectures and case exercises in English
Assessment	Graded 0-5 on the basis of activity, assignments given during the lectures and a portfolio composed of them.
Course Material	Reading material for the course provided by the lecturer
Prerequisites	Active participation and 80 % attendance

AC50A0300	ORGANIZATIONAL LEARNING AND COMPETENCE MANAGEMENT	6 ECTS cr
	Organizational Learning and Competence Management	

Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 4
Lecturer(s)	Senior Lecturer, Ph.D. (Psych) Jianzhong Hong
Aims	The aim of this virtual course is to familiarize students to the state of the art literature, functioning principles and enabling tools regarding the subject.
Contents	The course consists of three parts of virtual participation and interaction: 1) intensive reading of the course materials presented on the web and required journal articles and book chapters; 2) case analysis and written report by group; and 3) case presentation and discussion in the virtual discussion forum. The case analysis is conducted based on the problem-based learning method.
Teaching methods	4. period. Info-meeting at the beginning of the course. Guiding session before the start of the group work. Reading summaries, online exam, group assignment and discussion through LUT virtual learning tool Blackboard.
Assessment	0-5, individual literature study 40%, group work 60%
Course Material	1. Course materials presented on the Blackboard. 2. Assigned reading to be announced on the course web page.

CS10A0050	INTRODUCTION TO INTERNATIONAL BUSINESS	4 ECTS cr
	Introduction to International Business, Johdatus kansainväliseen liiketoimintaan	

Year and Period	B.Sc. (Tech.) 2, Period 4
Lecturer(s)	Professor, Ph.D. Tauno Tiusanen
Aims	Students have the basic knowledge of international business.
Contents	Must know: Basic definitions and features of international business will be introduced. Attention will be paid to foreign trade theories and alternatives in export business. Balance of payments on current account will be overviewed. Should know: Different trade policy alternatives are overviewed. Currency issues, especially exchange rates will be discussed. Evaluation of export markets and communicating across cultures.
Teaching methods	Lectures 21 h 4. period.
Assessment	0-5, examination.
Course Material	Lecture handouts.

	Root, Franklin: Entry Strategies: for International Markets. 1994. Three first chapters.

CS10A0600	*DOING BUSINESS IN TRANSITIONAL ECONOMIES*	*7 ECTS cr*

	Doing Business in Transitional Economies, Liiketoiminta siirtymätalouksissa
Year and Period	M.Sc. (Tech.) 1, Period 3-4
Lecturer(s)	Professor, Ph.D. Tauno Tiusanen Assistant, M.Sc. (Tech.) Anna Karhu
Aims	Students are able to evaluate the emerging markets and choose the right modes of operations in TEs.
Contents	Must know: Country profiles of European transitional economies (TEs). The communist legacy in TEs. Macro-economic framework of the transitional process. Post-communist region in the global economy. Risks and opportunities in the TE markets. Investment climate and foreign direct investment in the TEs. Should know: EU's enlargement process.
Teaching methods	Lectures 42 h 3. period, exercises 14 h 3. period and 14 h 4. period. Web-based learning environment platform Blackboard is used in this course.
Assessment	0-5, examination 50 %, exercises 25 %, research report 25 %.
Course Material	Lecture handouts. Tiusanen, Tauno: Foreign Investors in Transitional Economies: Cases in manufacturing and Services, Northern Dimension Research Centre, Publication n:o 27, Lappeenranta University of Technology 2006. Tiusanen, Tauno, Kinnunen, Jatta: EU's Eastern enlargement and the future expansion of the eurozone, Northern Dimension Research Centre, Publication n:o 23, Lappeenranta University of Technology 2005. Tiusanen Tauno: Development of rouble exchange rate in Russia, Northern Dimension Research Centre, Publication n:o 45, Lappeenranta University of Technology 2007. Tiusanen Tauno: Poland, the Largest New EU Country., Northern Dimension Research Centre, Publication n:o 4, Lappeenranta University of Technology 2004.
Prerequisites	CS10A0550 International Business Methods.

CS10A0650	*MANAGEMENT OF HIGH-TECH ENTERPRISES AND INNOVATIONS IN RUSSIA*	*5 ECTS cr*

	Management of High-tech Enterprises and Innovations in Russia , Teknologiayritysten ja innovaatioiden johtaminen Venäjällä
Year and Period	M.Sc. (Tech.) 1-2
Lecturer(s)	Professor, M.Sc. (Tech.) Juha Väätänen
Aims	To know the state of high-tech sectors and innovations management in Russia.
Contents	Must know: Key issues of technology and innovation management in Russia. Russian high-tech sectors. Should know: Russian innovation environment. Decision making in Russia, cultural characteristics. Management transformation in state owned and private companies. Nice to know: Managerial comparison between Russia and western countries in high-tech sectors. Transition of leadership and management in different business sectors.
Teaching methods	Literature exam. Introductory lectures.
Assessment	0-5, examination.
Course Material	Nevens, Michael T., Summe, Gregory L., and Uttal, Bro (1990). "Commercializing Technology: What the Best Companies Do." Harvard

Business Review May-June 1990: 154-163.

Easingwood, Chris, Moxey, Steven, and Capleton, Henry (2006). "Bringing High Technology to Market: Successful Strategies Employed in the Worldwide Software Industry." The Journal of Product Innovation Management 23:498-511

Bingham, Peter (2003). "Pursuing Innovation in a Big Organization." Research Technology Management 46(4): 52-58.

OECD (2005). Fostering Public-Private Partnership for innovation in Russia. OECD. ISBN 92-64-00965-5.

Gianella, C., and W. Tompson (2007). "Stimulating Innovation in Russia: The Role of Institutions and Policies", OECD Economics Department Working Papers, No. 539, OECD Publishing.

Fey, Carl F., Adaeva, Margarita, and Vitkovskaia, Anastasia (2001). "Developing a Model of Leadership Styles: What Works Best in Russia?" International Business Review 10: 615-643.

Ivanova, Oksana, Kyrki, Anna, Selioukova, Yana, and Väätänen, Juha (2005). Case Study on Software Development Company –Opportunities and Challenges of Russian High-Tech Start-Up. Northern Dimension Research Centre, Publication 15, Lappeenranta University of Technology.

Chesbrough, Henry (2003). "The Era of Open Innovation." MIT Sloan Management Review 44(3): 35-41.

Prerequisites	CS10A0800 The Basics of Doing Business in Russia.

CS10A0750	*ENTERPRISES AND COMPETITION IN RUSSIA 5 ECTS cr*
	Enterprises and Competition in Russia, Yritykset ja kilpailu Venäjällä
Year and Period	M.Sc. (Tech.) 1, Period 3
Lecturer(s)	Professor, M.Sc. (Tech.) Juha Väätänen
Aims	To understand Russian business environment, enterprise structures and competition on Russian markets.
Contents	Must know: Russian enterprise structures, emergence of new enterprises, natural resources and consumer markets. Should know: Russia´s competitiveness, dereculation of the economy, privatisation process and foreign direct investment development. Nice to know: Government regulations and licensing.
Teaching methods	Lectures 35 h, presentations 20 h, seminar work 40 h, 3rd period.
Assessment	0-5, examination.
Course Material	Helanterä, Antti. Ollus, Simon-Erik. Why they, why not we? - An analysis of the competitiveness of Finland and Russia. 2004. Edita Prima Ltd. The World Bank. Transition, the First Ten Years - Analysis and Lessons for Eastern Europe and the Former Soviet Union. 2002. Additional material will be announced on lectures.
Prerequisites	CS10A0800 The Basics of Doing Business in Russia, not required from foreign exchange students.

CS10A0850	*TRANSITIONAL COUNTRIES INTEGRATION 5 ECTS cr WITH THE EUROPEAN UNION - TRADE, MANUFACTURING AND LABOUR PERSPECTIVE*
	Transitional Countries Integration with the European Union - Trade, Manufacturing and Labour Perspective, Siirtymätalouksien integroituminen Euroopan Unioniin - kaupan, tuotannon ja työvoiman näkökulma
Year and Period	M.Sc. (Tech.) 1, Period 4
Lecturer(s)	Professor, M.Sc. (Tech.) Juha Väätänen
Aims	To understand the process of European Union enlargement and it's influence on the competitiveness of EU.

Contents	Must know: European Union enlargement process and competitiveness of EU. Should know: Special characteristics of new EU countries. Trade and investment flows. Nice to know: Harmonization of legislation and economies. Provisions for European Union enlargement.
Teaching methods	Lectures 35 h, presentations 20 h, seminar work 40 h, 4th period.
Assessment	0-5, examination.
Course Material	Literature will be announced on lectures.
Prerequisites	No prerequisites.

CS30A1500	TRANSPORTATION SYSTEMS	5 ECTS cr
	Transportation Systems, Kuljetusjärjestelmät	

Year and Period	M.Sc. (Tech.) 1-2, Period 4 int.
Lecturer(s)	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola
Aims	Finland's logistical position in Europe as well as in the global context. Course will give basic understanding from different transportation modes (air, road, sea and rail), and their relation to users (e.g. companies) financial and non-financial performance. Combining different modes of transportation to represent overall transportation service (e.g. automation and containers). Role of Russia and Asia in the transportation flows of Europe. Third party logistics solutions. Value enhancement in logistical services and processes, M&A waves, and the reasons for service provider integration.
Contents	Among lectures, course contains case exercises (which will combine the issues of different transportation modes together), and by participating in all of these, student will have some amount of basic points for exam.
Teaching methods	Lectures 14 h and cases 12 h as intensive teaching in the 4th period.
Assessment	0-5, examination (70 %) ja accepted case exercises (30 %).
Course Material	1. Häkkinen, Lotta (2005). Operations Integration and Value Creation in Horizontal Cross-Border Acquisitions. Turku School of Economics and Business Administration, A-6 (Doctoral Diss.). Available at URL: http://www.tukkk.fi/julkaisut/vk/Ae6_2005.pdf 2. Woxenius, Johan (1998). Development of Small-Scale Intermodal Freight Transportation in a System Context. Chalmers University of Technology, Report 34 (Doctoral Diss.). Available at URL: http://www.mot.chalmers.se/staff/johwox/_private/English/Reports/1998%20 Dissertation%20Woxenius.pdf 3. Hilmola, Olli-Pekka, Ulla Tapaninen, Erik Terk & Ville-Veikko Savolainen (2007). Container Transit in Finland and Estonia – Current Status, Future Demand and Implications on Infrastructure Investments in Transportation Chain. Publications from the Centre for Maritime Studies, University of Turku, A44. Available at URL: http://www.okt-infra.fi/!file/!id199/files/attachment/OKT_Infra_Cont_Report.pdf 4. Terk, Erik, Ulla Tapaninen, Olli-Pekka Hilmola & Tonis Hunt (2007). Oil Transit in Estonia and Finland – Current Status, Future Demand, and Implications on Infrastructure Investments in Transportation Chain. Publications of Estonian Maritime Academy, No. 4, 2007. Available at URL: http://www.okt-infra.fi/!file/!id206/files/attachment/OKT_Infra_Oil_Report_a.pdf 5. Ivanova, Oksana, Tero Toikka & Olli-Pekka Hilmola (2006). Eurasian Container Transportation Market: Current Status and Future Development Trends with Consideration of Different Transportation Modes. Lappeenranta University of Technology, Department of Industrial Engineering and Management. Research Report 179. Available at URL: http://kouvola.lut.fi/!file/!id980/files/attachment/Research_Report_179_Nora.pdf 6. Additional material provided by the lecturer (notes, articles and case exercises).
Prerequisites	Recommended to have taken some logistical courses before, e.g. from topics of supply chain management and production control.

CS34A0500	*TECHNOLOGY COMMERCIALIZATION AND CORPORATE VENTURING*	*5 ECTS cr*
	Technology Commercialization and Corporate Venturing, Teknologian kaupallistaminen	
Year and Period	M.Sc. (Tech.) 1-2, Period 4 int.	
Lecturer(s)	Professor, D.Sc. (Tech.) Marko Torkkeli	
	Visiting lecturers	
Aims	To understand the characteristics of technology commercialization and high growth technology ventures.	
Contents	This course examines issues related technology commercialization, corporate venturing, and ways to profitably exploit business opportunities. Business models.	
Teaching methods	Lectures and guest speakers 28 h as intensive teaching in the 4th period. Written report.	
Assessment	0-5. Written report 100 %.	
Course Material	Lectures and course pack.	
	Block Zenas and MacMillan Ian (1985) Corporate Venturing: Creating New Businesses Within the Firm. Harvard Business School Pr.	
	McGrath Rita and MacMillan Ian, (2005). MarketBusters: 40 Strategic Moves That Drive Exceptional Business Growth. Harvard Business School Pr.	

FV18A9900	*FINNISH SOCIETY AND CULTURE*	*2 ECTS cr*
	Finnish Society and Culture	
	Language of instruction is English	
Year and Period	Period 1-2 and 3-4	
Lecturer(s)	Dr. Kalle Michelsen, Professor (Finnish History, Political Culture, Social and Economic System)	
	M.A. Kristiina Korjonen-Kuusipuro, Researcher (Finnish Culture)	
	Ph.D. Tuija Mikkonen (Architecture and Built Environment)	
	Dr. Mika Tonder, Senior Lecturer (Landscapes, mentalities)	
Aims	The aim of this course is to introduce Finland and South Karelia to foreign students. The course provides basic information of Finnish history (focusing on Karelia and Karelian issues) from 1809 to the present, culture (arts, architecture and landscape), political system and international issues as well as social and economic systems (demography, ethnic, regional, gender and equality issues, trade, industry, science and technology).	
Teaching methods	22 h lectures in English. The course is divided in following parts:	
	A) History (4 lectures)	
	B) Culture (4 lectures)	
	C) Lifestyle (4 lectures)	
	D) Architecture and Built Environment (2 lectures)	
	E) Society (2 lectures)	
	F) Economic Systems (2 lectures)	
	F) Nature and Landscape (4 lectures)	
	G) Exam (2 lectures)	
Assessment	Pass/fail on the basis of participation 60% and a written examination 40%.	
Course Material	Portraying Finland. Facts and Insights. Otava 2005. (Available in the library)	

15 Language Centre Courses 2008–2009

The LUT Language Centre offers courses in eight languages: Finnish, English, German, Spanish, French, Russian, Chinese and Swedish. A number of courses in Finnish, English, German, Spanish, French, Russian and Chinese do not require Finnish skills from participants and are available to international students. The language of instruction is mentioned in the course descriptions.

You must register for language courses before they begin. The number of participants for the language groups is limited, and teachers will decide on admissions based on certain criteria. The order in which students register is not a criterion for admission.

You can register for courses through WebOodi. The registration periods of Language Centre courses differ slightly from those of the faculties because of the student admission process. Please check the registration periods on the Language Centre web site at **www.lut.fi/kike**. Students will be informed of admissions by e-mail. Please make sure that your e-mail address in WebOodi is correct.

Remember to register for courses and exams separately.

		ECTS cr
FV11A2201	Technical English Reading Course	2
FV11A2600	Business English Reading Course	2
FV11A3200	Information Technology	2
FV11A4600	Energy Issues	3
FV11A4900	Financial English	2
FV11A5200	English for Academic Seminars	3
FV11A5800	Aspects of Work	3
FV11A6200	English for Negotiating	3
FV11A6500	Presenting in English	2
FV11A7400	Technology and the Environment	3
FV11A8500	Machines and Processes	3
FV11A9000	Academic Seminar for International Programs	6
FV11A9100	Going International and Intercultural Communication	3
FV11A9200	Technical and Current Issues	2
FV11A9300	Scientific and Technical English Writing Course	4
FV12A2000	Activation of German Skills	2
FV12A2500	Suggestopedic German Course	2
FV12A3200	Finland and Germany - Business Partner Scenario	3
FV12A4400	German for Mechanical Engineering	2
FV12A6200	Listening Comprehension in German	1
FV12A6600	Getting to Know Austria and Switzerland	2
FV12A6800	German Culture and History	3
FV12A7001	German Conversation Course	1
FV12A7200	Finnish Industry in German	2
FV12A7400	German for Forest Industry	2
FV12A7600	Business German	3
FV12A7800	Environmental Issues in German	2
FV12A8000	Environmental technology in German	2
FV12A8600	Basics of Macroeconomics	3
FV12A8800	Negotiating in German	2
FV14A3000	Russian Intensive Course in St. Petersburg	1
FV15A1200	French 1	3
FV15A1400	French 2	3
FV15A1500	French Pronunciation	2
FV15A1600	French for Working Life	3
FV15A5000	Business French	3
FV15A5500	Suggestopedic Course in Business French	2
FV15A6000	Finland in French – Intercultural course	4

FV16A1200	Spanish 1	3
FV16A1400	Spanish 2	3
FV16A1600	Spanish for Working Life	3
FV16A2201	Facts about Spain	1 - 3
FV16A2601	Finland in Spanish	2
FV16A3201	Business Spanish	3
FV16A5201	Intercultural Spanish Course	3
FV18A9101	Finnish 1	2
FV18A9201	Finnish 2	2
FV18A9301	Finnish 3	2
FV18A9800	German-Finnish Language and Culture Tandem	1
FV19A1000	Chinese 1	3
FV19A2000	Chinese 2	3
FV19A3000	Chinese for Working Life 1	3
FV19A4000	Chinese for Working Life 2	3

Course Descriptions

FV11A2201	TECHNICAL ENGLISH READING COURSE 2 ECTS cr
	Technical English Reading Course
Year and Period	B.Sc. (Tech.) 1-3, M.Sc. (Tech.) 1, Period 1, 2, 3, 4
Lecturer(s)	Jukka Taipale
CEF Level	The course will be taught at a B2/B2+ level according to the Common European Framework.
Aims	By the end of the course, students will be expected to know how to learn and master general technical vocabulary through reading general technical texts and to be able to read quickly and effectively.
Contents	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work. The language of instruction: English.
Teaching methods	28 contact lessons, with 24 hours required for homework and self-study. 1st period: group A 2nd period: group B 3rd period: group C 4th period: group D. Attendance: 50% of the lessons. Marks are based on a reading comprehension test (duration 90 minutes). Students must do all the course assignments to be eligible for the examination.
Assessment	0–5
Course Material	Provided by the teacher.
Prerequisites	Students with a matriculation exam grade of A, B, C or a short course in English may enroll for the course. Students who have taken Technical English Reading Course 1, Technical English Reading Course 2 or the Business English Reading Course are not eligible for this course.

FV11A2600	BUSINESS ENGLISH READING COURSE 2 ECTS cr
	Business English Reading Course
Year and Period	M.Sc. (Econ. & Bus. Adm.) 1, Period 1, 2, 3, 4
Lecturer(s)	Jukka Taipale
CEF Level	The course will be taught at B2/B2+ level according to the Common European Framework.
Aims	By the end of the course, students will be expected to know how to learn and master general business vocabulary through reading general business texts, and to be able to read quickly and effectively.
Contents	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.

Teaching methods	The languages of instruction are both Finnish and English. 28 contact lessonss, with 24 hours required for homework and self-study. 1st period: group A 2nd period: group B 3rd period: group C 4th period: group D. Attendance: 50% of the lessons. Marks are based on a reading comprehension test (duration 90 minutes). Students must do all the assignments to be eligible for the examination.
Assessment	0–5
Course Material	Provided by the teacher.
Prerequisites	Students who have taken Technical English Reading Course 1 or Technical English Reading Course 2 or FV11A2201 Technical English Reading Course are not eligible for this course.

FV11A3200	INFORMATION TECHNOLOGY	2 ECTS cr
	Information Technology	
Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1, 2, 3, 4	
Lecturer(s)	Jukka Taipale	
CEF Level	The course will be taught at a B2/B2+ level according to the Common European Framework.	
Aims	By the end of the course, students will be expected to master the language needed to read and talk about issues connected with information technology and to have learned the study skills needed to follow lectures given in English.	
Contents	The Internet / World Wide Web / Video will be used as a resource. A wide variety of teaching methods will be used, including exercises based on reading, writing, speaking and listening skills. The language of instruction is English.	
Teaching methods	28 contact hours, with 24 hours required for homework and self-study. 1st period: group A 2nd period: group B 3rd period: group C 4th period: group D. Continuous assessment of the student's participation in class, resulting in an oral mark, and written exercises approved by the teacher. Attendance: 100% of the lessons.	
Assessment	0–5, oral mark 50%, written exercises 50%	
Course Material	Provided by the teacher and the students.	

FV11A4600	ENERGY ISSUES	3 ECTS cr
	Energy Issues	
Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3–4	
Lecturer(s)	Peter Jones	
CEF Level	B2 and above	
Aims	To develop and maintain speaking, listening and reading skills based on the theme of energy. On completion of the course, students will be able to read and understand written texts about energy issues, understand spoken texts about energy issues, and discuss topical energy issues with a degree of fluency permitting active participation in study and work related to the field of energy technology.	
Contents	Language practice and exercises based on texts, both written and spoken, concerning various topical energy issues – ranging from technological challenges to economic and environmental considerations. Language of instruction: English	
Teaching	Contact hours: 48 (24+24) Homework 30+	

methods	Periods 3-4: Groups A and B. Minimum attendance requirement: 75%. Written test and continuous assessment/oral test.
Assessment	0-5, written test (50%), continuous assessment/oral test (50%). Students must successfully complete all course assignments to be eligible for the examination.
Course Material	Provided by the teacher.

FV11A4900	*FINANCIAL ENGLISH*	*2 ECTS cr*
	Financial English	

Year and Period	Period 1, 2
Lecturer(s)	Peter Jones Timothy Fowler
CEF Level	B2 and above
Aims	To improve English skills in the field of financial management. On completion of the course, students will be able to read and understand written texts about finance quickly and effectively and will have an adequate mastery of basic terminology from the field, thus permitting active participation in study and work related to the area of finance.
Contents	The language of finance, including business finance, taxation, investment etc. Language of instruction: English.
Teaching methods	Contact hours: 24 Homework: 15+ Minimum attendance requirement: 75%. Period 1: Groups A and B Period 2: Groups C, D and E
Assessment	0-5, written test (100%). Students must successfully complete all course assignments to be eligible for the examination.
Course Material	Provided by the teacher.

FV11A5200	*ENGLISH FOR ACADEMIC SEMINARS*	*3 ECTS cr*
	English for Academic Seminars **Students who have attended Scientific and Technical Writing Course or Academic Seminar for International Programs are not eligible for this course.**	

Year and Period	B.Sc. (Tech.) 3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1–2, 3–4
Lecturer(s)	Timothy Fowler
CEF Level	B2 and above
Aims	General: To learn and practise basic skills needed to research and give an academic seminar in English. Learning Outcomes: Understanding of appropriate style in academic papers Ability to write accurate texts meeting academic conventions Ability to research and present an academic paper effectively
Contents	Students will study features of English for academic and scientific writing. Students will research and hold a seminar in English. Language of instruction: English.
Teaching methods	Contact hours: 24 (Period 1 and 3) Homework: 55+ Seminar: (Period 2 and 4) Periods 1–2: Group A Periods 3–4: Group B Attendance required (80%). Seminar paper and presentation. Students who have attended Scientific and Technical Writing Course or Academic Seminar for International Programs are not eligible for this course.
Assessment	0–5, seminar paper and presentation (100%).

Course Material Prerequisites	Provided by the teacher. The course is primarily meant for students of chemical technology. The course in periods 1–2 is exclusively for those students majoring in applied chemistry. Students of other departments are welcome to apply to the course in periods 3–4.

FV11A5800	*ASPECTS OF WORK*	*3 ECTS cr*
	Aspects of Work	
Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1–2, 3–4	
Lecturer(s)	Hwei-Ming Boey Timothy Fowler	
CEF Level	B2 and above	
Aims	• To develop the student's speaking, listening and reading skills • To discuss various types of CVs and letters of application By the end of the course students will be able to • communicate (with varying degrees of competence) about issues dealt with during the course • use the communication skills developed in circumstances outside of class • differentiate between various types of CVs and letters of application	
Contents	Issues concerning work. Language of instruction: English.	
Teaching methods	48 contact hours + 30 hours independent study 1st–2nd period: groups A and B 3rd–4th period: groups C, D and E A minimum of 75% attendance required. Tests: 1) A reading comprehension and writing test 2) An oral expression test (Students whose speaking skills can be continuously assessed in class will be exempted from the oral expression test.)	
Assessment	0–5, reading comprehension and writing test 50%, oral expression or continuous assessment 50%.	
Course Material	Provided by the teacher.	

FV11A6200	*ENGLISH FOR NEGOTIATING*	*3 ECTS cr*
	English for Negotiating	
Year and Period	B.Sc. (Tech.) 3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3–4	
Lecturer(s)	Hwei-Ming Boey	
CEF Level	B2 and above	
Aims	To practise the language needed for participating in negotiations. By the end of the course, students will be able to • communicate more effectively in negotiations • use the language skills developed in other communication instances	
Contents	Discussion and practice of the language for effective negotiating, participation in simulations of negotiations. Language of instruction: English.	
Teaching methods	48 contact hours + 30 hours independent study 3rd–4th period: groups A and B Continuous assessment. A minimum of 80% attendance required.	
Assessment	0–5	
Course Material	Provided by the teacher.	

FV11A6500	*PRESENTING IN ENGLISH*	*2 ECTS cr*
	Presenting in English	
Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1, 2	
Lecturer(s)	Peter G. Jones	
CEF Level	B2 and above	
Aims	To improve the ability to construct and deliver oral presentations in English. By the end of the course, students will be able to deliver carefully constructed, clear and effective presentations for academic and professional purposes.	
Contents	The language of presentations: - Starting a presentation, controlling the flow, the language of diagrams, summing up, handling questions etc. - Establishing and maintaining contact with the audience. - Delivering presentations in a supportive context. - Analysing one's own performance and establishing areas in need of further development. Language of instruction: English	
Teaching methods	Contact lessons: 24 Homework: 25+ Period 1: Groups A and B Period 2: Groups C, D and E Classroom exercises, presentation practice, and homework. Minimum attendance requirement: 75%.	
Assessment	Pass/Fail. Evaluated presentation (100%).	
Course Material	Provided by the teacher.	

FV11A7400	*TECHNOLOGY AND THE ENVIRONMENT*	*3 ECTS cr*
	Technology and the Environment	
Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1–2	
Lecturer(s)	Hwei-Ming Boey	
CEF Level	B2 and above	
Aims	To develop the student's speaking, listening and reading skills. By the end of the course, students will be able to: • Communicate (with varying degrees of competence) about issues dealt with in the course • Use the language skills developed in instances of communication beyond the classroom	
Contents	Issues concerning the environment. Language of instruction: English.	
Teaching methods	48 contact hours + 30 hours independent study 1st–2nd period: Groups A and B A minimum of 75% attendance required. A listening comprehension and an oral expression test. Students whose speaking skills can be continuously assessed in class will be exempted from the oral expression test.	
Assessment	0–5, listening comprehension 50% of final mark, oral expression/continuous assessment 50%.	
Course Material	Provided by the teacher.	

FV11A8500	*MACHINES AND PROCESSES*	*3 ECTS cr*
	Machines and Processes	
Year and Period	B.Sc. (Tech.) 1-3, Period 1–2, 3–4	
Lecturer(s)	Kristiina Karjalainen	
CEF Level	B2–C1	

Aims	By the end of the course, students will be able:
	• to describe machines and their functions.
	• to describe processes.
	• to identify and construct a classic scientific definition.
	• to carry out clear and well organized presentations for a variety of stakeholders.
	• to compile a glossary specific to their fields of study.
	• to show effective summarizing skills.
	• to show an improvement in spoken fluency.
	• to demonstrate ability to actively work in groups.
	• to show effective critical feedback skills.
Contents	Using technically-oriented materials, students will mainly work on their oral communication skills, with some concentration on active listening skills and summary writing skills.
Teaching methods	48 hours, with at least 30 hours required for homework and self-study.
	1st–2nd period: Groups A and B.
	3rd–4th period: Group C
	This class is for students in engineering. If there are spaces available, students from other disciplines are welcome.
Assessment	Pass/Fail will be determined through continuous assessment as well as self-assessment.
	For students to be eligible for this option, they must attend a minimum of 75% of the classes.
	Students who participate between 50 and 75% of the classes will be eligible to sit the final exam, which is made up of a speaking (50%), listening (25%) and writing (25%) component.
Course Material	Materials will be provided by the students and the teacher.
Prerequisites	B2 level according to the Common European Framework.
	Students must assess their level of English before the course using an online diagnostic tool called Dialang. It can be downloaded at www.dialang.org.
	Alternatively, students can access Dialang in Origo, in Sini and Cosini.
	Students are also expected to know the following before coming to class:
	• the names of basic shapes and their adjective forms,
	• how to read numbers and decimals in English.
	Self-study materials are available online and in the self-access room (1410B) for review.

FV11A9000	*ACADEMIC SEMINAR FOR INTERNATIONAL PROGRAMS* *6 ECTS cr*
	Academic Seminar for International Programs
Year and Period	Period 2–4
Lecturer(s)	Barbara Miraftabi
	Peter Jones
CEF Level	Students should have a B2 or C1 level according to the Common European Framework.
Aims	By the end of the course, students will be able to:
	• demonstrate an ability to take lecture notes
	• analyze weaknesses in their spoken English
	• demonstrate skills for participating in seminar discussions
	• write an acceptable seminar paper
	• present an oral report on the seminar paper
Contents	During the second period of the autumn semester, concentration will be on listening and oral skills. Students will work in small groups to critique each other's language skills and help each other to develop. Short presentations will be given to practice presentation skills, and this will be a period with a great deal of independent study.
	During the third and fourth periods, writing theory will be presented and students will write for peer group review. In order to pass the course, each

	student must submit a paper written about a subject assigned by a department instructor. After peer review (in order to monitor, critique and support each other's work) and consultation with the writing instructor, the paper may have to be rewritten until grammar, unity, cohesion, etc are acceptable. The course will also include an oral presentation of the paper as if it were to be presented at a conference.
	The language of instruction and all activities is English.
Teaching methods	72 contact lessons, 84 hours independent study
	2nd–4th periods: groups A and B
	The course is offered once during the academic year for the departmental international master's degree programs.
	It is wise to remember that attendance is important. Since this is a 6 ECTS course, student responsibility will be noted and a student may fail if not attending the classes regularly.
Assessment	Pass/Fail
Course Material	No required book; handouts from various books, material developed by language teachers, and information on the Internet will be used.
Prerequisites	Acceptance by a department of LUT into an International Master's Degree program.
	Students should have a B2 or C1 level according to the Common European Framework.

FV11A9100	*GOING INTERNATIONAL AND INTERCULTURAL COMMUNICATION*	*3 ECTS cr*

	Going International and Intercultural Communication
Year and Period	Period 1–2, 3–4
Lecturer(s)	Barbara Miraftabi
CEF Level	Teaching level: C2; language will not be taught and students will gain in fluency at B2/C1 levels.
Aims	By the end of the course, students will be expected:
	• to demonstrate understanding of the concept of culture and how it is learned.
	• to explain the iceberg analogy of culture in contrast to other analogies of culture.
	• to demonstrate an ability to use the DIE observation skills model, e.g. with pictures.
	• to show they can work effectively in small groups.
	• to show they can risk new behaviour by sharing in large groups.
	• to explain cultural learning in areas like ideas, sentiments, values, etc by using Finland as an example.
	• to explain the basic principle of culture related to semiotics.
	• to put oneself on the Milton Bennett model of intercultural sensitivity chart.
Contents	Through the principles of experiential learning and general interculturalist theories, students will analyze their own cultures, practise observation of culture by using Finnish situations as examples, and learn more about self as a cultural being. Students will write response papers both individually and in groups regarding different aspects of the course to show a grasp of the principles and self-awareness.
Teaching methods	48 h contact lessons, 30 hours independent study and homework.
	Periods 1–2: Group A
	Periods 3–4: Group B
	NOTE: Although ECTS credits are given to fulfill language requirements, the course is a content course studying culture and not a language course studying language. The language of instruction and all student activities is English, and many activities will involve students in activities outside classroom.
	Students (with a level of at least B2) from all departments are welcome.
	Preference will be given to students applying to student exchange or planning to work abroad.
	Since experiential learning techniques are important for the course, do not take

	this course if you plan a lengthy vacation during the class period. Any absence lasting longer than three consecutive class meetings will require additional work on the part of the student.
Assessment	Pass/Fail
Course Material	No required book; handouts will be given and Internet sources used.

FV11A9200   TECHNICAL AND CURRENT ISSUES   2 ECTS cr

Technical and Current Issues

Year and Period	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1–2, 3–4
Lecturer(s)	Jukka Taipale Timothy Fowler
CEF Level	Level coming into the course: C1.
Aims	By the end of the course, students will have increased their fluency in English and improved their understanding of spoken discourse, both technical and general.
Contents	Language practice and exercises based on audio and video material from a variety of sources concerning topics of interest, both technical and general. Language of instruction: English.
Teaching methods	Contact hours: 26 Homework: 25+ 1st–2nd period: Groups A and B 3rd–4th period: Groups C and D Listening comprehension test. Continuous assessment/speaking test. 75% attendance required. Students who have attended the course Current Issues are not eligible for this course.
Assessment	0–5, listening comprehension test (50%), continuous assessment/speaking test (50%).
Course Material	Provided by the teacher.
Prerequisites	Students' spoken ability should be at a C1 level.

FV11A9300   SCIENTIFIC AND TECHNICAL ENGLISH   4 ECTS cr
WRITING COURSE

	Scientific and Technical English Writing Course
Year and Period	M.Sc. (Tech.) 1-2, Period 1–2, 3–4
Lecturer(s)	Barbara Miraftabi
CEF Level	By the end of the course, students should be at a C1 level in writing skills.
Aims	By the end of the course, students will be able to demonstrate their grasp of academic writing theory by: • writing a draft of a research paper or some other acceptable paper (related to the fields of study offered at LUT) negotiated with the instructor • presenting the paper orally • rewriting parts of the paper as needed
Contents	The draft must contain acceptable sections as covered in theory classes. Papers may have to be rewritten until grammar, unity, cohesion, etc are acceptable. The course will also include an oral presentation of the paper. The language of instruction is English.
Teaching methods	48 contact lessons, 56 hours independent study. 1st–2nd period: Group A 3rd–4th period: Group B Students should have a B2 or C1 level of English and some piece of factual material related to their field of study to for writing a paper.
Assessment	Pass/Fail
Course Material	No book required; there will be handouts from various books, including materials developed by the teacher. Information on the Internet will also be referenced.
Prerequisites	A CEF B2 level in writing and speaking skills.

FV12A2000	*ACTIVATION OF GERMAN SKILLS*	*2 ECTS cr*
	Saksan kielitaidon aktivointi	
Year and Period	Period 2, 3, 4	
Lecturer(s)	Pirjo Rantonen	
	Jörg Wunderlich	
	Sanna Heikkeri	
CEF Level	Entry level: A2.	
Aims	By the end of the course, students are expected:	
	- to know the basic German grammar	
	- to be able to write texts at the proficiency level in question	
	- to be able to have everyday discussions in German.	
Contents	Contact lessons: revision of grammar, spoken exercises, pair work, writing assignments.	
	Homework: grammar exercises.	
	Languages of instruction: German and Finnish.	
Teaching methods	Contact lessons 24, independent work approx. 28 hours.	
	2nd period: Group A	
	3rd period: Group B	
	4th period: Group C	
	Active participation and successfully completed exercises or a written test.	
	Continuous assessment requires 75% attendance and active participation.	
Assessment	Pass/fail.	
Course Material	Materials provided by the teacher.	
Prerequisites	Approx. two years of German studies.	

FV12A2500	*SUGGESTOPEDIC GERMAN COURSE*	*2 ECTS cr*
	Suggestopedinen saksa	
Year and Period	Period 3	
Lecturer(s)	Pirjo Rantonen	
	Lecturer(s) responsible: Pirjo Rantonen	
CEF Level	A2/B1	
Aims	By the end of the course students will be expected to:	
	- be able to communicate orally in varying and even unexpected situations using standard language	
	- understand standard spoken language on varying topics	
	- communicate orally more unreservedly and spontaneously than at the beginning of the course	
	- kohtaamaan entistä rohkeammin uusia kielenkäyttötilanteita.	
Contents	Primarily everyday and work related situations familiar from the basic language courses, oral communication with the help of the suggestopedic method. Extended vocabulary related to these situations.	
Teaching methods	Pair and group work, role play	
	Lessons 28, independent work 16 hours. Weekend course, dates given in 3rd period registration.	
	3rd period (1 group).	
	Learning journal, continuous assessment requires full attendance and active participation.	
Assessment	Pass/fail.	
Course Material	Material provided by the teacher.	

FV12A3200	*FINLAND AND GERMANY - BUSINESS PARTNER SCENARIO*	*3 ECTS cr*
	Finnland als Partner	
Year and Period	Period 1–2, 3–4	
Lecturer(s)	Jörg Wunderlich	

CEF Level	Entry level: A2.
Aims	By the end of the course, students are expected to be able
	- to recognise differences and similarities between the Finnish and German cultures
	- to use their oral skills in cooperation with German partners
	- to give presentations in German
Contents	General forms of communication, such as writing an invitation, preparing for meetings, making a hotel reservation, going to a restaurant, organising informal get-togethers, preparing a schedule for a visit, talking on the phone, taking visitors sight-seeing.
	Students prepare a short presentation on a topic related to the country, e.g. geography, culture, media, history, politics, sports, climate.
	Discussions on cultural differences between Finland and Germany.
	Language of instruction: German.
Teaching methods	Contact lessons 48 (24+24), independent work approx. 30 hours.
	1st–2nd period (Group A, group B in the evenings once a week, on Mondays 4 h/meeting)
	3rd–4th period (Group C, group D in the evenings once a week, on Mondays 4 h/meeting)
	Pair and group assignments, listening comprehension, role play.
	Active participation. Grade based on continuous assessment or an oral test and listening comprehension test.
	Continuous assessment requires 75% attendance and active participation.
Assessment	0–5
Course Material	Materials provided by the teacher and online material in the Blackboard learning environment.
Prerequisites	German for Working Life, Activation of German or equivalent skills.

FV12A4400   GERMAN FOR MECHANICAL ENGINEERING   2 ECTS cr

	Deutsch im Maschinenbau
Year and Period	Period 3
Lecturer(s)	Jörg Wunderlich
CEF Level	Level: B1
Aims	By the end of the course, students are expected
	- to know basic terminology in the field
	- to be able to describe a technical process
	- to understand texts on mechanical engineering
	- to know grammar needed in technical language.
Contents	Revision of grammatical structures for technical language.
	Written and spoken description of technical procedures and processes.
	Exercises in spoken language once a week during contact lessons.
	Language of instruction: German.
Teaching methods	Contact lessons 14, independent work (online) approx. 38 hours.
	3rd period (1 group).
	Continuous assessment requires 75% attendance and active participation.
	Successfully completed written and spoken assignments or written and oral test.
Assessment	0–5
Course Material	Online material and exercises:
	http://www.uni-tuebingen.de/ael/deuma/deuma_overview.htm
Prerequisites	Facts about Finland and Germany or equivalent skills.

FV12A6200   LISTENING COMPREHENSION IN GERMAN   1 ECTS cr

	Hörkurs Deutsch
Year and Period	Period 4
Lecturer(s)	Jörg Wunderlich
CEF Level	Entry and target level: B1

Aims	By the end of the course the students are expected to understand spoken language at a normal pace.
Contents	Listening comprehension exercises. Learning new standard language vocabulary. Language of instruction: German.
Teaching methods	Contact lessons: 12, independent work approx. 14 hours. 4th period (1 group). Grade based on continuous assessment, listening comprehension exercises and a listening comprehension test. Continuous assessment requires 75% attendance and active participation.
Assessment	0–5
Course Material	Listening comprehension exercises (partly in the Blackboard learning environment), material provided by the teacher.
Prerequisites	Facts about Finland and Germany or equivalent skills.

FV12A6600	*GETTING TO KNOW AUSTRIA AND SWITZERLAND*	*2 ECTS cr*

	Die Alpenländer	
Year and Period	Period 4	
Lecturer(s)	Theodor Steidel	
CEF Level	B1	
Aims	To learn about the characteristics of Austria and Switzerland. By the end of the course, students will be able to - give a short presentation on one of the topics dealt with on the course - recognise differences and similarities between German-speaking countries.	
Contents	Taking a look behind Austrian and Swiss stereotypes. Learning the essentials of the countries' history, culture, society and business through texts, videos and the Internet. Language of instruction: German.	
Teaching methods	Contact lessons 24, independent work approx. 28 hours. 4th period (1 group). Pair and group work in class, written and spoken assignments. Grade based on successfully completed assignments or a written exam. Continuous assessment requires 75% attendance and active participation.	
Assessment	0–5	
Course Material	Handouts given by the teacher.	
Prerequisites	Facts about Finland and Germany or equivalent skills.	

FV12A6800	*GERMAN CULTURE AND HISTORY*	*3 ECTS cr*

	Kultur und Geschichte	
Year and Period	Period 3–4	
Lecturer(s)	Pirjo Rantonen	
CEF Level	B1	
Aims	By the end of the course, students will be able to - identify important German personalities from different periods in time and briefly relate what kind of impact they had on culture and society - understand the essential cultural developments in Germany - explain in more detail the developments in Germany after World War II in order to better understand the current societal structure and its main influencing factors - have a discussion in German on important societal and cultural topics and compare the German and Finnish society and culture - critically analyse German literature and movies - independently study texts in German on historical, societal and cultural topics, identify the key information and summarise it in their own words.	
Contents	A variety of written and spoken assignments related to German culture, history and society, independent and group work, presentations and discussion.	

Teaching methods	Language of instruction: German. 48 contact lessons + approx. 30 hours of independent work. Continuous assessment requires 75% attendance and active participation. Grade based on continuous assessment (50%) and presentations and written assignments (50%).
Assessment	0–5
Course Material	Material provided by the teacher.
Prerequisites	Finnland als Partner or equivalent skills.

FV12A7001	*GERMAN CONVERSATION COURSE*	*1 ECTS cr*

	Gesprächsrunde
Year and Period	Period 1–2, 3–4
Lecturer(s)	Sanna Heikkeri
	Theodor Steidel
CEF Level	B2
Aims	By the end of the course, students will be able to
	- easily understand German spoken at a normal pace
	- discuss e.g. topical issues related to the society in German
	- state and justify their opinions in German, as well as respond to other people's opinions.
Contents	Topics chosen by the group.
	Language of instruction: German.
Teaching methods	Discussion with both a native German teacher and German exchange students.
	Contact lessons 24 (6 meetings, dates set in the 1st meeting):
	1st–2nd period (Group A) is suitable for all students, especially for those who have taken part in student exchange in a German-speaking country
	3rd–4th period (Group B) is suitable for all students, especially for those planning an exchange period in a German-speaking country
	Continuous assessment, requires 75% attendance and active participation.
Assessment	Pass/fail.
Prerequisites	Courses at B1 level or equivalent skills.

FV12A7200	*FINNISH INDUSTRY IN GERMAN*	*2 ECTS cr*

	Finnische Industrie
Year and Period	Period 2
Lecturer(s)	Jörg Wunderlich
	Theodor Steidel
CEF Level	B1
Aims	By the end of the course, students will be expected to be able to tell and write about Finnish industry and products.
	Students are also expected to be able to give a presentation on Finnish industry in German.
Contents	Exploring material on Finnish industry available in German.
	Language of instruction: German.
Teaching methods	Contact lessons 24, independent work approx. 28 hours.
	2nd period (1 group).
	Continuous assessment requires 75% attendance and active participation.
	Individual, pair and group work. Successfully completed written and spoken assignments or a written and oral test.
Assessment	0–5
Course Material	Material provided by the teacher and Finnish company web sites in German.
Prerequisites	Facts about Finland and Germany or equivalent skills.

FV12A7400	*GERMAN FOR FOREST INDUSTRY*	*2 ECTS cr*
	Wald und Holz	
Year and Period	Period 1	
Lecturer(s)	Jörg Wunderlich	
CEF Level	B1	
Aims	By the end of the course, students will	
	- know basic terminology related to the field	
	- be able to describe issues related to the forest industry	
	- understand texts on the forest industry	
	- know the grammatical structures related to technical language.	
Contents	Forestry, wood trade, harvesting, wood processing (sawmills). Revision of grammatical structures needed in technical language.	
	Oral exercises during contact lessons once a week.	
	Language of instruction: German.	
Teaching methods	Contact lessons 14, independent work (online) approx. 38 hours.	
	1st period (1 group).	
	Successfully completed written and spoken assignments or written and oral test. Continuous assessment requires 75% attendance and active participation.	
Assessment	0–5	
Course Material	Material and exercises online:	
	http://www.uni-tuebingen.de/ael/ilegefos/ilegefos_overview.htm	
Prerequisites	Facts about Finland and Germany or equivalent skills.	

FV12A7600	*BUSINESS GERMAN*	*3 ECTS cr*
	Wirtschaftsprache Deutsch	
Year and Period	Period 1–2, 3–4	
Lecturer(s)	Sanna Heikkeri	
	Theodor Steidel	
CEF Level	B1	
Aims	By the end of the course, students are expected to	
	- understand business-related texts in German	
	- know vocabulary and structures in business texts	
	- know the special characteristics of German business texts	
	- be able to describe the Finnish economy in German	
	- be able to critically analyse German business texts	
	- be able to produce business texts in German	
Contents	Individual, pair and group work. Business vocabulary exercises, reading and writing business texts. The course is suitable for students from any department.	
	Language of instruction: German.	
Teaching methods	Contact lessons 48 (24+ 24), independent work approx. 30 hours:	
	1st–2nd period: Groups A and B	
	3rd–4th period: Group C	
	Continuous assessment and successfully completed written assignments or a written test.	
	Continuous assessment requires 75% attendance and active participation.	
Assessment	0–5	
Course Material	Provided by the teacher.	
Prerequisites	German for Working Life or equivalent skills.	

FV12A7800	*ENVIRONMENTAL ISSUES IN GERMAN*	*2 ECTS cr*
	Deutsch für die Umwelt	
Year and Period	Period 2	
Lecturer(s)	Jörg Wunderlich	
CEF Level	B1	
Aims	By the end of the course, students are expected to	

	- know the basic terminology in the field
	- be able to describe the environment (orally and in writing)
	- understand texts on nature's processes
	- know the necessary structures
	- be able to study in an international environment.
Contents	Basic environmental issues, such as air, water, soil, waste.
	Language of instruction: German.
Teaching methods	Contact lessons 14, independent work (online) approx. 38 hours.
	2nd period (1 group).
	Spoken exercises during contact lessons once a week.
	Assignment through international online cooperation with students from European universities.
	Successfully completed written and spoken assignments or written and oral test.
	Continuous assessment requires 75% attendance and active participation.
Assessment	0–5
Course Material	Online exercises (http://www.uni-tuebingen.de/entecnet/) and handouts in class.
Prerequisites	Facts about Finland and Germany or equivalent skills.

FV12A8000	*ENVIRONMENTAL TECHNOLOGY IN GERMAN 2 ECTS cr*
	Umwelttechnik
Year and Period	Period 3
Lecturer(s)	Jörg Wunderlich
CEF Level	B1
Aims	By the end of the course, students will
	- know the basic terminology in the field
	- be able to describe processes (orally and in writing)
	- understand texts on environmental technology
	- know the structures needed in technical language
	- be able to study in an international environment.
Contents	Online course and exercises on basic environmental technology.
	Topics: cleaning of flue gas and waste water, ground pollution, environmental biotechnology, waste management, biogas production.
	Language of instruction: German.
Teaching methods	Contact lessons 14, independent work (online) approx. 38 hours.
	3rd period (1 group).
	Spoken exercises during contact lessons once a week. Assignment through international online cooperation with students in European universities.
	Successfully completed written and spoken assignments or written and oral test.
	Continuous assessment requires 75% attendance and active participation.
Assessment	0–5
Course Material	Online course and exercises:
	http://www.uni-tuebingen.de/entecnet/
Prerequisites	Facts about Finland and Germany or equivalent skills.

FV12A8600	*BASICS OF MACROECONOMICS* *3 ECTS cr*
	Makroökonomie ganz einfach
	This course will not be taught in the academic year 2007–2008.
Year and Period	Period 1–2
Lecturer(s)	Sanna Heikkeri
	Theodor Steidel
CEF Level	Entry level: B2.
Aims	By the end of the course students will be expected to
	- understand German texts on economics

	- manage the central terminology of economics in German and use it in spoken and written language
	- be able to tell about the special features of the Finnish economy in German, comparing them with other countries
	- be able to analyse German texts on the field of the course
Contents	Individual, pair and group work. Vocabulary, spoken, reading and writing exercises related to the field of the course. The course is suitable for students of all departments.
	The course can be included in German as a minor subject.
	Language of instruction: German.
Teaching methods	Contact lessons 48 (24 + 24)
	1st–2nd periods (1 group)
	Continuous assessment and successfully completed written assignments or a written test.
	Continuous assessment requires 75% attendance and active participation.
Assessment	0–5. Written part 50%, oral 50%.
Course Material	Provided by the teacher.
Prerequisites	Business German or equivalent skills.

FV12A8800	*NEGOTIATING IN GERMAN*	*2 ECTS cr*
	Verhandlungssprache Deutsch	

Year and Period	Period 3–4
Lecturer(s)	Theodor Steidel
	Sanna Heikkeri
CEF Level	Entry level: B2.
Aims	By the end of the course students are expected to
	- be familiar with key elements in German negotiations
	- be able to use the most central German expressions in the most common negotiation situations
Contents	Preparing for negotiations, their simulation and analysis.
	Language of instruction: German.
Teaching methods	Contact lessons 48 (24 + 24)
	3rd–4th period (1 group)
	Active participation or an oral test. Continuous assessment requires 75% attendance and active participation.
Assessment	0–5
Course Material	Provided by the teacher.
Prerequisites	Wirtschaftsprache Deutsch or equivalent skills.

FV14A3000	*RUSSIAN INTENSIVE COURSE IN ST. PETERSBURG*	*1 ECTS cr*
	Venäjän kielen intensiivikurssi Pietarissa, Русский язык интенсивно в Санкт-Петербурге	

Year and Period	Period 3
Lecturer(s)	NN
	Lecturer(s) responsible: Pirjo Seppänen-Katajisto
CEF Level	Target level: A2
Aims	By the end of the course, students will be extected to
	• speak Russian more fluently and to better understand spoken language
	• understand the Russian way of life.
Contents	Oral communication exercises and revision of grammar with a native Russian instructor.
	The course can be included in Russian as a minor subject.
	Language of instruction: Russian.
Teaching methods	Contact lessons approx. 24. The course will be held in the spring semester of 2008, exact dates and times will be given later. Registration in October. Five to ten students will be accepted. The course is aimed at students at a more

	advanced level.
	Active participation and 100% attendance required.
	Written and oral tests at the end of the course.
Assessment	Pass/fail.
Prerequisites	An advanced course in Russian, at least Russian for Working Life/Russian 3.

FV15A1200	**FRENCH 1**	**3 ECTS cr**
	Ranska 1	

Year and Period	Period 1–2, 3–4
Lecturer(s)	David Erent
CEF Level	Entry level: 0, target level: A1
Aims	By the end of the course, students are expected
	- to understand spoken language when it is slow, clear and related to topics discussed during the course
	- to use simple sentences to talk about themselves and their work
	- to use simple sentences on the telephone
	- to write short and simple e-mails and letters
	- to understand key words in a text related to topics discussed during the course
	- to use polite phrases and expressions typical of the French communication culture.
Contents	Situations: introducing oneself, describing family, travelling, describing things.
	Structures: verbs in the present and future tense, passé composé, articles, adjectives, prepositions of place, prepositions à and de, personal pronouns, structures expressing ownership, negations, questions, numerals
	Languages of instruction: French and Finnish. If there are exchange students in the group, they will get instruction in English, if needed.
Teaching methods	Exercises that support communication skills.
	Contact lessons 48 (24 + 24), independent study approx. 30 hours.
	1st–2nd period (group A),
	3rd–4th period (group B).
	Written examination. Oral test or grade based on continuous assessment.
	Continuous assessment requires 75% attendance and active participation.
Assessment	Pass/fail. Written examination 50%, oral test or continous assessment 50%.
Course Material	Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express, lessons 1-5.

FV15A1400	**FRENCH 2**	**3 ECTS cr**
	Ranska 2	

Year and Period	Period 1–2, 3–4
Lecturer(s)	David Erent
CEF Level	Entry level: A1, target level: A2.
Aims	By the end of the course, students are expected
	- to cope in situations practised during the course
	- to be able to discuss topics introduced during the course
	- to fill out their personal information in a form and write a short and simple text related to topics discussed during the course
	- to understand the main idea of texts on topics discussed during the course
	- to understand and apply the most important French customs.
Contents	Situations: talking about work, the working environment and working day, presenting a company (very shortly), going to a bank, describing people, talking about the past and future and seeing a doctor.
	Structures: verbs: imperfect, future, imperative, conditional, partitive structure, objects of personal pronouns, interrogative pronouns, demonstratives, comparative forms, relative pronouns.
	Languages of instruction: French and Finnish. If there are exchange students in the group, they will get instruction in English, if needed.
Teaching	Exercises that support communication skills.

methods	Contact lessons 48 (24 + 24), independent study approx. 30 hours. 1st–2nd period (group A), 3rd–4th period (group B). Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.
Assessment	Pass/fail. Written examination 50%, oral test or continuous assessment 50%
Course Material	Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express, lessons 6–10.
Prerequisites	French 1 or equivalent skills.

FV15A1500	*FRENCH PRONUNCIATION*	*2 ECTS cr*
	Ranskan ääntämiskurssi	
Year and Period	Period 1 tai 2, 3–4	
Lecturer(s)	Vuokko Paakkonen David Erent	
CEF Level	Entry level: A1.	
Aims	By the end of the course, students are expected - to pronounce correctly the speech sounds practised during the course - to identify the speech sounds practised during the course based on their spelling - read texts aloud according to French liaison rules - read texts aloud according to French intonation and rhythm - to identify the sounds practised during the course in speech and utilise them in listening comprehension - to utilise phonetic writing to support correct pronunciation - to identify mistakes in their own pronunciation and to correct them.	
Contents	The French vowel and consonant sounds, of which the most important ones for oral communication will be handled in more detail. The writing corresponding to the sounds. Phonetic symbols. Liaison, rhythm and intonation. Languages of instruction: French or Finnish. If there are exchange students in the group, they will get instruction in English, if needed.	
Teaching methods	Group A: Practising pronunciation using mainly the Gattegno method. Pronunciation and listening comprehension exercises in the language lab. Contact lessons 28 (a weekend course; times will be set together with the students). Independent work approx. 23 hours. Introductory session at the beginning of the 1st period. Instruction on learning how to learn in the introductory session. 1st or 2nd period (group A). Learning journal and approved exercises. Continuous assessment and the Gattegno method require 80% attendance and active participation. Group B: Pronunciation and listening comprehension exercises in the language lab. Contact lessons 28 (14+14), independent work approx. 24 hours. 3rd–4th period. Approved exercises. Continuous assessment (requires at least 50% attendance and active participation) or a final exam.	
Assessment	Pass/fail. Group A: exercises and learning journal 50%, continous assessment 50%. Group B: exercises 50%, continous assessment or the final exam 50%	
Course Material	Provided by the teacher. Additional material available in the self-access centre of the Language Centre.	

FV15A1600	*FRENCH FOR WORKING LIFE*	*3 ECTS cr*
	Työelämän ranskaa	
Year and Period	Period 1–2, 3–4	

Lecturer(s)	David Erent
CEF Level	Entry level: A2, target level: B1.
Aims	By the end of the course, students are expected to be able - to talk about themselves as employees - to talk about work and the working environment both in face-to-face situations and on the phone - to communicate in situations related to work and travelling - to write work related e-mails and official letters - to understand the main points of general texts on the world of work - to understand and apply the most important French work related customs.
Contents	Situations: visitors at the working place, organising meetings, talking about working conditions, describing simple manufacturing processes, explaining how a machine functions, communication in work-related travelling (using public transportation, getting to know a city, hotel and restaurant situations), using e-mail, using the telephone, writing letters. Structures: different prepositions, relative pronouns, the present tense, passé composé and the future, the passive, indirect speech. Language of instruction: French.
Teaching methods	Exercises that support communication skills. Contact lessons 48 (24 + 24), independent study approx. 30 hours. 1st–2nd period (group A), 3rd–4th period (group B). Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.
Assessment	0–5. Written examination 50%, oral test or continuous assessment 50%
Course Material	Jean-Luc PENFORNIS: français.com, lessons 1–5
Prerequisites	French 2 or equivalent skills.

FV15A5000	*BUSINESS FRENCH*	*3 ECTS cr*
	Français de l'entreprise	

Year and Period	Period 1–2
Lecturer(s)	David Erent
CEF Level	Entry level: B1.
Aims	By the end of the course, students are expected to be able - to give a presentation in French - to follow oral presentations actively - to describe a company - to talk about various tasks and responsibilities in a company - to communicate both orally and in writing when applying for a job - to understand work-related texts - to understand and apply the most important French work-related customs.
Contents	Situations: describing a company, applying for a job (advertisement, letter of application, CV, job interview). Oral presentation. Structures: comparative forms, structures expressing condition or presumption, harmony of tenses, indirect speech, adverbs, past perfect, subjunctive, passé simple, past tense conditional. Language of instruction: French.
Teaching methods	Exercises that support communication skills. Contact lessons 48 (24 + 24), independent study approx. 30 hours. 1st–2nd period (1 group). Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.
Assessment	0–5, written examination 50%, oral test or continuous assessment 50%
Course Material	Jean-Luc PENFORNIS: français.com, lessons 6–10
Prerequisites	French for Working Life or equivalent skills.

FV15A5500	*SUGGESTOPEDIC COURSE IN BUSINESS FRENCH*	*2 ECTS cr*

	Yrityselämän ranskaa suggestopedian avulla	
Year and Period	Period 3 tai 4	
Lecturer(s)	Vuokko Paakkonen	
CEF Level	Entry level: B1.	
Aims	By the end of the course, students are expected to be able	
	- to communicate orally in changing and even surprising work-related situations	
	- to understand speech on varying topics in work-related situations	
	- to communicate orally more unreservedly and spontaneously than at the beginning of the course	
	- to encounter new situations more boldly than before.	
Contents	Subjects: mainly the same situations as in the courses French for Working Life and Français de l'entreprise, communicating orally using the suggestopedic method. Revising the most important structures and slightly extending the vocabulary of the above-mentioned courses.	
	Language of instruction: French.	
Teaching methods	Pair and group work using role play, relaxation techniques, and exercises improving creativity.	
	Contact lessons 32, independent work approx. 18 hours.	
	This is a weekend course; the dates and times will be agreed upon with the students. Introductory session at the beginning of the 3rd period. Instruction on learning how to learn in the introductory session.	
	3rd or 4th period (1 group)	
	Learning journal. Continuous assessment and the suggestopedic method require 80% attendance and active participation.	
Assessment	Pass/fail.	
Course Material	Provided by the teacher.	
Prerequisites	French for Working Life or equivalent skills.	

FV15A6000	*FINLAND IN FRENCH – INTERCULTURAL COURSE*	*4 ECTS cr*

	La Finlande en français - cours interculturel	
	This course is suitable for French students, too.	
Year and Period	Period 3–4	
Lecturer(s)	David Erent	
CEF Level	Entry level: B1.	
Aims	By the end of the course, Finnish students are expected	
	- to be able to describe Finland, Finnish people and culture to a French person, paying attention to the characteristics of the French culture	
	- to apply the interactive skills practiced during the course when encountering a new culture.	
	By the end of the course, French students are expected	
	- to know Finland, Finnish people and Finnish culture in general terms and to pay attention to the characteristics of the Finnish culture when communicating with a Finn	
	- to apply the interactive skills practiced during the course when encountering a new culture.	
Contents	Subjects related to Finland that will be agreed upon with the students and discussed in small groups.	
	Every task consists of the preparation phase, presenting the task and the following conversation.	
Teaching methods	Contact lessons 48 (24 + 24). independent study (incl. group work) approx. 56 hours.	
	3rd–4th period (1 group).	

Assessment	Approved exercises and continuous assessment, requires 75% attendance and active participation. 0–5.
Course Material	Provided by the teacher and the students.

FV16A1200	*SPANISH 1*	*3 ECTS cr*
	Espanja 1	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Sari Pärssinen
	Javier González García
CEF Level	Entry level: 0, target level: A1.
Aims	By the end of the course, students are expected to use the basic structures and vocabulary needed in communication situations of the world of work and student life, and polite phrases and expressions typical of the Spanish communication culture.
Contents	Introducing oneself, professions, introduction, hobbies, living.
	Structures: pronouns, nouns, adjectives and the present tense.
	Languages of instruction: Finnish and Spanish.
Teaching methods	Exercises that support communication skills.
	Contact lessons 48 (24+24), independent study approx. 30 hours.
	1st–2nd period: groups A–C
	3rd–4th period: groups D–E.
	Written examination. Oral test or grade based on continuous assessment.
	Continuous assessment requires 75% attendance and active participation.
Assessment	Pass/fail.
Course Material	Es español (lessons 1–7)

FV16A1400	*SPANISH 2*	*3 ECTS cr*
	Espanja 2	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Sari Pärssinen
	Javier González García
CEF Level	Entry level: A1.
Aims	By the end of the course, students are expected to be able to use the structures and vocabulary needed in communication situations of the world of work and everyday life, to talk about the past and understand and apply the most important Spanish customs.
Contents	On the phone, leisure, expressing an opinion, talking about the past, work history, future plans.
	Structures: object pronouns, past tenses, the future.
	Languages of instruction: Finnish and Spanish.
Teaching methods	Exercises that support communication skills.
	Contact lessons 48, independent study approx. 30 hours.
	1st–2nd period: groups A and B
	3rd–4th period: groups C and E.
	Written examination. Oral test or grade based on continuous assessment.
	Continuous assessment requires 75% attendance and active participation.
Assessment	Pass/fail.
Course Material	Es español 1 (lessons 8–12)
Prerequisites	Spanish 1 or equivalent skills.

FV16A1600	*SPANISH FOR WORKING LIFE*	*3 ECTS cr*
	Työelämän espanjaa	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Sari Pärssinen

	Javier González García
CEF Level	Entry level: A2.
Aims	By the end of the course, students are expected to be able to use the structures and vocabulary needed in work-related communication situations, and to understand and apply the most important Spanish customs.
Contents	Expressing opinions, applying for a job, invitations, meetings, presenting a company, organisational structure, company culture. Structures: subjunctive, conditional, indirect speech. Languages of instruction: Finnish and Spanish.
Teaching methods	Exercises that support communication skills. Contact lessons 48, independent study approx. 30 hours. 1st–2nd period: groups A and B, 3rd–4th period: group C. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.
Assessment	Pass/fail.
Course Material	Ahtola Kalle, Álvarez Reyes Jorge, Kaasinen Kaija & Laine Marja-Liisa: Fantástico 4.
Prerequisites	Spanish 2 or equivalent skills.

FV16A2201	*FACTS ABOUT SPAIN*	*1 - 3 ECTS cr*
	Conozca España	

Year and Period	Period 1, 1-2, 3-4
Lecturer(s)	Javier González García
CEF Level	Entry level: A2.
Aims	By the end of the course, students are expected to be familiar with Spain, Spanish culture, the geography, history, society and economy of Spain, as well as their manifestations. The issues dealt with during the course are a significant help in communication situations in Spanish.
Contents	Learning about historical events and changes in Spain from various points of view. Topics dealt with during the course include e.g. culture, art, society, economy, politics, broadcasting and current issues, and the global presence and importance of the Spanish language. The emphasis of the course is on listening and reading comprehension. Language of instruction: Spanish.
Teaching methods	There are two options for completing the course: 1. continuous assessment or a written examination. Continuous assessment requires 75 % attendance, active participation and successfully completed written and listening comprehension assignments. Contact lessons 24 and independent work approx. 28 hours (2 ECTS). 1st period (1 group) or 2. during an exchange period in Spain, completing the assignments previously agreed upon with the instructor responsible for the course (1–3 ECTS). 1st-2nd/3rd-4th period
Assessment	Pass/fail.
Prerequisites	Spanish for Working Life or equivalent skills.

FV16A2601	*FINLAND IN SPANISH*	*2 ECTS cr*
	Hablemos de Finlandia	

Year and Period	Period 3
Lecturer(s)	Sari Pärssinen
CEF Level	Entry level: A2.
Aims	By the end of the course, students are expected to be able to talk about Finns, Finland and the Finnish culture in Spanish.
Contents	Defined together with the students at the beginning of the course. Language of instruction: Spanish.

Teaching methods	Exercises that support oral communication skills; each students gives a presentation.
	Contact lessons 24, independent work approx. 28 hours.
	3rd period (1 group)
	Oral test or continuous assessment. Presentation. Continuous assessment requires 75% attendance and active participation.
Assessment	0–5. Written exam 50%, oral test or continuous assessment 25%, presentation 25%.
Course Material	Provided by the teacher.
Prerequisites	Spanish for Working Life or equivalent skills.

FV16A3201	BUSINESS SPANISH	3 ECTS cr
	Español de negocios	

Year and Period	Period 2
Lecturer(s)	Javier González García
CEF Level	Entry level: A2.
Aims	By the end of the course, students are expected to be able to communicate in Spanish in basic business situations.
Contents	Business culture, business enterprises, products, marketing, business communication in the Spanish-speaking world. Also suited for technology students.
	Language of instruction: Spanish.
Teaching methods	Exercises that support business communication. Students give a presentation on a Finnish or Spanish company.
	Contact lessons 24, independent work approximately 54 hours.
	2nd period (1 group).
	Successfully completed written and oral assignments and written test.
	The course can also be carried out in a Spanish-speaking country by completing assignments given in advance by the teacher.
Assessment	0–5.
Course Material	Notified later.
Prerequisites	Spanish for Working Life or equivalent skills.

FV16A5201	INTERCULTURAL SPANISH COURSE	3 ECTS cr
	Curso intercultural entre Finlandia y España	

Year and Period	Period 4
Lecturer(s)	Sari Pärssinen
CEF Level	Entry level: B1.
Aims	By the end of the course, students are expected to be able to describe Finns, Finland and the Finnish culture in Spanish, and to compare these issues to the corresponding Spanish ones.
Contents	The cultural characteristics of Spain and Finland. Subjects include history, geography, culture and society. Students may suggest subjects of their own interest. The emphasis will be on cultural cooperation.
	Language of instruction: Spanish.
Teaching methods	The teacher will lead the discussion and comparison of the cultures together with Spanish exchange students. Students will give a presentation in pairs, in which they compare Finnish and Spanish cultures.
	Contact lessons 24, independent study approx. 54 hours.
	4th period (1 group).
	Continuous assessment (requires 75% attendance and active participation).
Assessment	Pass/fail.
Course Material	Handouts in class.
Prerequisites	Spanish for Working Life or equivalent skills.

FV18A9101	*FINNISH 1*	*2 ECTS cr*
	Finnish 1	
Year and Period	Period 1, 3	
Lecturer(s)	Elina Häkkinen	
CEF Level	A1.1	
Aims	After the course students are expected to be able to	
	1. understand a very simple Finnish conversation (about topics dealt with during the course) in which the people speak very slowly	
	2. tell about themselves in Finnish using very simple expressions	
	3. use simple Finnish everyday phrases	
	4. understand the main contents of a very simple text on concrete topics with the help of a dictionary	
	5. write very simple sentences on course topics with the help of a dictionary.	
Contents	Topics: greeting people, introducing oneself, telling about one's plans and schedules, asking for the price, grocery shopping, family, expressing time	
	Grammar: the Finnish phonetic and orthographic system, numbers, verb conjugation, negative sentences, questions, partitive, genitive, consonant gradation, i>e change	
	The languages of instruction: Finnish and English.	
Teaching methods	Individual and group work that support learning to communicate in Finnish. Contact lessons 28, homework approximately 24 hours.	
	Period 1:	
	groups A + B (for the departmental international master's degree programs), groups C + D (for the exchange students)	
	Period 3:	
	group E + F (for the exchange students)	
	A written examination.	
Assessment	0–5	
Course Material	Handouts given in class.	
Prerequisites	No previous knowledge of the Finnish language is expected.	

FV18A9201	*FINNISH 2*	*2 ECTS cr*
	Finnish 2	
Year and Period	Period 2, 4	
Lecturer(s)	Elina Häkkinen	
CEF Level	A1.1	
Aims	By the end of the course students are expected to be able to	
	1. take part in a very simple conversation on topics dealt with during the course	
	2. cope orally in simple everyday situations which are dealt with during the course	
	3. understand directions	
	4. relate what happened in the past.	
Contents	Topics: location, travelling, shopping, weather, seasons, hobbies, describing people, asking for directions	
	Grammar: locative cases, postpositions, object cases, 3rd infinitive, singular imperative, past tense	
	The languages of instruction: Finnish and English.	
Teaching methods	Simple literary texts will be studied both in class and as homework. In the classroom the newly learnt language material will be practiced by working in pairs and groups plus by doing other similar activities. Contact lessons 28, homework approximately 24 hours.	
	Period 2:	
	group A (for the departmental international master's degree programs), group B (for the exchange students)	
	Period 4: Group C	
	A written examination.	
Assessment	0–5	

Course Material	Handouts given in class.
Prerequisites	Finnish 1 or equivalent knowledge.

FV18A9301	*FINNISH 3*	*2 ECTS cr*
	Finnish 3	
Year and Period	Period 3-4	
Lecturer(s)	Elina Häkkinen	
CEF Level	A1.2	
Aims	By the end of the course the students are expected to be able to	
	- discuss simple issues that are dealt with during the course	
	- talk about the past more elaborately	
	- cope orally in a simple situation involving health care	
	- read simple newspaper articles on concrete topics with the help of a dictionary	
Contents	Topics: profession and work, living-related and household issues, opinion, emotions, health, setting appointments, phone conversations	
	Grammar: present perfect tense, translative, essive, expressing necessity, more advanced sentence types, plural imperative, adjective comparison.	
	The languages of instruction: Finnish and English.	
Teaching methods	Texts with some new vocabulary and grammatical structures will be studied in class and as homework. Different kinds of spoken situations will be practiced. There will be lectures on grammar as well as different written grammar exercises. Contact lessons 28, homework approximately 24 hours.	
	A written exam.	
Assessment	0–5	
Course Material	Handouts given in class.	
Prerequisites	Finnish 1 and 2 or equivalent knowledge.	

FV18A9800	*GERMAN-FINNISH LANGUAGE AND CULTURE TANDEM*	*1 ECTS cr*
	German-Finnish Language and Culture Tandem	
Year and Period	Period 1, 3	
Lecturer(s)	N.N.	
	Elina Häkkinen	
CEF Level	A1–C2	
Aims	By the end of the course the students are expected to be able to	
	- discuss and reflect on cultural aspects between the German and Finnish cultures	
	- understand differences and similarities between the two cultures.	
Contents	Language of instruction: English.	
Teaching methods	Contact lessons 4.	
	Work in pairs 22 hours.	
	The course can be completed during either one or two semesters. A learning diary will be required. The teacher will announce the time of the first meeting by e-mail.	
Assessment	Pass/Fail.	

FV19A1000	*CHINESE 1*	*3 ECTS cr*
	Chinese 1	
Year and Period	Period 1–2, 3–4	
Lecturer(s)	Matina Ma	
CEF Level	A1.1	
Aims	By the end of the course students will be able	
	• to read and write Chinese phonetics,	
	• to make simple sentences,	

Contents	• to produce simple everyday greetings, • to use a Chinese dictionary. In the first period, students will learn Chinese phonetics through speaking and listening. In the second period, students will work on Chinese characters and develop a basic knowledge of sentence structure. Topics include greetings, numbers and time, introduction of self and family. Language of instruction: English and Chinese.
Teaching methods	56 contact lessons, meeting twice a week. Each lesson lasts one and a half hours. 1st–2nd period: group A 3rd–4th period: group B. 75% attendance is required.
Assessment	0–5. Exams (60%) and continuous assessment (40%).
Course Material	Provided by the teacher.
Prerequisites	The course is meant for beginners.

FV19A2000	CHINESE 2	3 ECTS cr
	Chinese 2	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Matina Ma
CEF Level	A1.2
Aims	By the end of the course students are expected to • be able to deal with basic modern Chinese grammar • have the ability to understand and write simple passages • be able to read Chinese with satisfactory intonation • be able to understand short, slowly spoken dialogues • be able to speak on simple topics.
Contents	Topics include travelling and shopping in Chinese communities, personal information and employment, daily schedule, family and interests. Language of instruction: English and Chinese.
Teaching methods	56 contact lessons, meeting twice a week. Each lesson lasts one and a half hours. 1st–2nd period: group A 3rd–4th period: group B. 75% attendance is required.
Assessment	0–5. Exams (60%) and continuous assessment (40%).
Course Material	Provided by the teacher.
Prerequisites	Successful completion of FV19A1000 Chinese 1 or having equivalent skills.

FV19A3000	CHINESE FOR WORKING LIFE 1	3 ECTS cr
	Chinese for Working Life 1	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Matina Ma
CEF Level	A2.1
Aims	By the end of the course students are expected to • be able to read articles on topics dealt with in the course • know essential Chinese modern grammar • be able to exchange ideas with native speakers on topics concerning school and social life, provided that the speech is relatively slow and clear • understand some aspects of Chinese culture.
Contents	Topics include Chinese table manners, an introduction to business Chinese, a Chinese modern wedding and Finland in Chinese. Language of instruction: English and Chinese.
Teaching methods	56 contact lessons, meeting twice a week. Each lesson lasts one and a half hours. 1st–2nd period: group A 3rd–4th period: group B.

Assessment	75% attendance is required.
	0–5. Exams (60%) and continuous assessment (40%).
Course Material	Provided by the teacher.
Prerequisites	Successful completion of FV19A2000 Chinese 2 or having equivalent skills.

FV19A4000	*CHINESE FOR WORKING LIFE 2*	*3 ECTS cr*
	Chinese for Working Life 2	

Year and Period	Period 1–2, 3–4
Lecturer(s)	Matina Ma
CEF Level	A2.2
Aims	By the end of the course students are expected to
	• sufficiently understand points of advertisements, short and simple everyday texts from Chinese magazines and newspapers
	• be able to communicate with native speakers on topics concerning social life and travel in China
	• know essential Chinese modern grammar
	• be able to write personal letters describing self relevant matters
	• understand more aspects of Chinese culture.
Contents	Topics include Chinese communities, health care, accommodation, food, introduction of essential Chinese values and Chinese festivals.
	Languages of instruction: English and Chinese.
Teaching methods	56 contact lessons, meeting twice a week. Each lesson lasts one and a half hours.
	1st–2nd period: group A
	3rd–4th period: group B.
	75% attendance is required.
Assessment	0–5. Exams (60%) and continuous assessment (40%).
Course Material	Provided by the teacher.
Prerequisites	Successful completion of FV19A3000 Chinese for Working Life 1 or equivalent skills.

16 How to Prepare a Master's Thesis in Technology

The following instructions on preparing a Master's thesis, issued by the vice-rector on 4 June 2008, are observed at Lappeenranta University of Technology. **Faculties may also give their own instructions for the Master's thesis.**

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 related to his or her professional field. It is an advanced research assignment which requires approximately 6 months of work and is worth 30 ECTS credits or 20 credit units in the old degree (for students who complete the old 180-credit unit degree, the thesis is entered into the records in credit units). The student must demonstrate the ability to carry out the project independently and following a plan. The student also takes a maturity test on the topic of the Master's thesis and prepares a written report according to instructions.

The Master's thesis can be a collaborative effort of two or more students. In such cases the work of each individual student should be distinguished and evaluated separately.

Starting the Work

Students who wish to start working on their Master's thesis should read these instructions carefully and meet with the professor in charge of the field (usually a professor of the student's major subject). The student discusses the topic of the thesis with the professor to make sure it meets the scientific requirements for a Master's thesis.

Especially the following points should be reviewed:

- the prerequisites for starting the Master's thesis (completed studies)
- the topic and objective of the thesis
- the supervising professor
- public access to the thesis
- examiners of the thesis (the supervising professor is always the 1st examiner)
- topic application to the head of the degree programme
- an initial outline of the work
- funding (by the student, a grant or an employer) and
- matters to be discussed with the community providing the funding and the supervisor representing it.

Topic, Supervisors and Examiners of the Master's Thesis

The Master's thesis is related to the student's major subject and its topic is agreed on by the supervisor and the student together. The student applies for the approval of the topic of the Master's thesis and the appointment of the supervising professor and examiners from the head of the degree programme. The student's personal study plan is attached to the application. The form is available on the university web site.

The head of the degree programme will appoint an LUT professor or adjunct professor as the supervisor for the thesis. The supervisor must specialise in the student's major subject. The head of the degree programme will also appoint two examiners, the first of which is always the supervising (adjunct) professor. The second examiner can be appointed from outside LUT. If the second examiner is not a professor or an adjunct professor, he/she must have at least a higher university degree.

In addition, the thesis usually has a supervisor who represents the company or university that commissioned the thesis. This supervisor is approved by the supervising professor (1st examiner) on signing the application for the topic.

The following requirements for the approval the thesis topic apply to **students who complete the old M.Sc. (Tech.) degree (180 credit units)**:

- a minimum of 140 credit units completed for the degree
- **basic studies completed**
- compulsory internship 6 credit units
- the student must have received a grade of 3 or higher for the intermediate or advanced course related to the research field of the thesis **or** in the Department of Industrial Engineering and Management a grade of 3 or higher for an advanced course in the student's field of specialisation included in the degree.

The following requirements for the approval the thesis topic apply to **students who complete the new M.Sc. (Tech.) degree (120 ECTS credits)**:

- a completed Bachelor's degree (if the student has been admitted to complete both the Bachelor's and Master's degrees)
- possible complementary studies completed (if the student has been admitted to complete only the Master's degree)
- the compulsory internship for the Master's degree completed
- a minimum of 15 ECTS credits of the major studies for the Master's degree completed
- other studies possibly required by the faculty or degree programme.

Applying for Master's thesis work at a company is the student's responsibility. If the student wishes to start preparations for the thesis before the topic is officially approved, this should be discussed with the professor of the major subject (the possible supervisor).

The topic application can be submitted when the required studies are completed and thesis work has been obtained from a company and discussed with the supervising professor.

Language of the Master's Thesis
The Master's thesis is written in Finnish, Swedish or English. The student may also apply for permission from the head of the degree programme to write it in another language in connection with the topic application. The author of the thesis is responsible for the language revision of the thesis. Students of degree programmes organised in English also write their Master's thesis in English.

Employee Inventions
The research work for a Master's thesis may result in an invention that can be patented or otherwise protected by industrial law. An invention may be a new or improved technical devise or method with industrial or commercial importance.

Inventions must be discussed with all parties involved (the student, supervisors at the university and the commissioning company). Measures should be taken to protect the invention before the thesis is published.

If the invention has ensued under an employment relationship, the Act on the Right in Employee Inventions (656/1967) is applied to the company. If the employment relationship is between the student and a university or higher education institution, the act on the right in employee inventions at higher education institutions (369/2006) is applied to the school.

General patenting legislation is applied to the patenting of an invention and general copyright legislation to copyright issues unless otherwise agreed by the parties involved in the work (the commissioner, university and student).

Further information is available from the university's research and innovation services.

Maturity Test

Students must take a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. The maturity test is taken in the language in which the student has received his or her education in Finland. If the student has received his or her education in a language other than Finnish or Swedish, the head of the degree programme determines the language of the maturity test. In such cases only the contents of the maturity test is evaluated, not the language.

If the student has demonstrated his or her Finnish or Swedish skills in connection with the Bachelor's degree or another previous university degree, only the content of the maturity test will be evaluated and the head of the degree programme may decide to accept the presentation given by the student in the Master's degree seminar as the maturity test. Degree programmes may also have other ways of substituting the maturity test.

If a student has not passed the maturity test in the Bachelor's degree or in another previous university degree (or if the student completes the 180-credit unit Master's degree in accordance with the old degree structure), he or she must take a supervised maturity test. No reference material is allowed and both the contents and language will be evaluated. The contents will be assessed by the 1st examiner of the Master's thesis and the language will be evaluated by a language consultant assigned by the university.

The maturity test is evaluated on a scale of passed/failed.

Details are also available from the Language Centre study guide, the faculty study guidance staff and the university web site.

Examination and Evaluation of the Master's Thesis

The faculty council will assess the thesis. The assessment is based on the thesis itself and on the statement of the examiners. Students must apply for the assessment.

The student provides the examiners each with their own, bound copy. In addition, the student leaves the assessment application, abstract in English and a bound copy of the Master's thesis with the faculty's administrative staff. Foreign students do not need to prepare an abstract in Finnish. **The faculty decides on the meeting dates and deadlines, by which the student must submit the above-mentioned material to the examiners and faculty administration.**

The examiners prepare a written statement on the thesis along with a grade proposal to the faculty council. If the thesis was a group project, separate statements and grade proposals are given for the sections prepared by each individual student. The statement must individually examine the following points on which the faculty council bases its assessment:

- the theoretical and/or practical results of the work
- originality
- coherence and careful preparation of the text
- language

In addition, the examiners or the faculty may specify other aspects considered in the evaluation.

Master's theses are graded on the following scale:

- excellent (5)
- very good (4)
- good (3)
- very satisfactory (2)
- satisfactory (1).

The title and grade of the thesis are shown in the degree certificate. The grade of the Master's thesis does not affect the overall grade of the degree.

If a student is not satisfied with the evaluation, he or she may leave a request for correction with the faculty council within 14 days of the day the grade was made known. The request for correction should be addressed to the faculty council in question and submitted in writing to the faculty's study affairs administration. Students must submit the request in writing within 14 days of the day the grade was made known. They also have the right to find out why they were given the grade.
Students who are dissatisfied with the decision may bring the matter before the degree board within 14 days of having been informed of the decision. A request addressed to the degree board in writing is to be submitted to the Study Affairs Office.

The faculty council may require that the author of the Master's thesis give a brief (approx. 20 min.) public presentation of the thesis.

Public Access to the Master's Thesis

The supervising professor must see to it that the commissioner and author of the thesis are aware of the following policies concerning public access to the thesis when the study is begun.

Master's theses submitted to the university for examination are normally public documents. If the thesis includes information that the commissioner wishes to remain confidential, the thesis may be classified confidential for a period of two years in connection with its approval. In such cases, the commissioner must provide the university in writing with the reasons for confidentiality.

If a confidentiality period longer than two years is required, two versions of the thesis must be prepared: a public and a confidential one. The public version should not contain any confidential information. In addition, the public version must mention that a confidential one exists.

Confidential theses are handled in the faculty council meeting following normal procedure. If there are separate public and confidential versions, both are handled in the faculty council meeting. Faculty council members are liable for keeping the information confidential, and the agenda and minutes of the meeting are not to include anything in violation of this confidentiality. The period of confidentiality shall be mentioned in the minutes of the meeting.

Notice of Confidentiality
If the thesis includes confidential information (held confidential for a maximum of two years), the commissioner of the thesis must submit a written notification of the extent of the confidential information, the reasons for confidentiality and the time the information is to be held confidential (usually in full years). The student is responsible for forwarding the notice to the faculty's study affairs administration. The notice is submitted along with the assessment application, at the latest.

The Master's thesis will include the mention "Confidential" and the date the confidentiality expires.

Writing a Thesis

The Master's thesis is a written report on the research work involved, presenting the stages of the work, the methods, results and explanations. The format of the thesis is based on commonly applied Finnish standards and guides (e.g. Tirronen K., 1987). In accordance with these instructions, the following format is applied at Lappeenranta University of Technology:

Covers and Layout
The Master's thesis is bound in black, hard covers, size A4.

On the front cover, printed in gold (*painokulta*), font Times or equivalent:
- MASTER'S THESIS (centred, bottom margin 200 mm, font size 44pt) and
- Author's name and year of publication (lower right-hand corner, bottom and right margin 30-35 mm, font size 22 pt).

- Another alternative is the cover recommended by LUT's publication committee, including the university's logo in gold in the upper left-hand corner. Further instructions on the cover format recommended by the publication committee are available on the university web site.

On the back, printed in gold (*painokulta*), font Times or equivalent:
- MASTER'S THESIS (left alignment, left margin 40 mm)
- Author's name
- Year of publication (right alignment, right margin 30 mm)

The thesis is printed on standard A4 paper sheets. It can be printed on both sides of the paper or on one side only. In a bound thesis the left margin is 35-50 mm. The upper margin is 30-35 mm and the right margin approximately 22 mm. The recommended line spacing is 1.5. If the paper is double-sided, you should remember that odd and even pages have different margins. Each paragraph is aligned to the left, there are no indentations and there is an empty line between paragraphs. For a neat layout, try justified alignment. The margins also apply to appendices; especially the left one is important in book binding.

If drawings are an essential part of the thesis but need not be included in the bound copy, the originals or photocopies of them are enclosed in a separate A4-sized folder.

If the thesis was a group project, the contributions of each student are bound together in order of content. Each part must contain the author's name and a list of references. The common table of contents must indicate the author of each part. Otherwise, the general guidelines apply also to a group project.

Title and Title Page

The title of the Master's thesis is either the one approved along with the topic or modified from it. Modifications to the originally approved title are merely additional details and agreed on with the supervising professor. The title must be well-defined and correspond to the content of the thesis. A key word, which expresses something essential about the thesis and has an explicit and specific meanin, is recommended as the first word. Examples of inappropriate key words: some, review, method, report, study, equipment etc. Abbreviations are not allowed.

Examples of titles:
- Torsion Control in a Permanent Magnetic Synchronous Motor
- Bleaching Plant Waste Water Treatment in the Sulphate Cellulose Process

The title page is the first, unnumbered page of the thesis. **The faculty decides on the information presented on the cover page. However, the following is always printed on it:**
- university, faculty, degree programme
- title of the thesis
- examiners and supervisors of the thesis
- ~~date and signature of the author~~ (removed 9th September 2008, Vice-Rector Rantanen)
- ~~author's address and telephone number~~ (removed 9th September 2008, Vice-Rector Rantanen)

The points above are not to be used as headings on the title page, e.g. "University: Lappeenranta University of Technology" is incorrect, but "Lappeenranta University of Technology, Faculty of Technology" is correct. The layout of the title page should be balanced, such as in assignment reports.

Abstracts in Finnish and English

The abstract is a concise (one A4 sheet), independent summary of the Master's thesis. It should be intelligible as such, without the original document. The abstract presents the key contents and relevance of the thesis. The abstract is written in Finnish and English. Foreign students may write the abstract in English only.

A good abstract is written in complete and concise sentences. The author does not express his or her opinions, but describes the thesis as would an outside reporter. No direct references are made to the original text. The abstract should fit on one A4 paper sheet.

The complete identification information should be included in the beginning of both the Finnish and the English abstract.

Finnish abstract:	English abstract:
TIIVISTELMÄ (in bold font)	**ABSTRACT (in bold font)**
Lappeennan teknillinen yliopisto *Faculty* *Degree Programme*	Lappeenranta University of Technology *Faculty in English * *Degree Programme in English *
* Author's name *	* Author's name *
* Thesis title in Finnish * **(in bold font)**	*** Thesis title in English *** **(in bold font)**
Diplomityö	Master's thesis
* year of publication *	* year of publication *
* number of pages, figures, tables and appendices * (xx sivua, xx kuvaa, xx taulukkoa ja xx liitettä)	* number of pages, figures, tables and appendices * (xx pages, xx figures, xx tables and xx appendices)
Tarkastajat: Professor * name * Professor * name *	Examiners: Professor * name * Professor * name *
Asiasanat: Keywords:	Keywords:

In addition to these general instructions, the faculties may give further guidelines on e.g. the layout of the abstract (e.g. students may need to fill out a form).

The abstracts are to be attached to the assessment application, and they will be forwarded to the LUT library by the study affairs staff. The author sends electronic copies of the abstracts to the LUT library. Further instructions and information on the electronic copies of the abstract are available at the LUT library and its web site.

The abstract is a public document, and therefore all confidential information must be excluded from it.

Table of Contents
The table of contents lists all of the headings and their page numbers in chronological order. The pages are numbered in Arabic numerals starting from the table of contents A separate list of figures and tables can be included at the end of the table of contents.

Decimals and indentations are used in the table of contents – as well as in the headings in the text – according to the following example. If variables need to be used in the first-level headings, they are to be written out as they are in equations. In such cases the author and the supervising professor may decide on the most appropriate way to present the headings in order to obtain a neat and legible layout.

TABLE OF CONTENTS

List of Symbols and Abbreviations (if Needed)
Symbols, abbreviations and terms which are not common knowledge are listed in alphabetical order along with their definitions and arranged in groups: e.g. first Roman symbols, then Greek ones and finally abbreviations. The list of symbols and abbreviations is placed immediately after the table of contents.

Foreword or Acknowledgments (Optional)
In the foreword, the author acknowledges the contribution to the research work made by the examiners and supervisors as well as any help, guidance, advice etc. received from outsiders. The author may also thank sponsors for their financial support and guidance. He or she concludes the foreword by dating and signing it.

Introduction
The actual research report is opened with an introduction. The purpose of the introduction is to introduce the topic and awaken the reader's interest. The introduction contains a brief presentation of the background, extent and objectives of the research and its relation to other studies and literature in the field. It also describes the key points of the research report. It does not, however, include detailed descriptions of the theory, methods or results.

Discussion
The discussion is divided into chapters with headings that depict the organisation of the thesis (in exactly the same form as in the table of contents). In this section, the author relates all of the material he or she wishes in reply to the research questions posed, as well as the conclusions based on the material. The discussion must be drawn up in such a way that a professional in the field can repeat the research work e.g. to check the equations, expressions, measurements, calculations or results and conclusions.

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. The topic must be presented to the reader unequivocally, intelligibly and consistently. The style must be academic and the technical terminology established. In particular, the use of foreign words should be avoided. They should be replaced with paraphrases or expressions in the language of the thesis.

The presentation and organisation are determined by the topic. A typical way to organise the thesis is to first discuss the material and theory, followed by the methods and finally the conclusions.

In order for the observations to be of use to others, the stages of the research work must be presented in complete and the results of the observations in their original form in tables etc. Long sequences of equations and programming code are appended with headings. It is not necessary to

show the derivation of the equations quoted, although the author must make sure the equations are presented correctly. However, the derivation of new expressions and equations introduced in the thesis must be shown, at least in outline.

Equations must be written clearly, each on their own line so that they are separated from the text. They may, for instance, be indented. Equations are numbered either consecutively or by chapter. The number is written in parentheses on the right-hand side of the column. References to an equation can be made only after it has been presented, with certain exceptions. Figures and tables are captioned and numbered similarly to equations. Figures and tables have to be referred to in the text, preferably before they are introduced. The captions of tables are placed above the table and those of figures below the figure. Figures and tables are not to include foreign words.

In mathematical presentation, the author must use standard symbols if such exist and if not, other established symbols. In the absence of established symbols the author may create new ones. The name of a unit symbol, e.g. the electric charge Q, must be mentioned when it is first introduced in the text and repeated when needed. Standard conventions must be followed when marking variables. For instance, variables in equations, charts and figures are *written in italics*, **vectors in bold italics** (or in italics and topped with an arrow, $\vec{E}$). Subscripts and superscripts or numbers are not italicised, unless they refer to a variable. For example: There is a relationship between the electric field strength E_1 and the electric flux density D_1, which depends on permittivity ε

$$D_1 = \varepsilon E_1.$$

Mathematical functions and operators are written in normal text type (sin, log, lim, etc.).

Matrices can be handled as regular variables. Equations can be used as parts of sentences with normal punctuation. Punctuation marks are placed immediately after the equation, not its number. Standardised graphic symbols are used in drawings and graphs. Their figures and variables are expressed in the same way as in equations.

Discussion and Conclusions
Depending on the nature and scope of the study, the report ends either with the chapter "Conclusions", or two separate chapters, e.g. "Discussion" and "Conclusions". The discussion demonstrates e.g. the agreement of the theory and empirical results and what causes it. The need for further research and possible practical applications may also be argued here. The conclusions consist mainly of the final results, what the author has discovered through the research and how they relate to issues discussed in literature. The results should be compared to those previously published in the field.

References in the Text and List of References
The purpose of a reference is to provide sufficient information on a source used in the study that allows the source to be identified and obtained, if necessary. References should be made to the original sources to avoid possible misinterpretations and misprints appearing in second-hand citations. References are usually made in accordance with the name-and-year system (the so-called Harvard system) and the number designation system. The student should consult the supervising professor when deciding which system to use.

In the name-and-year system (the Harvard system) the reference list is alphabetised according to the first author of the source. If several sources by the same author or group of authors are referenced, they are listed in order of publication. When referencing several sources published by an author within the same year, they are distinguished from each other with a lower case letter after the publication year (1999a, 1999b etc.). If the author is unknown, the abbreviation Anon. can be used instead of the author's name. Alternatively, the name of the publication can be used as the reference.

In the number system, the references are listed in the order they appear in the text. The list is numbered consecutively.

Also unpublished reference material and important oral communications must be listed. The reference list must also indicate where rare and less known sources are available.

Electronic sources are referred to according to the SFS 5831 standard. Further information is available on the library web site www.lut.fi/fi/kirjasto, in the library's SFS standard collection and the library administrators. Electronic documents should be referenced only if no other original source exists.

Detailed instructions on the Harvard and number systems are available in literature (e.g. Nykänen O., 2002, p. 76-110).

Appendices
Supplementary information, such as figures, tables, software code and mathematical derivations, should be appended.

The heading of an appendix is written at the top of the page.

Appendices are numbered. If the number is positioned in the upper right-hand corner of the page, Roman numerals are used (Appendix I, Appendix II). If the number is placed before the heading, Arabic numerals are used (Appendix 1. Heading, Appendix 2. Heading). If the appendix consists of several pages, the pages are marked as follows:

For example: 1   Appendix I, 1
                         Appendix I, 2 etc.

For example: 2   Appendix 1. Heading
                         • (continued on page x) is written at the bottom of the page
                         • (Appendix 1 continued) is written in the upper right-hand corner of the following page.

Appendix pages are not numbered.

Useful Sources for the Author of a Master's Thesis

Literature
Airila, M. & Pekkanen, M. 2002. Tekniikan alan väitöskirjaopas. Hallinto-osaston julk. 2002/3. Espoo, TKK. 73 s. ISBN 951-225822-6

Barnet, S. & Bedau, H. 1999. Critical thinking reading and writing. A brief guide to argument. Boston, Bedford 462 p. ISBN 0-312-17153-6

Day, R. A. 1998. How to Write and Publish a Scientific Paper. Cambridge, Cambridge University Press. 211 s. ISBN 0 521 36572 4

Haarala, R. (päätoim.) 1990 – 1994. Suomen kielen perussanakirja I – III. Kotimaisten kielten tutkimuskeskuksen julkaisuja 55. Helsinki, Painatuskeskus Oy. 2008 s. ISBN 951-861-433-4

Iisa, K., Oittinen, H. & Piehl, A. 2002. Kielenhuollon käsikirja. Uudistetun ja päivitetyn laitoksen 1. painos. Helsinki, Yrityskirjat Oy. 357 s. ISBN 952-9660-42-1

Itkonen, T. (tarkistanut ja uudistanut Sari Maamies), 2000. Uusi kieliopas. Helsinki, Tammi. 456 s. ISBN 951-31-1716-2

Nykänen, O. 2002. Toimivaa tekstiä. Opas tekniikasta kirjoittaville. Helsinki, TEK. 212 s.
ISBN 952-5005-64-X

Oesch, R. & Pihlajamaa, H. 2003. Patenttioikeus. Keksintöjen suoja. Helsinki, Talentum. 303 s.
ISBN 952-14-0734-4

Quantities, units and symbols in physical chemistry. Prep. for publication by Ian Mills et al. 2nd ed. IUPAC Oxford, Blackwell. 1998. 166 s. ISBN 0-632-03583-8

Rajala, K. (toim.) 1998. Tutkimuksen tekijänoikeudet. Helsinki, Werner Söderström lakitieto Oy. 211 s. ISBN 951-670-020-9

Tirronen, K. 1987. Teknisen kirjoituksen laatiminen. Helsinki, Suomen Teknillinen Seura ja Teknillisten Tieteiden Akatemia. 89 s. ISBN 951-9110-36-4

Woolever, K. R. 1999. Writing for the technical professions. New York, Longman. 536 p. ISBN 0-321-01122-8

Finnish Standards on Writing and Presentation
SFS 3655. Suureet ja yksiköt. Suurenimet, tunnukset ja yksiköt. 2. p. 1982.

SFS 3855. Tiivistelmien laatiminen ja käyttö. 1978.

SFS 4004. Suureet ja yksiköt. Alaindeksit 2. p. 1992.

SFS 5342. Kirjallisuusviitteiden laatiminen. 2. p. 1992.

SFS 5831. Viittaaminen sähköisiin dokumentteihin tai niiden osiin. 1998.

SFS-ISO 31-0 + A1. Suureet ja yksiköt. Osa 0: Yleiset periaatteet. 1999.

SFS-ISO 31-11. Suureet ja yksiköt. Osa 11: Matemaattiset merkinnät fysikaalisissa tieteissä ja tekniikassa. 1999.

SFS-ISO 1000 + A1. SI-yksiköt sekä suositukset niiden kerrannaisten ja eräiden muiden yksiköiden käytöstä. 1999.

Internet Sources
The Finnish Terminology Centre TSK   www.tsk.fi
Research Institute for the Languages of Finland   www.kotus.fi
Finnish Standards Association SFS   www.sfs.fi

Ilkka Pöyhönen
Vice-Rector

17 How to prepare a Master's Thesis in Business Administration

The following instructions on preparing a Master's thesis, issued by the vice-rector on 23 May 2007, are observed at Lappeenranta University of Technology. ***Revised 6 May 2008.***

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 related to his or her professional field. The thesis is a research project which requires approximately six months of full-time work and is worth 30 ECTS credits. The student must demonstrate the ability to carry out the project independently and following a plan. The student also takes a maturity test on the topic of the Master's thesis and prepares a written report according to instructions.

Starting the Master's Thesis

Students who are starting their Master's thesis should read these instructions carefully and meet with the professor in charge of the field (usually a professor of the student's major subject). The student discusses the topic of the thesis with the professor to make sure it meets the scientific requirements for a Master's thesis.

Especially the following points should be reviewed:

- the prerequisites for starting the Master's thesis (completed studies)
- the topic and objective of the thesis
- supervisor of the Master's thesis
- publicity of the study
- examiners of the thesis (the supervising professor is the first examiner)
- submitting an application for the approval of the topic to the department's study coordinator
- an initial outline of the work
- funding (by the student, a grant or an employer)
- matters to be discussed with the community providing the funding and the supervisor representing it.

General Comments

The aim of the advanced research seminar is to introduce students to the basics of business research and help them complete their thesis.

Students take part in the thesis seminar in their second year of studies, and they must have completed their Bachelor's degree in business administration before the seminar. Major subjects may also have their own, additional requirements, which are listed in the degree requirements. Students should study them carefully. The extent of the thesis and seminar is 30 ECTS credits.

Language of the Master's Thesis

The Master's thesis can be prepared in Finnish, Swedish or English. Permission for using other languages is granted by the head of the degree programme. The author of the thesis is responsible for the language revision of the thesis.

In Master's programmes taught in English, the Master's thesis is also prepared in English.

Applying for a Topic

Students must have completed their B.Sc. (Econ. & Bus. Admin.) degree (with the exception of those admitted directly into a Master's programme) and possible complementary studies before applying for a topic for their thesis.

The student applies for the approval the Master's thesis topic and the appointment of a supervising professor and examiners from the head of the degree programme. The head of the degree programme appoints a faculty professor or adjunct professor as the supervisor of the thesis and two examiners, the first of which is the supervisor. The examiners are usually professors or adjunct professors. The second examiner may also be a person from outside LUT with at least a higher university degree. If one or both of the examiners change, this must be approved by the head of the degree programme.

The student asks the examiners to sign the application and submits it to the study coordinator. The student's ipersonal study plan is attached to the application. The study plan is confirmed by the study coordinator.The application form, instructions and deadlines are available at: www.lut.fi/kati/opiskelu.php or the study coordinator.

The topic is applied for at the beginning of the project when it has been agreed on with the supervising professor. The title does not need to be finalised upon application; it may be modified during the course of the project.

The thesis may also have several authors. In such cases, each student must independently prepare and indicate their own section of the study.

Maturity Test

Students must take a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. The maturity test is evaluated by the supervisor of the thesis and a language reviser approved by the university. The maturity test is taken in the language in which the student has received his or her education in Finland. If the student has received his or her education in a language other than Finnish or Swedish, the head of the degree programme determines the language of the maturity test. In such cases only the contents of the maturity test is evaluated, not the language.

If a student has demonstrated his or her language skills in connection with the Bachelor's degree or other previous university degree, the language of the maturity test will not be evaluated, only the contents. In such cases, the head of the degree programme may decide to allow the student to substitute the presentation given in the thesis seminar for the maturity test. If the student has not passed the maturity test in connection with his/her Bachelor's degree or another previous university degree, the test will be taken in supervised facilities, and both its language and its content will be evaluated.

The maturity test may also be written on a computer. For further information, please see www.lut.fi/fi/opiskelu/nykyiset_opiskelijat/kuulustelut/kypsyysnayte.html.

The maturity test should be taken five weeks before graduation. The supervisor/examiner will determine the earlies possible date for taking the test. The date and time for the test should be set together with the examiner and faculty office. The examiner gives the topic of the test.

The maturity test is evaluated on a scale of passed/failed.

Further information in the study guide of the LUT Language Centre.

Assessment of the Master's Thesis

The thesis must be reviewed by the examiners before it is printed.

The student turns in the final, printed version of the Master's thesis bound in a black cover to the examiners (one for each) at least 14 calendar days before the faculty council meeting where the thesis is up for approval. Also an application for evaluation, abstracts in Finnish and English, a possible request for confidentiality from the commissioner of the thesis, and a third copy bound in a black cover are to be submitted to the study coordinator **at least 14 calendar days before the above-mentioned faculty council meeting**.

The examiners prepare a written statement on the thesis along with a grade proposal to the faculty council. The title of the thesis, the grade and the names of the examiners are indicated in the degree certificate. If the thesis is written by several authors, the sections prepared independently by each author are evaluated separately. The grade of the Master's thesis does not affect the overall grade for the major subject.

The faculty council evaluates and approves the Master's thesis upon application. Forms, deadlines and faculty council meetings are available at: www.lut.fi/kati/opiskelu.php

If a student is not satisfied with the evaluation, he or she may leave a request for correction with the faculty council within 14 days of the day the grade was made known. The request for correction should be addressed to the faculty council in question and submitted in writing to the faculty's head of study affairs. Students must submit the request in writing within 14 days of the day the grade was made known. They also have the right to find out why they were given the grade.

Students who are dissatisfied with the decision may bring the matter before the degree board within 14 days of having been informed of the decision. A request addressed to the degree board in writing is to be submitted to the Study Affairs Office.

Assessment Criteria

Purpose and Delimitation of the Research
- Objectives, definitions and delimitation
- Relationship to previous research

Stages of Research
- Formulation of concepts, models, hypotheses and frameworks
- Data collection
- Collection of additional material and complete analysis
- Discussion, interpretation and conclusions

Management of Research Area
- Balanced organisation of the research
- Methodical and logical approach
- Comprehensive and in-depth study
- Independent, critical and profound analysis

Revising the Text
- Layout and presentation
- Language and legibility

Assessment Scale

- improbatur (fail)
- approbatur (lowest passing grade)
- lubenter approbatur
- non sine laude approbatur
- cum laude approbatur
- magna cum laude approbatur

- eximia cum laude approbatur
- laudatur (highest grade)

The student has completed his/her degree **with distinction** if the overall grade is at least 4 and the Master's thesis grade at least eximia cum laude approbatur. In addition to this, at least 40 credits included in the degree must be carried out at LUT and graded on a scale of 1–5.

Publicity of the Study

Master's theses submitted to the university for examination are normally public documents.

This must be mentioned to the commissioner when the topic of the thesis is first discussed. If the thesis includes information which the commissioner considers confidential, the university may agree to hold the thesis **confidential for a maximum of two years**. The confidentiality starts from the date the faculty council assesses the thesis. In such cases, the commissioner must provide the university in writing with a free-form explanation for why confidentiality is required.

If the commissioner requires a period of confidentiality which longer than two years, another version excluding the confidential information must be submitted for publication.

The supervisor of the thesis must see to it that the commissioner is aware of the restrictions to confidentiality in the very beginning of the discussions.

Confidential theses are handled in the faculty council meeting following normal procedure. The faculty council must also have access to the confidential part. The public version of the Master's thesis must mention that the thesis also includes a confidential part. Faculty council members are liable for keeping the information confidential, and the agenda and minutes of the meeting are not to include anything in violation of this confidentiality. The period of confidentiality is to be mentioned in the minutes of the meeting.

In accordance with the faculty council decision of 15 March 2005, this rule can be applied to all Master's theses for which the topic application has been submitted after 1 March 2005.

The only exception are theses with a confidentiality period longer than two years that was agreed on by the employer and supervising professor (or adjunct professor) at an earlier date. Such cases should always be discussed with the supervising (adjunct) professor.

Notice of Confidentiality

If the thesis includes confidential information (held confidential for a maximum of two years), the commissioner of the thesis must submit a written notification of the extent of the confidential information, the reasons for confidentiality and the time the information is to be held confidential (usually in full years). The student is responsible for forwarding the notice to the faculty's study coordinator. The notice is given to the study coordinator along with the assessment application.

The Master's thesis will include the mention "Confidential" and the date the confidentiality expires in the lower right-hand corner of the title page..

Chapters and Layout

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. It should convey the message to the reader unequivocally and intelligibly, and the organisation should be logical and coherent. Say only what is needed, avoid wordiness. You should particularly avoid buzzwords and unnecessary foreign words.

The Master's thesis is bound in black, hard covers, size A4. The recommended font is Arial 12. The thesis can be printed on both sides of the paper or on one side only. Page margins are as follows: 35 mm at the top, approx. 50 mm on the left, and in one-sided printing approx. 20 mm on the right and at the bottom. Page numbering is at the top of the page, either centred or right-aligned. Spacing

is 1.5. If you print on both sides of the paper, the outer margins should be approx. 20 mm and the inner ones approx. 50 mm. Each paragraph is aligned to the left, there are no indentations and there is an empty line between paragraphs. The paragraphs are justified. Avoid long spaces between words: use hyphenation. The thesis should be approximately 80-100 pages.

The text "Master's thesis", the author's name and the year are printed in gold on the spine. The text starts 80 mm from the top and the year is 30 mm from the bottom.

On the front cover, in gold, centred and approx. 100 mm from the top is the word Master's thesis. The author's name and the year are in the lower right-hand corner.

LUT's publication committee recommends that the university's logo be printed in gold in the upper left-hand corner of the cover. A cover template recommended by the publication committee is available on the university web site at www.lut.fi/fi/opiskelu/nykyiset_opiskelijat/ohjeita_opiskeluun.html and in printing presses in Lappeenranta.

If the thesis was a group project, the contributions of each student are bound together in order of content. Each part must contain the author's name and a list of references. The common table of contents must indicate the author of each part. Otherwise, the general guidelines apply also to a group project.

Instructions for Layout and Presentation

The parts of the thesis are organised as follows:

<u>Title page</u>

The title page contains the following information:

> University, **Faculty**, Major subject
> Title of the Master's thesis
> Examiners (supervisor first)
> date and signature of the author
> Address and telephone (optional)
> Possible period of confidentiality (lower right-hand corner) The confidentiality starts from the date the faculty council assesses the thesis.

The title must be well-defined and correspond to the content of the thesis. A key word, which expresses something essential about the thesis and has an explicit and specific meaning, is recommended as the first word. Avoid the following: some, review, method, report, study, equipment etc.

<u>Abstracts in Finnish and English</u>

The abstract is a concise, objective, independent presentation which can be published separately. It should be intelligible as such, without the original document. It explains the contents of the thesis: the objective, methodologies, results and conclusions. The main method, novel results and observations, practical importance or theoretical novelty should be presented. The organisation does not need to follow that of the thesis; e.g. the most important result can be introduced upfront. The abstract is no longer than one page. Use short, complete sentences.

The abstract is done in both Finnish and English (equivalent contents). In the Finnish abstract, the title is in Finnish and in the English one in English. Foreign students do not need to prepare an abstract in Finnish.

The wordcount is approximately 100. Both the Finnish and English abstracts are attached to the thesis. They are also submitted to the study coordinator along with the assessment application.

The abstract is a public document, and therefore all confidential information must be excluded from it.

The author sends electronic copies of the abstracts or the entire thesis to the LUT library. More details available from the library and its web site.

You should favour the passive voice or the 3rd person active in case the abstract is published separately. Unestablished abbreviations, symbols or technical terms should be explained. Tables, equations etc. are used only if they are necessary for the sake of clarity. No direct references are made to the original text.

The information below is given at the beginning of the abstract in the following order:

Author's name
Title
Faculty
Major Subject
Year of publication
Master's Thesis. University
Number of pages, figures, tables and appendices
Examiners (supervisor first)
Keywords in Finnish
Keywords in English

An example of how to present the bibliographic information in the abstract:

Abstract:

ABSTRACT

Author:	Markkanen, Marja
Title:	Activity-based costing in a service enterprise
Faculty:	School of Business
Major Subject:	**Accounting**
Year:	2000
Master's Thesis:	Lappeenranta University of Technology
	80 pages, 26 figures, 4 tables and 8 appendices
Examiners:	Prof. Timo Tietäväinen
	Prof. Tiina Tietäväinen
Keywords:	activity-based costing, service enterprise, cost management

The keywords must be informative and describe the contents of the thesis accurately. Concrete concepts (e.g. equipment) are in plural, abstract ones (e.g. methods) in singular. A good title should include at least some of the most important keywords. The number of keywords should be three to five.

Acknowledgements

The possible acknowledgements recognise the help, guidance, advice etc. provided by others and giving thanks to them. Also the commissioner of the thesis is mentioned.

Table of Contents

The table of contents lists the headings and sub-headings and their page numbers. The pages are numbered in Arabic numerals from where the text starts. A separate list of figures and tables can be included at the end of the table of contents.

Decimals and indentations are used in the table of contents – as well as in the headings in the text – according to the following example (note the use of upper and lower case lettering and the indentation of sub-headings). The page numbers are aligned to the right.

TABLE OF CONTENTS

Explanation of Abbreviations and Symbols

Abbreviations and variables and their explanations can be listed in alphabetical order, mathematical and other symbols as a list of their own, and identifying letters as yet another list (latin, greek etc. each separately).

Introduction

The introduction contains an introduction to the topic, definition of the research problem, objectives, point of view, delimitation and research methodology. Different parts can be presented as separate subsections.

Discussion

The discussion is divided into chapters with headings that depict the organisation of the thesis (in exactly the same form as in the table of contents). In this section, the author relates all of the material he or she wishes in reply to the research questions posed, as well as the conclusions based on the material. Repetition should be avoided, unless it is necessary.

Each citation should be clearly referenced so that the reader may refer to the original source.

The nature of the work determines the form of discussion. The discussion may often be divided into a theoretical part, empirical part and results:

- the theoretical background, including the literature and previous research and concepts on which the thesis is based
- observations and collection of basic material etc In order for the observations to be scientifically valid, the research process should be described in as much detail as possible.

- the discussion on observations and presentation of the results are often closely connected. All calculations need not be shown, as long as the author explicitly explains how they are done.

Figures, tables, equations etc. make the discussion more concrete and enhance readability. They are captioned and numbered, each as their own group.

On the use of technical and mathematical terms and expressions:

- cited expressions and equations must always be referenced unless they can be considered common knowledge You do not need to show how an equation is derived.
- the derivation of new expressions and equations must be presented, or at least its main points. The source of parent equations must be mentioned.
- equations are numbered.

Conclusions and Summary

The conclusions summarise the discussion: the starting point of the research, theoretical and empirical choices, objectives and results, conclusions and possible ideas for further research. You may also voice criticism. There is no need to repeat what has already been said in the discussion. Instead, a more expansive viewpoint can be adopted, explaining which questions were left unanswered etc. New information is not introduced in the conclusions, and no direct references are made to the discussion.

References

Listing references and the related ISO 690.2 and SFS 5342/1987 standard are presented in detail by Mälkiä (1994). If you use more than one source by the same author, the older ones are listed first. If more than one of them are from the same year, they are listed in alphabetical order according to the title and a lower-case letter is added after the year (a, b, c…).

The references may not include sources that are not cited. The sources should be described in detail and in the same way.

Sources are usually referenced as follows:

books   author(s), editor(s)
           publication year
           title
           edition (if more than one)
           place of publication
           publisher (NB: not printing press! Excluding company form abbreviations)

Example of source with one author: Patton, M. Q. 1990. Qualitative evaluation and research methods. London: Sage.
Example of source with two authors: Leino, A. & Leino, J. 1988. Kasvatustieteen perusteet. Jyväskylä: Gummerus.

Sources with many volumes are presented in the same way, and the volume in question is also mentioned.

journal papers   author(s)
                    publication year
                    title of paper
                    title of journal
                    volume (annual set)
                    issue
                    pages

Example of a source with more than one author: Porter, L. W., Steers, R. M., Mowday, R. T. & Boulian, P. V. 1974. Organizational commitment, job satisfaction, and tumover among psychiatric technicians. Journal of Applied Psychology, vol. 59, no. 2, pages 603-609.

publication series   author(s)
publication year
title of publication
body in charge
place of publication
publisher
title and number of series

E.g.: Laiho, L. (ed.) 1984. Arctic technology research projects in Finland. Espoo: Valtion teknillinen tutkimuskeskus (VTT). Tiedotteita 331.

final theses   author
year
title
type of thesis
(doctoral dissertation, Master's Thesis etc.)
institution and department

If you reference a compilation, introduce the parent publication with the word "In:" or type it in capital letters.

For example: Rajala. T. 2000. Henkilöstö kunnan voimavarana. Rajala. T. 2000. Henkilöstö kunnan voimavarana. In: Hoikka, P. (ed.) Kunnat 2000-luvun kynnyksellä. 2nd revised ed. Tampere: Tampereen yliopisto.

conference papers

author
publication year
title of paper
name, place and date of conference
place of publication
publisher or conference organiser
pages

For example: Sandström, J. 2001. How to reduce the complexity when formulating cost information for design engineers? 16th International Conference on Production Research (ICPR), July 23 - August 3, Prague, Czech Republic.

Electric Publications

Electronic sources are referred to according to the SFS 5831 standard. Further information: the library web site www.lut.fi/fi/kirjasto, the library's SFS standard collection and the library administrators. Electronic documents should be referenced only if no other original source exists.

Example of e-mail source:
- **Bergman, S. 1996. The Iceland Teacher Training School in the field of biology, science education and development work in environmental education. [e-mail]. stefanb@khi.is 28 June 1996.**

Example of Internet source:
- **Denning, P. 1996. Business Designs of the New University [online document]. [Accessed 5 June 2007]. Available at http://ene.grnu.edu/pjd/education.html**

Appendices

Appendices may include equations, diagrams, drawings etc. that do not need to be included in the actual text but to which are referred. Extensive additional reports, large tables and e.g. tables that are referred to often should be appended. However, figures, equations, tables, etc., which are a key part of the text and are also interpreted, are placed in the text.

The heading of an appendix is written at the top of the page. Appendices are numbered. Appendix pages are not numbered; only the final numbered pages of the thesis are part of the table of contents. Appendices and their headings may be listed at the end of the table of contents.

Referencing (citations in the text)

Citations from books, journals, publication series and theses follow the same guidelines as the list of references. Citations include the following: author(s), year, page(s). Thus referencing can be done as follows: "Williamsson (1995, 23-25) states" or (Teece et al. 1986). Mälkiä also discusses citations.

If there is more than one author, the first author's name is followed only by "et al.". This is also how you should cite electronic sources, for instance (Denning 1996). Do not include the web site address – it should be indicated in the list of references. If several sources are referenced at once, they should be separated with a semicolon in parenthesis (;). You should pay attention to where you place the reference. If you want the reference to include the entire preceding paragraph, place it in parenthesis after the final period. If you only want it to include the preceding sentence, place the period after the second bracket. This should also be done within a paragraph. Direct quotations should be in quotes. If you cite the same source twice in a row, the latter can simply be marked: Ibid.

Footnotes are only used for explanations and additional comments on the text and are numbered separately for each page. Footnotes placed at the bottom of the page and separated from the actual text with a line approximately 5 cm long. There should be an empty row above and below the line.

The instructions above are merely guidelines, they are not binding. Referencing can be done in another commonly approved way or following the examiners' instructions. The key to referencing is consistency.

Major subjects may issue their own instructions for authors to follow. Authors must also take into account the requirements set by the language of the thesis.

Further tools in preparing a thesis:
Sirkka Hirsjärvi et al: Tutkimus ja sen raportointi, 1990.
Hirsjärvi - Remes - Sajavaara: Tutki ja kirjoita, 2004.
Mälkiä, Matti: Teksti- ja kirjallisuusviitteiden laatiminen, 1994.

Lappeenranta, 23 May 2007
Ilkka Pöyhönen
Vice-Rector